

PART -1

Chapter 1: Large Numbers Around Us

NCERT CORNER

Intext Questions

1. Solution:

For 3 varieties of rice every day, they would need $1,00,000 \div 1095 \sim 91$ years. Here, they would be able to eat all 1 lakh varieties of rice in 100 years.

Choose a number for y. How close to one lakh is the number of days in y years, for the y of your choice?

Solution:

To get the number of days in y years, we have $365 \times y$ years.

For 1,00,000 days we have $1,00,000 \div 365 \sim 273$ years.

Thus, we have $365 \times y = 365 \times 273 \sim 99645$ days (closest to 1 lakh)

Question2

Solution:

Similar to the first question, we calculate the total varieties tasted over 100 years at a rate of 3 per day.

– Number of days in 100 years:

$$\begin{aligned} &100 \text{ years} \times 365 \text{ days/year} \\ &= 36500 \text{ days.} \end{aligned}$$

Total varieties tasted:

$$\begin{aligned} &36500 \text{ days} \times 3 \text{ varieties/day} \\ &= 109500 \text{ varieties.} \end{aligned}$$

Since 109,500 is more than one lakh (100,000), yes, you would be able to taste all the lakh varieties in a 100-year lifetime if you ate 3 varieties per day.

Question3

Solution:

Let's choose two values for y and calculate the number of days, comparing it to one lakh (100,000). We use 365 days per year.

Choice 1: $y = 100$ years

– Number of days

$$= y \text{ years} \times 365 \text{ days/year}$$

$$= 100 \times 365$$

$$= 36500 \text{ days.}$$

– How close to 1 lakh?

$$100000 - 36500 = 63500 \text{ days.}$$

For $y = 100$ years, the number of days (36,500) is 63,500 days less than one lakh.

Choice 2: $y = 274$ years (mentioned on page 4 as roughly 1 lakh days)

– Number of days

$$= y \text{ years} \times 365 \text{ days/year}$$

$$= 274 \times 365$$

$$= 100010 \text{ days.}$$

– How close to 1 lakh?

$$100010 - 100000 = 10 \text{ days.}$$

For $y = 274$ years, the number of days (100,010) is very close, just 10 days more than one lakh.

Figure it Out

Question 1.

Solution:

$$\text{One lakh} = 1,00,000$$

$$\text{Now, } 1,00,000 - 75,000 = 25,000$$

Thus, the population of Chintamani in 2011 was 25,000 less than one lakh.

Question 2.

Solution:

$$1,06,000 - 1,00,000 = 6,000$$

Thus, the population in 2024 is 6,000 more than one lakh.

Question 3.

Solution:

The population increase from 2011 to 2024 = $1,06,000 - 75,000 = 31,000$

Intext Questions

Solution:

(a) 1,23,456

(b) 4,07,704

(c) 50,05,050

(d) 10,00,235

Figure it Out

Solution:

(a) (i) $(8 \times 1000) + (3 \times 100) = 8300$

(ii) $(83 \times 100) = 8300$

(b) (i) $(4 \times 10000) + (6 \times 100) + (2 \times 10) + (9 \times 1) = 40629$

(ii) $(40 \times 1000) + (6 \times 100) + (29 \times 1) = 40629$

(c) (i) $(5 \times 10000) + (6 \times 1000) + (3 \times 100) + (54 \times 1) = 56354$

(ii) $(56 \times 1000) + (35 \times 10) + (4 \times 1) = 56354$

(d) (i) $(6 \times 10000) + (6 \times 1000) + (6 \times 100) + (66 \times 1) = 66666$

(ii) $(66 \times 1000) + (66 \times 10) + (6 \times 1) = 66666$

(e) (i) $(3 \times 100000) + (6 \times 10000) + (7 \times 1000) + (8 \times 100) + (13 \times 1) = 367813$

(ii) $(36 \times 10000) + (7813 \times 1) = 367813$

Intext Questions

Solution:

1. (a) For the largest 3-digit number:

Press the +100 button 9 times: $9 \times 100 = 900$

Add 10 more presses using the +10 button: $10 \times 10 = 100$

Add the remaining 11 presses using the +1 button: $11 \times 1 = 11$

Sum: $900 + 100 + 11 = 1011$, but that's a 4-digit number.

Scale back by reducing the number of +10 presses to 8 and +1 presses to 13.

Largest 3-digit number: 993 ($9 \times 100 + 8 \times 10 + 13 \times 1$)

For the smallest 3-digit number

Press the +10 button 8 times: $8 \times 10 = 80$

Add 22 more presses using the +1 button: $22 \times 1 = 22$

Smallest 3-digit number: 102 ($8 \times 10 + 22 \times 1$)

1. (b) 997 with 34 Clicks

$$9 \times (+100) = 900$$

$$8 \times (+10) = 80$$

$$17 \times (+1) = 17$$

2. Solution

Buttons	5072
+10,00,000	
+1,00,000	
+10,000	
+1,000	5
+100	0
+10	6
+1	12

(a) $5 \times (+1000) = 5000$ (5 clicks)

$7 \times (+10) = 70$ (7 clicks)

$2 \times (+1) = 2$ (2 clicks)

Total clicks: $5 + 7 + 2 = 14$ clicks

Expression: $5 \times 1000 + 7 \times 10 + 2 \times 1 = 5072$

(b)

Buttons	8300
+10,00,000	
+1,00,000	
+10,000	
+1,000	8
+100	3
+10	
+1	
Total Clicks	11

For 8300: $8 \times (+1000) = 8000$

For: $3 \times (+100) = 300$

Total = $8000 + 300 = 8300$

Figure it Out

Question 1.

Solution:

(a) 8300

$8 \times (+1000) = 8000$ (8 clicks)

$3 \times (+100) = 300$ (3 clicks)

Total clicks: $8 + 3 = 11$

Expression: $(8 \times 1000) + (3 \times 100) = 8300$

(b) 40629

$4 \times (+10000) = 40000$ (4 clicks)

$6 \times (+100) = 600$ (6 clicks)

$2 \times (+10) = 20$ (2 clicks)

$9 \times (+1) = 9$ (9 clicks)

Total clicks: $4 + 6 + 2 + 9 = 21$

Expression: $(4 \times 10000) + (6 \times 100) + (2 \times 10) + (9 \times 1) = 40629$

(c) 56354

$5 \times (+10000) = 50000$ (5 clicks)

$6 \times (+1000) = 6000$ (6 clicks)

$3 \times (+100) = 300$ (3 clicks)

$5 \times (+10) = 50$ (5 clicks)

$4 \times (+1) = 4$ (4 clicks)

Total clicks: $5 + 6 + 3 + 5 + 4 = 23$

Expression: $(5 \times 10000) + (6 \times 1000) + (3 \times 100) + (5 \times 10) + (4 \times 1) = 56354$

(d) 66666

$$6 \times (+10000) = 60000 \text{ (6 clicks)}$$

$$6 \times (+1000) = 6000 \text{ (6 clicks)}$$

$$6 \times (+100) = 600 \text{ (6 clicks)}$$

$$6 \times (+10) = 60 \text{ (6 clicks)}$$

$$6 \times (+1) = 6 \text{ (6 clicks)}$$

$$\text{Total clicks: } 6 + 6 + 6 + 6 + 6 = 30$$

$$\text{Expression: } (6 \times 10000) + (6 \times 1000) + (6 \times 100) + (6 \times 10) + (6 \times 1) = 66666$$

(e) 367813

$$3 \times (+100000) = 300000 \text{ (3 clicks)}$$

$$6 \times (+10000) = 60000 \text{ (6 clicks)}$$

$$7 \times (+1000) = 7000 \text{ (7 clicks)}$$

$$8 \times (+100) = 800 \text{ (8 clicks)}$$

$$1 \times (+10) = 10 \text{ (1 click)}$$

$$3 \times (+1) = 3 \text{ (3 clicks)}$$

$$\text{Total clicks: } 3 + 6 + 7 + 8 + 1 + 3 = 28$$

$$\text{Expression: } (3 \times 100000) + (6 \times 10000) + (7 \times 1000) + (8 \times 100) + (1 \times 10) + (3 \times 1) = 367813$$

Question 2.

Solution:

The smallest number of button clicks depends on the place value of the digit in the number. If the digit in a particular place is small, then less number of clicks are required and if it is big, then more number of clicks are required.

Question 3.

Do it yourself.

In-Text Questions

1.

Solution:

$$1,000 \text{ lakh} = 10,00,00,000 \text{ (8 zeros)}$$

2.

Solution:

$$100 \text{ thousand} = 1,00,000 \text{ (5 zeros)}$$

Figure it Out

Question 1.

Solution:

(a) Indian System

40.50.678 → 40 lakh 50 thousand and 678

Forty lakh fifty thousand six hundred seventy-eight

American System

4.050.678 → 4 million 50 thousand and 678

Four million fifty thousand six hundred seventy-eight

(b) Indian System

4.81.21.620 → 4 crore 81 lakh 21 thousand and 620

Four crore eighty-one lakh twenty-one thousand six hundred twenty

American System

48,121,620 → 48 million 121 thousand and 620

Forty-eight million one hundred twenty-one thousand six hundred twenty

(c) Indian System

2,0, 22,002 → 2 crore 22 thousand 2

Two crore twenty-two thousand two

American System:

20,022,002 → 20 million 22 thousand 2

Twenty million twenty-two thousand two

(d) Indian System

24,68,13,579 → 24 crore 68 lakh 13 thousand 579

Twenty-four crore sixty-eight lakh thirteen thousand five hundred seventy-nine

American System

246.813.579 → 246 million 813 thousand 579

Two hundred forty-six million eight hundred thirteen thousand five hundred seventy-nine

(e) Indian System:

34,50,00,543 → 34 crore 50 lakh 543

Thirty-four crore fifty lakh five hundred forty-three

American System:

345,000,543 → 345 million 543

Three hundred forty-five million five hundred forty-three

(f) Indian System:

1,020,304,050 → 1 arab 2 crore 3 lakh 4 thousand 50

One arab two crore three lakh four thousand fifty

American System:

1,020,304,050 → 1 billion 20 million 304 thousand 50

One billion twenty million three hundred four thousand fifty

Question 2.

Solution:

- (a) 1,01,01,010
- (b) 1,001,001,001
- (c) 10,20,30,040
- (d) 9,080,700,600

Question 3.

Solution:

- (a) 30 thousand < 3 lakh
- (b) 500 lakh > 5 million
- (c) 800 thousand < 8 million
- (d) 640 crore < 60 billion

In-Text Questions

1.

Solution:

(a) Round Up:

Ordering supplies for an event (like the school ordering 750 sweets for 732 people) to ensure there's enough; estimating project completion time to provide a buffer; calculating material needed for construction to avoid shortages.

(b) Round Down:

A shopkeeper estimating the cost for a customer might round down slightly (e.g., saying Rs 450 for a Rs 470 item) to make it sound more attractive; estimating remaining fuel in a car to be cautious.

(c) Either is Okay:

Casual conversation about large numbers where precision isn't important (e.g., "The city has about 10 lakh people"); rough estimations of distance or travel time for planning.

(d) Exact Numbers Needed:

Calculating financial transactions (bank balances, salaries, taxes); scientific measurements and experiments; engineering specifications; emergency contact

numbers (like dialing 139 for Railway Enquiry, not a rounded number); recipes requiring precise ingredient amounts.

2.

Solution:

Numbers	3,87,69,957	29,05,32,481
Nearest Thousand	3,87,70,000	29,05,32,000
Nearest Ten Thousand	3,87,70,000	29,05,30,000
Nearest Lakh	3,88,00,000	29,05,00,000
Nearest Ten Lakh	3,90,00,000	29,10,00,000
Nearest crore	4,00,00,000	29,00,00,000

In-Text Questions

From the information given in the table, answer the following questions by approximation:

Rank	City	Population (2011)	Population (2001)
1	Mumbai	1,24,42,373	1,19,78,450
2	New Delhi	1,10,07,835	98,79,172
3	Bengaluru	84,25,970	43,01,326
4	Hyderabad	68,09,970	36,37,483
5	Ahmedabad	55,70,585	35,20,085
6	Chennai	46,81,087	43,43,645
7	Kolkata	44,86,679	45,72,876
8	Surat	44,67,797	24,33,835
9	Vadodara	35,52,371	16,90,000
10	Pune	31,15,431	25,38,473
11	Jaipur	30,46,163	23,22,575
12	Lucknow	28,15,601	21,85,927
13	Kanpur	27,67,031	25,51,337
14	Nagpur	24,05,665	20,52,066

Question 1.

Solution:

The data shows the population of Indian cities in the years 2001 and 2011.

Question 2.

Solution:

Population of 20 Indian Cities during the years 2001 and 2011.

Question 3.

Solution:

Population of Pune in 2011 = 31,15,431 and in 2001 = 25,38,473

Approximate Increase in population: $31,00,000 - 25,00,000 = 6,00,000$

Question 4.

Solution:

Rank	City	Population (2011)	Population (2001)	Difference
1.	Mumbai	1,24,42,373	1,19,78,450	4,63,923
2.	New Delhi	1,10,07,835	98,79,172	11,28,663
3.	Bengaluru	84,25,970	43,01,326	41,24,644
4.	Hyderabad	68,09,970	36,37,483	31,72,487
5.	Ahmedabad	55,70,585	35,20,085	20,50,500
6.	Chennai	46,81,087	43,43,645	3,37,442
7.	Kolkata	44,86,679	45,72,876	- 86,197
8.	Surat	44,67,797	24,33,835	20,33,962
9.	Vadodara	35,52,371	16,90,000	18,62,371
10.	Pune	31,15,431	25,38,473	5,76,958
11.	Jaipur	30,46,163	23,22,575	7,23,588
12.	Lucknow	28,15,601	21,85,927	6,29,674
13.	Kanpur	27,67,031	25,51,337	2,15,694
14.	Nagpur	24,05,665	20,52,066	3,53,599

Bengaluru experienced the largest population increase, with a growth of 41,24,644 people.

Question 5.

Solution:

Bengaluru, Hyderabad, Surat, Vadodara, and nearly doubled their population between 2001 and 2011.

Question 6.

Solution:

Mumbai's population by Patna's population in 2011 = ~ 7

Patna's population needs to be multiplied by 7 to be close to Mumbai's population.

NCERT In-Text Questions

1.

Solution:

We know that $5 \times 2 = 10$ (multiplication fact) has two division facts: $10 \div 2 = 5$ and $10 \div 5 = 2$.

So, according to the question, we can use in place of 5. Either we 10 divide by 5 or by

2.

$11 \times 11 =$ $111 \times 111 =$ $1111 \times 1111 =$	$66 \times 61 =$ $666 \times 661 =$ $6666 \times 6661 =$
$3 \times 5 =$ $33 \times 35 =$ $333 \times 335 =$	$101 \times 101 =$ $102 \times 102 =$ $103 \times 103 =$

Solution:

$11 \times 11 = 121$ $111 \times 111 = 12321$ $1111 \times 1111 = 1234321$ $11111 \times 11111 = 123454321$ $111111 \times 111111 =$ 12345654321	$66 \times 61 = 4026$ $666 \times 661 = 440226$ $6666 \times 6661 = 44402226$ $66666 \times 66661 = 4,444,022,226$ 666666×666661 $= 444440222226$
$3 \times 5 = 15$ $33 \times 35 = 1155$ $333 \times 335 = 111555$ $3333 \times 3335 = 11115555$ 33333×33335 $= 1111155555$	$101 \times 101 = 10201$ $102 \times 102 = 10404$ $103 \times 103 = 10609$ $104 \times 104 = 10816$ $105 \times 105 = 11025$

Figure it Out

Question 1.

Find quick ways to calculate these products:

- (a) $2 \times 1768 \times 50 = 1768 \times 100 = 176800$
- (b) $72 \times 125 = 9 \times 1000 = 9000$
- (c) $125 \times 40 \times 8 \times 25$

Solution: $125 \times 8 = 1000$

$40 \times 25 = 1000$

Now multiply:

$1000 \times 1000 = 10,00,000$

Question 2.

Solution:

(a) $25 \times 12 = 25 \times 4 \times 3 = 100 \times 3 = 300$

(b) $25 \times 240 = 25 \times 4 \times 60 = 100 \times 60 = 6000$

(c) $250 \times 120 = 250 \times 4 \times 30 = 1000 \times 30 = 30000$

(d) $2500 \times 12 = 2500 \times 4 \times 3 = 10000 \times 3 = 30000$

(e) $25000 \times 4800 = 120000000$

In-Text Questions

In-Text Questions

Solution:

Total population of Mumbai = 1,24,00,000

Capacity of 5000 ships = $5000 \times 2500 = 1,25,00,000$

Yes, Mumbai's population can fit easily into 5000 ships, as the capacity of the ship is more than the total population of Mumbai.

Inspired by this strange question, Roxie wondered, "If I could travel 100 kilometers every day, could I reach the Moon in 10 years?"

(The distance between the Earth and the Moon is 3,84,400 km.)

How far would she have travelled in a year?

Solution:

Distance travelled by Roxie in a year = $100 \text{ km/day} \times 365 \text{ days} = 36500 \text{ km}$

How far would she have travelled in 10 years?

Solution:

Distance travelled by Roxie in 10 years = $100 \text{ km/day} \times 365 \text{ days} \times 10$

= $36500 \text{ km} \times 10$

= 365000 km

Is it not easier to perform these calculations in stages? You can use this method for all large calculations.

Solution:

Yes, it is easier to perform these calculations in stages.

2. Find out if you can reach the Sun in a lifetime, if you travel 1000 kilometres every day.

Solution:

Distance between the Earth and the Sun = $2100 \times 70,000 = 147000000$ km

Distance travelled by you = 1000 km/day

Time required = $147000000 \text{ km} \div 1000 \text{ km/day}$

= 147000 days

= $147000 \text{ days} \div 365 \text{ days/year}$

~ 403 years

Not possible, as an average human being has a life expectancy of less than 100 years.

3. Make necessary reasonable assumptions and answer the questions below:

Solution:

(a) Weight of a single sheet = 5 grams.

Weight of 1 lakh sheets = $1,00,000 \times 5 = 5,00,000 \text{ g} = 500 \text{ kg}$, which is too heavy for any person to lift at once, as it exceeds normal human lifting capacity. Thus, we couldn't lift 1 lakh sheets together.

(b) Number of babies born every minute = 250

Total babies born in a day = $250 \times 1440 = 3,60,000$ babies

[Number of minutes in a day = 1440 minutes]

Thus, a million babies (1,000,000) will not be born in a single day, as the daily count is 3,60,000 babies.

(c) Time taken to count 1 coin = 1 second.

In a single day, we can count 86,400 coins.

[Total seconds in a day = $24 \times 60 \times 60 = 86,400$ seconds]

Thus, we cannot count 1 million coins in a day at the rate of 1 coin per second, since it would take approximately $1,000,000 \div 86,400 \sim 12$ days to complete the task.

Figure it Out

Question 1.

Solution:

(a) To form the largest multiple of 5, the last digit must be 0 or 5.

Starting with the biggest digits in decreasing order, the largest multiple of 5 is 9876543210 (10 digits).

(b) To form the smallest even number, the last digit must be even (0, 2, 4, 6, 8), and the digits should be written in ascending order.

The even number is 1023456798 (10 digits).

Question 2.

Solution:

77,77,777 (Seventy-seven lakhs seventy-seven thousand seven hundred seventy-seven).

This has 61 letters, making it one of the longest 7-digit numbers.

Question 3.

Solution:

To ensure swapping any two digits increases the value, the digits must increase from left to right. So the arrangement would be: 123456789. There is only 1 number that satisfies the given condition.

Question 4.

Solution:

The given number is 12345123451234512345.

After removing the 10 smallest digits from the left, the number we get is 5534512345.

Question 5.

Solution:

The problem involves finding two consecutive numbers whose English names share no common letters.

Here, zero and one share “e” and “o”.

one (1) and two (2) share “o”.

two (2) and three (3) share “t”.

.....

Nineteen and twenty share: ‘t’, ‘e’, ‘n’

..... and so on.

Therefore, there are no consecutive numbers that do not share a letter in common.

Question 6.

Solution:

Numbers 1-9 contribute 9 digits (1 digit each).

Numbers 10-99 contribute $90 \times 2 = 180$ digits (2 digits each).

Numbers 100-999 contribute $900 \times 3 = 2700$ digits (3 digits each).

(a) To find the 1000th digit:

Digits so far: $9 + 180 = 189$.

So, the 1000th digit will lie in the 3-digit numbers range.

Remaining digits: $1000 - 189 = 811$.

Number of 3-digit numbers to reach 811 digits:

$811 \div 3 = 270$, with 1 remaining number.

Thus, first we need to write the first 270 3-digit numbers starting from 100.

So, the 270th 3-digit number = $100 + 270 - 1 = 369$.

The next number is 370.

Thus, the 1000th digit is the 1st digit of 370, which is 3.

(b) Using the same logic:

Numbers 1-9: 9 digits

Numbers 10-99: 180 digits

Numbers 100-999: 2700 digits

Numbers 1000-9999: $9000 \times 4 = 36,000$ digits

Numbers 10,000-99,999: $90,000 \times 5 = 4,50,000$ digits

Numbers 1,00,000-9,99,999: $9,00,000 \times 6 = 54,00,000$ digits

To reach the millionth digit:

Upto 5-digit numbers: $9 + 180 + 2700 + 36,000 + 4,50,000 = 4,88,889$

Remaining digits in the 6-digit range: $1,000,000$ (or $(10,00,000) - 4,88,889 = 5,11,111$)

The number of 6-digit numbers required: $5,11,111 \div 6 = 85,185$, with 1 remaining number.

So, the 85,185th 6-digit number is $85,185 + 1,00,000 - 1 = 1,85,184$.

The millionth digit occurs in the number $185184 + 1 = 1,85,185$.

(c) Single-digit numbers (1-9): 1 (only 5)

Two-digit numbers (10-99)

- (15, 25, 35, ..., 95), totaling 9 occurrences.
- 50, 51, 52, ..., 59, totaling 10 occurrences.

Thus, 19 occurrences of the digit 5 in the range 10-99.

Total occurrences so far: $1 + 19 = 20$

Three-digit numbers (100-999)

(i) Units position: Numbers like 105, 115,, 995 contribute 10 occurrences per 100 numbers. Across 900 numbers, there are 90 occurrences.

(ii) Tens position: Numbers like 150-159, 250-259,, 950-959 also contribute 10 occurrences per 100 numbers, and 90 occurrences in all.

(iii) Hundreds position: Numbers like 500-599 contribute 100 occurrences in this range.

Thus, 90 (units) + 90 (tens) + 100 (hundreds) = 280 occurrences

Total occurrences so far: $20 + 280 = 300$

Four-digit numbers (1000-9999)

Now it gets more intense! Here, 5 appears in four positions (units, tens, hundreds, thousands):

(i) Units position: Every 10 numbers, e.g., 1005, 1015, ..., 9995 = 900 occurrences total.

(ii) Tens position: 1050-1059, 1150-1159, ..., 9950-9959. That's 900 occurrences total.

(iii) Hundreds position: 1500-1599, 2500-2599, ..., 9500-9599 = 900 occurrences total.

(iv) Thousands position: 5000-5999 = 1000 occurrences

Adding these up: 900 (units) + 900 (tens) + 900 (hundreds) + 1000 (thousands) = 3700 occurrences

Total occurrences so far: $300 + 3700 = 4000$

Numbers starting from 10000 onward

For the 5000th number, we require $5000 - 4000 = 1000$ more numbers that lie in 10001-10999.

(v) Among 10000-10999, one digit 5 appears in 100 numbers (e.g., 10005, 10015, ..., 10995).

The digit 5 appears in 100 numbers (e.g., 10050-10059, ..., 10950-10959).

The digit 5 appears in 100 numbers (e.g., 10500-10599).

Total $4000 + 300 = 4300$

In 11000-11999

5 at unit place = 100

5 at tens place = 100

5 at a hundred place = 100

Total $4300 + 300 = 4600$

In 12000-12999

$4600 + 300 = 4900$

In 13000- 13999

Unit = 100

Total = 5000

Final number = 13995

Question 7.

Solution:

(a) $20,800 = 2 \times 10,000 + 8 \times 100$

Number of clicks = $2 + 8 = 10$ clicks

(b) $92,100 = 9 \times 10,000 + 21 \times 100$

Number of clicks = $9 + 21 = 30$ clicks

(c) $1,20,500 = 12 \times 10,000 + 5 \times 100$

Number of clicks = $12 + 5 = 17$ clicks

(d) $65,30,000 = 653 \times 10,000 + 0 \times 100$

Number of clicks = $653 + 0 = 653$ clicks

(e) $70,25,700 = 702 \times 10,000 + 57 \times 100$

Number of clicks = $702 + 57 = 759$ clicks

Question 8.

Solution:

1 lakh = 1,00,000

1 billion = 1,000,000,000

So, $1,000,000,000 \div 1,00,000 = 10,000$.

Thus, 10,000 lakhs make a billion.

Question 9.

Solution:

(a) Largest possible sum = $9988776 + 65544 = 10054320$

(b) Smallest possible difference = $1122334 - 99887 = 1022447$

Question 10.

Solution:

(a) $4000 \times (20 + 5) + 13000$

= $4000 \times 25 + 13000$

= $100000 + 13000$

= 113000

This gives us 1,13,000, which is very close to 1,10,000.

(b) $1,50,000 + 70,000 - 4000 \times 5 = 2,00,000$

(c) $70,000 \times 5 + 1,50,000 + 4,000 \times 20 = 5,80,000$

(d) $70,000 \times 20 - 1,50,000 - 4,000 - 300 \times 5 = 12,44,500$

This gives us 12,44,500, which is very close to 12,45,000.

(e) $13,000 \times 300 - 70,000(20 + 5) - 1,50,000 + 4,000 = 20,04,000$

Question 11.

Solution:

The approximate height of the Statue of Unity is 180 m (1,80,000 mm)

Thickness of one coin = 1 mm [Given]

To match the height, we need: 1,82,000 coins

Question 12.

Solution:

Using 900 km/day:

km ~ 13 days

So, it would take about 13 days.

Using 1000 km/day:

km = 12 days

So, it would take about 12 days.

It would take approximately 12-13 days to complete the 12,000 km trip.

Question 13.

Solution:

Total distance = 13,560 km and duration = 11 days

Distance covered every day = $13,560 \div 11 \sim 1,233$ km/day.

Thus, the godwit covers approximately 1,233 km per day.

One day = 24 hours

Distance covered every hour = $1,233 \div 24 \sim 51$ km/hour.

Thus, the godwit covers approximately 51 km per hour.

Question 14.

Solution:

Let's compare these heights to Somu's building:

Bald eagle: 4500 – 6000 m;

Mount Everest: 8850 m;

Aeroplanes: 10,000 – 12,800 m

Somu's building is 44 m tall.

Ratios compared to Somu's building:

Bald eagle: $(4500 \div 44 \sim 100)$ to $(6000 \div 44 \sim 150)$

The bald eagle's flying height is 100 – 150 times higher.

Mount Everest: $8850 \div 44 = 201$

Mount Everest is 201 times bigger.

Aeroplanes: $(10,000 \div 44 \sim 230)$ to $(12,800 \div 44 \sim 290)$

An aeroplane's flying height is 230 – 290 times higher.

Practice Time 1.1

Question 1

Write the number name for:

4,56,789

Solution

Step 1: Read the number using the Indian place value system

4,56,789

= 4 lakh + 56 thousand + 789

Step 2: Write in words

Four lakh fifty-six thousand seven hundred eighty-nine

Question 2

How many months will it take to save ₹50,000 if you save ₹1,000 every month?

Solution

Step 1: Write total amount and monthly savings

Total amount to save = ₹50,000

Monthly saving = ₹1,000

Step 2: Divide

$$50,000 \div 1,000 = 50$$

Final Answer

50 months

Question 3

A warehouse has delivery trucks. Each truck delivers 250 packages per day. How many packages are delivered in 50 days?

Solution

Step 1: Packages delivered in one day

$$250$$

Step 2: Packages delivered in 50 days

$$250 \times 50$$

Step 3: Multiply

$$250 \times 50 = 12,500$$

Final Answer

12,500 packages

Question 4

A town has a population of 90,000. How much more than 1 lakh is this population?

Solution *Step 1: Write 1 lakh in numbers*

$$1 \text{ lakh} = 1,00,000$$

Step 2: Compare with town population

$$1,00,000 - 90,000 = 10,000$$

Final Answer

The population is 10,000 less than 1 lakh.

Question 5

A tower is 300 metres tall. How many 4-metre floors would it have?

Solution

Step 1: Total height of tower

300 metres

Step 2: Height of one floor

4 metres

Step 3: Divide

$$300 \div 4 = 75$$

Final Answer

The tower would have 75 floors.

Question 6

Write the number name for:

12,34,567

Solution *Step 1: Read according to Indian place value system*

12,34,567

$$= 12 \text{ lakh} + 34 \text{ thousand} + 567$$

Step 2: Write in words

Twelve lakh thirty-four thousand five hundred sixty-seven

Final Answer

Twelve lakh thirty-four thousand five hundred sixty-seven

Question 7

How many years are equal to 50,000 days, assuming 365 days in a year?

Solution

Step 1: Divide total days by days in one year

$$50,000 \div 365$$

Step 2: Calculate

$$50,000 \div 365 \approx 136$$

Final Answer

Approximately 136 years

Question 8

If 1 lakh people stand in a line, and each person occupies 0.5 metres, how long would the line be in kilometres?

Solution By Steps

Step 1: Write 1 lakh in numbers

$$1,00,000$$

Step 2: Find total length in metres

$$1,00,000 \times 0.5 = 50,000 \text{ metres}$$

Step 3: Convert metres into kilometres

$$50,000 \div 1000 = 50$$

Final Answer

The line would be 50 kilometres long.

Practice Time 1.2

Question 1

How many times would you need to press the +1000 button to get the number 40,000?

Solution By Steps

Step 1: Divide total number by 1000

$$40,000 \div 1000 = 40$$

Final Answer

40 times

Question 2

If you want to reach 7,800 using the +100 button, how many times would you press it?

Solution

Step 1: Divide 7,800 by 100

$$7800 \div 100 = 78$$

Final Answer

78 times

Question 3

Write 6,432 using thousands, hundreds, tens and ones.

Solution

Break the number according to place values:

$$\begin{aligned} &6,432 \\ &= 6 \times 1000 + 4 \times 100 + 3 \times 10 + 2 \times 1 \end{aligned}$$

Final Answer

$$6 \times 1000 + 4 \times 100 + 3 \times 10 + 2 \times 1$$

Question 4

To make the number 85,000, how many times would you press the +1000 button?

Solution

$$85,000 \div 1000 = 85$$

Final Answer

85 times

Question 5

How would you break down the number 9,634 using +100s, +10s and +1s?

Solution

$$\begin{aligned} &9,634 \\ &= 96 \times 100 + 3 \times 10 + 4 \times 1 \end{aligned}$$

Final Answer

$$96 \times 100 + 3 \times 10 + 4 \times 1$$

Question 6

Using the +10 button, how many times do you need to press to get 670?

Solution

$$670 \div 10 = 67$$

Final Answer

67 times

Practice Time 1.3

Question 1

Write the number name of:

10,23,45,678

in both Indian and International systems.

Solution

Indian System

Step 1: Place commas in Indian system

10,23,45,678

= 10 crore 23 lakh 45 thousand 678

Step 2: Write in words

Ten crore twenty-three lakh forty-five thousand six hundred seventy-eight

International System

Step 3: Place commas in International system

102,345,678

= 102 million 345 thousand 678

Step 4: Write in words

One hundred two million three hundred forty-five thousand six hundred seventy-eight

Final Answer

Indian System:

Ten crore twenty-three lakh forty-five thousand six hundred seventy-eight

International System:

One hundred two million three hundred forty-five thousand six hundred seventy-eight

Question 2

Convert the number 40801000 into the Indian number system with commas and name it.

Solution

Step 1: Place commas according to Indian system

40801000 = 4,08,01,000

Step 2: Write number name

4 crore 8 lakh 1 thousand

Final Answer

4,08,01,000

Number name:

Four crore eight lakh one thousand

Question 3

How many lakhs make a crore?

Solution

Step 1: Write values

1 crore = 1,00,00,000

1 lakh = 1,00,000

Step 2: Divide

$$1,00,00,000 \div 1,00,000 = 100$$

Final Answer

100 lakhs make 1 crore.

Question 4

How many crores make an arab?

Solution

Step 1: Write values

1 arab = 1,00,00,00,000

$$1 \text{ crore} = 1,00,00,000$$

Step 2: Divide

$$1,00,00,00,000 \div 1,00,00,000 = 100$$

Final Answer

100 crores make 1 arab.

Question 5

Which system uses terms like million and billion?

Solution

The International place value system uses terms like:

- thousand
 - million
 - billion
-

Final Answer

The International System uses terms like million and billion.

Question 6

Place commas correctly in the number:

1098765432

using both systems.

Solution**Indian System**

1,09,87,65,432

International System

1,098,765,432

Final Answer

Indian System:

1,09,87,65,432

International System:

1,098,765,432

Question 7

The population of a country is:

1,27,00,00,000

Write this in words using the Indian system.

Solution

Step 1: Read according to Indian place values

1,27,00,00,000

= 127 crore

Step 2: Write in words

One hundred twenty-seven crore

Final Answer

One hundred twenty-seven crore

Question 8

Write the International system number name for:

5,67,89,000

Solution

Step 1: Convert into International comma style

56,789,000

Step 2: Read the number

56 million 789 thousand

Step 3: Write in words

Fifty-six million seven hundred eighty-nine thousand

Final Answer

Fifty-six million seven hundred eighty-nine thousand

Question 9

Read and write:

1,000,000

in the Indian system.

Solution

Step 1: Convert to Indian comma style

10,00,000

Step 2: Read the number

Ten lakh

Final Answer

10,00,000

Ten lakh

Question 10

Write one real-life situation where the Indian system is more useful than the International one.

Solution

In India, population, money, and business amounts are commonly written using lakhs and crores.

Example:

- A city population may be written as 2 crore people.

Final Answer

The Indian system is more useful in India for writing population, salaries, and large amounts of money using lakhs and crores.

Practice Time 1.4

Question 1

The population of a town is 89,643. What is its approximate population, rounded to:

(a) Nearest thousand

Solution By Steps

Step 1: Check hundreds digit

89,643

Hundreds digit = 6

Since $6 \geq 5$, round up.

Step 2: Round the number

$89,643 \approx 90,000$

Final Answer

90,000

(b) Nearest ten thousand

Solution

Step 1: Check thousands digit

Thousands digit = 9

Since $9 \geq 5$, round up.

Step 2: Round the number

$$89,643 \approx 90,000$$

Final Answer

90,000

(c) Nearest lakh

Solution By Steps

89,643

Since it is close to 1 lakh:

$$89,643 \approx 1,00,000$$

Final Answer

1,00,000

Question 2

A shopkeeper has 974 packets of biscuits. He wants to tell his customer an approximate number. What should he say?

Solution

974 is close to 1000.

So, approximate number:

1000

Final Answer

Approximately 1000 packets

Question 3

The price of a refrigerator is ₹47,860. Approximate this amount to:

(a) Nearest thousand

Solution By Steps

Hundreds digit = 8

Since $8 \geq 5$, round up.

$$47,860 \approx 48,000$$

Final Answer

₹48,000

(b) Nearest ten thousand

Solution By Steps

Thousands digit = 7

Since $7 \geq 5$, round up.

$$47,860 \approx 50,000$$

Final Answer

₹50,000

Question 4

Estimate the sum:

$$56,792 + 43,119$$

Will your answer be more or less than 1,00,000?

Solution By Steps

Step 1: Round numbers

$$56,792 \approx 57,000$$

$$43,119 \approx 43,000$$

Step 2: Add

$$57,000 + 43,000 = 1,00,000$$

Final Answer

Estimated sum = 1,00,000

Question 5

Estimate the difference:

$$98,605 - 46,920$$

Will your answer be more or less than 50,000?

Solution By Steps

Step 1: Round numbers

$$98,605 \approx 99,000$$

$$46,920 \approx 47,000$$

Step 2: Subtract

$$99,000 - 47,000 = 52,000$$

Step 3: Compare with 50,000

$$52,000 > 50,000$$

Final Answer

Estimated difference = 52,000

It is more than 50,000.

Practice Time 1.5

Question 1

Multiply:

$$144 \times 25$$

using the shortcut.

(Hint: $25 = \frac{100}{4}$)

Solution By Steps

Step 1: Rewrite 25

$$25 = \frac{100}{4}$$

Step 2: Apply shortcut

$$144 \times 25 = 144 \times \frac{100}{4}$$

Step 3: Divide first

$$144 \div 4 = 36$$

Step 4: Multiply by 100

$$36 \times 100 = 3600$$

Final Answer

$$144 \times 25 = 3600$$

Question 2

What will be the number of digits in:

$$222 \times 333$$

Solution By Steps

Step 1: Multiply

$$222 \times 333 = 73926$$

Step 2: Count digits

73926

has 5 digits.

Final Answer

5 digits

Question 3

Which is greater:

2-digit $\times$ 3-digit

or

3-digit $\times$ 2-digit?

Solution By Steps

Using multiplication property:

$$a \times b = b \times a$$

Both products are equal.

Example:

$$25 \times 300 = 7500$$

$$300 \times 25 = 7500$$

Final Answer

Both are equal.

Question 4

Find:

$$999 \times 1$$

and

$$999 \times 0$$

Solution By Steps

Step 1: Multiply by 1

Any number multiplied by 1 remains the same.

$$999 \times 1 = 999$$

Step 2: Multiply by 0

Any number multiplied by 0 becomes 0.

$$999 \times 0 = 0$$

Final Answer

$$999 \times 1 = 999$$

$$999 \times 0 = 0$$

Question 5

Predict the product of:

$$1111 \times 1111$$

Then solve and check.

Solution By Steps

Step 1: Multiply

$$\begin{aligned} 1111 \times 1111 \\ = 1234321 \end{aligned}$$

Final Answer

$$1111 \times 1111 = 1234321$$

Practice Time 1.6

Question 1

If a train carries 1000 passengers, how many trains are needed for 10 lakh people?

Solution By Steps

Step 1: Write 10 lakh in numbers

$$10,00,000$$

Step 2: Divide by passengers in one train

$$10,00,000 \div 1000$$

Step 3: Calculate

$$= 1000$$

Final Answer

1000 trains are needed.

Question 2

You walk 8 km a day. In how many years will you walk 1 lakh km?

Solution By Steps

Step 1: Distance walked in one year

$$8 \times 365 = 2920 \text{ km}$$

Step 2: Divide 1 lakh by yearly distance

$$1,00,000 \div 2920 \approx 34$$

Final Answer

Approximately 34 years

Question 3

Can a person read 1 crore words in a year if they read 5000 words daily?

Solution By Steps

Step 1: Find total words read in one year

$$5000 \times 365 = 18,25,000$$

Step 2: Compare with 1 crore

$$\begin{aligned} 1 \text{ crore} &= 1,00,00,000 \\ 18,25,000 &< 1,00,00,000 \end{aligned}$$

Final Answer

No, a person cannot read 1 crore words in one year at that speed.

Question 4

If 5 g of sugar is in one spoon, how much sugar is there in 1 lakh spoons?

Solution By Steps

Step 1: Write 1 lakh in numbers

1,00,000

Step 2: Multiply

$$1,00,000 \times 5 = 5,00,000$$

Final Answer

5,00,000 g

or

500 kg

Question 5

How many seconds are there in 1 million seconds?

(Hint: divide by 60 and 60 again)

Solution By Steps

Step 1: Convert seconds to minutes

$$10,00,000 \div 60 = 16,666.67 \text{ minutes}$$

Step 2: Convert minutes to hours

$$16,666.67 \div 60 \approx 277.78 \text{ hours}$$

Final Answer

Approximately 278 hours

Exam Time

A. Multiple Choice Questions (MCQs)

Question 1

Which of the following is the smallest six-digit number?

Solution By Steps

The smallest 6-digit number is:

1,00,000

Final Answer

Correct option: **(c) 1,00,000**

Question 2

How many lakhs make a crore?

Solution By Steps

$$1 \text{ crore} = 100 \text{ lakhs}$$

Final Answer

Correct option: **(b) 100**

Question 3

Which number is equal to one lakh in the Indian number system?

Solution By Steps

$$1 \text{ lakh} = 1,00,000$$

Final Answer

Correct option: **(a) 1,00,000**

Question 4

If a warehouse has 5 delivery trucks, each delivering 200 packages per day, how many packages are delivered in 100 days?

Solution By Steps

Step 1: Packages delivered in one day

$$5 \times 200 = 1000$$

Step 2: Packages delivered in 100 days

$$1000 \times 100 = 1,00,000$$

Final Answer

Correct option: **(c) 1,00,000**

Question 5

Which is the correct number name for:

12,34,567

Solution By Steps

12,34,567

is read as:

Twelve lakh thirty-four thousand five hundred sixty-seven

Final Answer

Correct option: **(b)**

B. Fill in the Blanks

Question 1

One crore is equal to _____ zeroes.

Solution By Steps

1 crore = 1,00,00,000

It has 7 zeroes.

Final Answer

7

Question 2

In the Indian system,

1,00,000

is read as _____.

Final Answer

One lakh

Question 3

The number 50,000 is made by pressing the + _____ button 50 times.

Solution By Steps

$$50 \times 1000 = 50,000$$

Final Answer

1000

Question 4

The number name for 99,999 in the Indian system is _____.

Solution By Steps

99,999

is read as:

Ninety-nine thousand nine hundred ninety-nine

Final Answer

Ninety-nine thousand nine hundred ninety-nine

Question 5

If you save ₹1,000 every month, it will take _____ months to save ₹1,00,000.

Solution By Steps

$$1,00,000 \div 1000 = 100$$

Final Answer

100 months

C. Write True or False

Question 1

The number 50,000 is written as 50,000 in the Indian system and 50000 in the International system.

Solution By Steps

In both systems, the value remains the same.

Only comma placement differs for larger numbers.

For 50,000:

- Indian system: 50,000

- International system: 50,000

So the statement is incorrect.

Final Answer

False

Question 2

One lakh is equal to one hundred thousand.

Solution By Steps

$$\begin{aligned}1 \text{ lakh} &= 1,00,000 \\100,000 &= 1,00,000\end{aligned}$$

Both are equal.

Final Answer

True

Question 3

The International System uses terms like crore and lakh.

Solution By Steps

The International system uses:

- thousand
- million
- billion

It does not use lakh or crore.

Final Answer

False

Question 4

A person can save ₹2,500 every month and reach ₹1,00,000 in 40 months.

Solution By Steps

Step 1: Multiply savings by months

$$2500 \times 40 = 1,00,000$$

Final Answer

True

Question 5

A building with 10 floors, each 4 metres tall, is 40 metres tall.

Solution By Steps

$$10 \times 4 = 40$$

Final Answer

True

D. Match the Columns

Column A**Column B**

- | | |
|--|--------------------------|
| 1. 1 lakh | a. 1,00,00,000 |
| 2. 1 crore | b. 1,00,000 |
| 3. 1 million | c. Ten lakhs |
| 4. 1,00,000 people standing shoulder-to-shoulder | d. About 38 km long line |
| 5. Rounding 76,068 to nearest ten thousand | e. 80,000 |
-

Solution By Steps**1. 1 lakh**

$$1 \text{ lakh} = 1,00,000$$

Matches with **(b)**

2. 1 crore

$$1 \text{ crore} = 1,00,00,000$$

Matches with **(a)**

3. 1 million

$$1,000,000 = 10 \text{ lakhs}$$

Matches with **(c)**

4. 1,00,000 people standing shoulder-to-shoulder

Approximate line length:

About 38 km

Matches with **(d)**

5. Rounding 76,068 to nearest ten thousand

$$76,068 \approx 80,000$$

Matches with (e)

Final Answer

Column A	Column B
1	b
2	a
3	c
4	d
5	e

E. Very Short Answer Type Questions

Question 1

How many zeroes are there in one crore?

Solution By Steps

$$1 \text{ crore} = 1,00,00,000$$

It has 7 zeroes.

Final Answer

7 zeroes

Question 2

Write 1 lakh in numeral form.

Solution By Steps

$$1 \text{ lakh} = 1,00,000$$

Final Answer

$$1,00,000$$

Question 3

How many thousands make one lakh?

Solution By Steps

$$1,00,000 \div 1000 = 100$$

Final Answer

100 thousands

Question 4

What is the population of Mumbai approximately according to the text?

Solution By Steps

The text mentions Mumbai's population as approximately:

$$1,24,00,000$$

Final Answer

Approximately 1 crore 24 lakh

Question 5

What is the smallest six-digit number?

Solution By Steps

The first 6-digit number is:

1,00,000

Final Answer

1,00,000

F. Short Answer Type Questions

Question 1

Define approximation with one example from daily life.

Solution

Approximation means finding a number close to the exact value for easier understanding.

Example:

A shopkeeper may say “about 1000 packets” instead of exactly 974 packets.

Final Answer

Approximation means using a nearby value instead of the exact number.

Example:

974 packets $\approx$ 1000 packets.

Question 2

What is the difference between the Indian and International place value systems?

Solution By Steps

Indian System

Uses:

- lakhs
- crores

Comma placement:

1,23,45,678

International System

Uses:

- millions
- billions

Comma placement:

123,456,678

Final Answer

The Indian system uses lakhs and crores, while the International system uses millions and billions.

Question 3

How many floors of 4 metres each will make a 200 metre-tall tower?

Solution By Steps

$$200 \div 4 = 50$$

Final Answer

50 floors

Question 4

Write the number name of:

4,56,789

in the Indian system.

Solution By Steps

4,56,789

= 4 lakh 56 thousand 789

Final Answer

Four lakh fifty-six thousand seven hundred eighty-nine

Question 5

Estimate the sum:

$$56,792 + 43,119$$

and say whether it is more or less than one lakh.

Solution By Steps

Step 1: Round numbers

$$56,792 \approx 57,000$$

$$43,119 \approx 43,000$$

Step 2: Add

$$57,000 + 43,000 = 1,00,000$$

Final Answer

Estimated sum = 1,00,000

G. Long Answer Type Questions

Question 1

Explain with examples how large numbers are used in daily life.

Solution

Large numbers are used in many real-life situations such as:

- population
- money
- distances
- business
- science

Examples:

- Population of cities is written in lakhs and crores.
- Government budgets use crores.

- Distances between planets use millions of kilometres.
-

Final Answer

Large numbers help us represent huge quantities easily in daily life such as population, money, and distance.

Question 2

Compare and contrast the Indian and International place value systems with one example each.

Solution By Steps

Indian System

Uses:

- lakh
- crore

Example:

12,34,567

= Twelve lakh thirty-four thousand five hundred sixty-seven

International System

Uses:

- million
- billion

Example:

1,234,567

= One million two hundred thirty-four thousand five hundred sixty-seven

Final Answer

The Indian system uses lakhs and crores, while the International system uses millions and billions.

Question 3

Describe how rounding helps in estimation. Give two examples.

Solution

Rounding helps us estimate numbers quickly without exact calculation.

Examples:

$$47,860 \approx 48,000$$

$$89,643 \approx 90,000$$

This makes calculations easier.

Final Answer

Rounding replaces a number with a nearby easier number for quick estimation.

Examples:

- $47,860 \approx 48,000$
 - $89,643 \approx 90,000$
-

Question 4

A person saves ₹1,000 every month. How many months will it take to save ₹2,00,000?

Solution By Steps

$$2,00,000 \div 1000 = 200$$

Final Answer

200 months

Question 5

If a waterfall is 450 m tall, how many floors of 4 metres each would it take to reach the same height?

Solution By Steps

$$450 \div 4 = 112.5$$

Since half floors are not practical:

113

Final Answer

Approximately 113 floors

Competency-Based Questions**A. Assertion and Reason Type Questions**

Question 1

Assertion (A):

The number 1,00,000 has six digits and is called one lakh.

Reason (R):

In the Indian system, the first comma comes after three digits from the right and then after every two digits.

Solution By Steps

- Assertion is true.

- Reason is also true.
 - Reason correctly explains Indian comma placement.
-

Final Answer

Correct option: **(a)**

Both (A) and (R) are true and (R) is the correct explanation of (A).

Question 2

Assertion (A):

Approximation makes large numbers easier to communicate and calculate.

Reason (R):

Rounding off always increases the given number.

Solution By Steps

- Assertion is true.
 - Reason is false because rounding may increase or decrease the number.
-

Final Answer

Correct option: **(c)**

(A) is true but (R) is false.

B. Case Study Based Questions

Race to One Lakh

Aarav and Myra start from 10,000.

(a) Aarav always chooses +10,000.

Solution By Steps

Target:

1,00,000

Difference:

$$1,00,000 - 10,000 = 90,000$$

Each move adds:

10,000

Moves needed:

$$90,000 \div 10,000 = 9$$

Final Answer

Aarav needs 9 moves.

(b) Myra chooses +1,000 ten times before using +10,000 once.

Solution By Steps

Ten +1000 moves:

$$10 \times 1000 = 10,000$$

This equals one +10,000 move.

So Myra takes more steps.

Final Answer

Myra needs more moves than Aarav.

Ch- 2 – Airthmetic Expressions

NCERT CORNER

In-Text Questions

1. Use “>”, “<” or “=” in each expression

(a) $245 + 289$ __ $246 + 285$

Solution By Steps

Step 1: Compare the sums

Left side:

$$245 + 289 = 534$$

Right side:

$$246 + 285 = 531$$

Step 2: Compare 534 and 531

$$534 > 531$$

Final Answer

$$245 + 289 > 246 + 285$$

(b) $273 - 145$ __ $272 - 144$

Solution By Steps

Step 1: Find both differences

$$273 - 145 = 128$$

$$272 - 144 = 128$$

Step 2: Compare

Both are equal.

Final Answer

$$273 - 145 = 272 - 144$$

(c) $364 + 587$ ___ $363 + 589$

Solution By Steps

Step 1: Add both sides

$$364 + 587 = 951$$

$$363 + 589 = 952$$

Step 2: Compare

$$951 < 952$$

Final Answer

$$364 + 587 < 363 + 589$$

(d) $124 + 245$ ___ $129 + 245$

Solution By Steps

Step 1: Add both sides

$$124 + 245 = 369$$

$$129 + 245 = 374$$

Step 2: Compare

$$369 < 374$$

Final Answer

$$124 + 245 < 129 + 245$$

(e) $213 - 77$ ___ $214 - 76$

Solution By Steps

Step 1: Find both differences

$$213 - 77 = 136$$

$$214 - 76 = 138$$

Step 2: Compare

$$136 < 138$$

Final Answer

$$213 - 77 < 214 - 76$$

Figure it Out

Question 1.

Fill in the blanks to make the expressions equal on both sides of the '=' sign:

(a) $13 + 4 = \underline{\hspace{2cm}} + 6$

(b) $22 + \underline{\hspace{2cm}} = 6 \times 5$

(c) $8 \times \underline{\hspace{2cm}} = 64 \div 2$

(d) $34 - \underline{\hspace{2cm}} = 25$

Solution:

(a) $13 + 4 = 17$

$11 + 6 = 17$

Therefore, $13 + 4 = 11 + 6$

(b) Since $6 \times 5 = 30$

$22 + 8 = 30$

Therefore, $22 + 8 = 6 \times 5$

(c) Since $64 \div 2 = 32$

$8 \times 4 = 32$

Therefore, $8 \times 4 = 64 \div 2$

(d) Since $34 - 25 = 9$

Therefore, $34 - 9 = 25$

Question 2.

Arrange the following expressions in ascending (increasing) order of their values.

(a) $67 - 19$

(b) $67 - 20$

(c) $35 + 25$

(d) 5×11

(e) $120 \div 3$

Solution:

(a) $67 - 19 = 48$

(b) $67 - 20 = 47$

(c) $35 + 25 = 60$

(d) $5 \times 11 = 55$

(e) $120 \div 3 = 40$

Clearly, $40 < 47 < 48 < 55 < 60$

Therefore, $120 \div 3 < 67 - 20 < 67 - 19 < 5 \times 11 < 35 + 25$

Thus, (e) < (b) < (a) < (d) < (c).

Intext Questions

1.

Solution:

No. Since in the expression, each term is separated by a '+' sign.

So, changing the order in which the terms are added does not change the value.

As, $4 + 15 + (-9) = 10$ or $(-9) + 15 + 4 = 10$

Yes, swapping the terms having negative numbers does not change the sum.

As $(-3) + (-2) = -5$ or $(-2) + (-3) = -5$

(Answer may vary)

2. Mnasa forgot to include 9055 while adding

Numbers:

1342, 774, 8611, 9055, 1022

She got answer:

11749

Solution By Steps

Step 1: Add the forgotten number to the obtained answer

$$\begin{aligned} 11749 + 9055 \\ = 20804 \end{aligned}$$

Final Answer

No, she does not need to start again. She only needs to add the forgotten number 9055 to 11749.

Correct answer:

20804

3. Manasa is going outside to play. Her mother says, “Wear your hat and shoes!” Which should she wear first?

Solution By Steps

Step 1: Think logically

To wear shoes properly, socks and shoes should come before the hat.

The order matters here.

Final Answer

She should wear her shoes first and then the hat.

In-Text Questions

1. If the total number of friends goes up to 7 and the tip remains the same, how much will they have to pay? Write an expression for this situation and identify its terms.

Solution:

Since the total number of friends = 7

and the cost of each dosa = ₹ 23

Therefore, the total cost of 7 dosas = 7×23

As the tip remains the same, that is ₹ 5.

So, the expression for describing the total cost is $7 \times 23 + 5 = 7 \times 23 + 5 = 161$

$$+ 5 = ₹ 166.$$

The terms in the expression $7 \times 23 + 5$ are 7×23 , 5.

Think and discuss

Solution:

Do it yourself.

3. For each of the cases below, write the expression and identify its terms:

If the teacher had called out '4', Ruby would write _____

If the teacher had called out '7', Ruby would write _____

Solution:

(i) If the teacher had called out '4', Ruby would write $8 \times 4 + 1$

Terms: 8×4 , 1

(ii) If the teacher had called out '7', Ruby would write $4 \times 7 + 5$

Terms: 4×7 , 5

(iii) Write an expression like the above for your class size.

Solution:

Do it yourself.

Identify the terms in the two expressions above.

Solution:

$$432 = 4 \times 100 + 1 \times 20 + 1 \times 10 + 2 \times 1$$

Terms: 4×100 , 1×20 , 1×10 , and 2×1

$$432 = 8 \times 50 + 1 \times 10 + 4 \times 5 + 2 \times 1$$

Terms: 8×50 , 1×10 , 4×5 , and 2×1

Figure it Out

Question 1.

Find the values of the following expressions by writing the terms in each case.

(a) $28 - 7 + 8$

(b) $39 - 2 \times 6 + 11$

(c) $40 - 10 + 10 + 10$

(d) $48 - 10 \times 2 + 16 + 2$

(e) $6 \times 3 - 4 \times 8 \times 5$

Solution:

(a) $28 - 7 + 8 = 28 + (-7) + 8$

Terms: 28, -7, and 8

$$28 - 7 + 8$$

$$= 28 + (-7) + 8$$

$$= 21 + 8 = 29$$

(b) $39 - 2 \times 6 + 11 = 39 + (-2 \times 6) + 11$

Terms: 39, -2×6 , and 11

$$39 - 2 \times 6 + 11$$

$$= 39 + (-2 \times 6) + 11$$

$$= 39 + (-12) + 11$$

$$= 27 + 11$$

$$= 38$$

(c) $40 - 10 + 10 + 10 = 40 + (-10) + 10 + 10$

Terms: 40, -10, 10, and 10

$$40 - 10 + 10 + 10$$

$$= 40 + (-10) + 10 + 10$$

$$= 30 + 10 + 10$$

$$= 40 + 10$$

$$= 50$$

(d) $48 - 10 \times 2 + 16 + 2 = 48 + (-10 \times 2) + (16 + 2)$

Terms: 48, -10×2 , $16 + 2$

$$48 - 10 \times 2 + 16 + 2$$

$$= 48 + (-10 \times 2) + (16 + 2)$$

$$= 48 + (-20) + (8)$$

$$= 28 + 8 = 36$$

(e) $6 \times 3 - 4 \times 8 \times 5 = (6 \times 3) + (-4 \times 8 \times 5)$

Terms: 6×3 , $4 \times 8 \times 5$

$$6 \times 3 - 4 \times 8 \times 5$$

$$= (6 \times 3) + (-4 \times 8 \times 5)$$

$$= 18 + (-160)$$

$$= -142$$

Question 2.

Write a story/situation for each of the following expressions and find their values.

(a) $89 + 21 - 10$

(b) $5 \times 12 - 6$

(c) $4 \times 9 + 2 \times 6$

Solution:

(a) $89 + 21 - 10$

Riya and Siya are cousins. They went to the beach, from where Riya collected

89 stones and Siya collected 21 stones. When they reached home, their other younger sister asked them for some stones. They give her 10 stones from their collection. How many stones were left with both Riya and Siya?

$$89 + 21 - 10 = 89 + 21 + (-10) = 89 + 11 = 100$$

(b) $5 \times 12 - 6$

Radha bought 5 pens from a stationery shop. The cost of each pen is ₹ 12. The shopkeeper also gave her a discount of ₹ 6 on the total cost. Find the total amount that she has to pay to the shopkeeper.

$$5 \times 12 - 6 = 5 \times 12 + (-6) = 60 + (-6) = 54$$

(c) $4 \times 9 + 2 \times 6$

Sumit bought 4 pencils, the cost of each pencil is ₹ 9, and he also bought 2 erasers, which cost ₹ 6 each. How much money does he have to spend to buy these items?

$$4 \times 9 + 2 \times 6 = 36 + 12 = 48$$

Question 3.

For each of the following situations, write the expression describing the situation, identify its terms, and find the value of the expression.

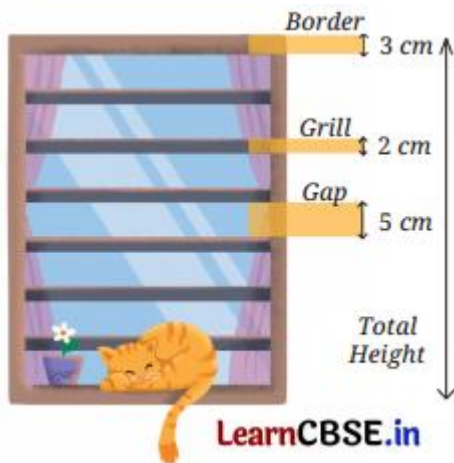
(a) Queen Alia gave 100 gold coins to Princess Elsa and 100 gold coins to Princess Anna last year. Princess Elsa used the coins to start a business and doubled her coins. Princess Anna bought jewellery and has only half of the coins left. Write an expression describing how many gold coins Princess Elsa and Princess Anna together have.

(b) A metro train ticket between two stations is ₹ 40 for an adult and ₹ 20 for a child. What is the total cost of the tickets?

(i) for four adults and three children?

(ii) for two groups having three adults each?

(c) Find the total height of the window by writing an expression describing the relationship among the measurements shown in the picture.



Solution:

(a) Number of gold coins Princess Elsa got = 100

Number of gold coins Princess Anna got = 100

Princess Elsa used the coins to start the business and doubled her coins.

So, the number of coins Princess Elsa has = 2×100

Princess Anna bought jewellery and has only half of the coins left.

So, the number of coins Princess Anna has =

$$= 200 + 50 = 250$$

(b) (i) Metro train ticket for an adult = ₹ 40

So, the metro train ticket for four adults = 4×40

Metro train ticket for a child = ₹ 20

So, the metro train ticket for three children = 3×20

Therefore, the expression describing the total cost of tickets for four adults and three children is $4 \times 40 + 3 \times 20$

Terms: 4×40 , 3×20

$$\text{Now, } 4 \times 40 + 3 \times 20 = 160 + 60 = 220$$

(ii) Metro train ticket for an adult = ₹ 40

So, the metro train ticket for a group of three adults = 3×40

Therefore, the expression describing the total cost of tickets for the two groups having three adults each is $2 \times (3 \times 40)$.

Terms: $2 \times (3 \times 40)$

$$\text{Now, } 2 \times (3 \times 40) = 2 \times 120 = 240$$

(c) By observing the given picture, the total height of the window = number of gaps $\times 5$ cm + number of grills $\times 2$ cm + number of borders $\times 3$ cm = $7 \times 5 + 6 \times 2 + 2 \times 3$

Terms: 7×5 , 6×2 , 2×3

Now, $7 \times 5 + 6 \times 2 + 2 \times 3 = 35 + 12 + 6 = 47 + 6 = 53$

Figure it Out

Question 1.

Fill in the blanks with numbers, and boxes with operation signs such that the expressions on both sides are equal.

(a) $24 + (6 - 4) = 24 + 6 \square$ _____

(b) $38 + (\square \square) = 38 + 9 - 4$

(c) $24 - (6 + 4) = 24 \square 6 - 4$

(d) $24 - 6 - 4 = 24 - 6 \square$ _____

(e) $27 - (8 + 3) = 27 \square 8 \square 3$

(f) $27 - (\square \square) = 27 - 8 + 3$

Solution:

(a) $24 + (6 - 4) = 24 + 6 - 4$

(b) $38 + (9 - 4) = 38 + 9 - 4$

(c) $24 - (6 + 4) = 24 - 6 - 4$

(d) $24 - 6 - 4 = 24 - 6 - 4$

(e) $27 - (8 + 3) = 27 - 8 - 3$

(f) $27 - (8 - 3) = 27 - 8 + 3$

Question 2.

Remove the brackets and write the expression having the same value.

(a) $14 + (12 + 10)$

(b) $14 - (12 + 10)$

(c) $14 + (12 - 10)$

(d) $14 - (12 - 10)$

(e) $-14 + 12 - 10$

(f) $14 - (-12 - 10)$

Solution:

(a) $14 + (12 + 10)$

$= 14 + 12 + 10$

$= 14 + 22$

$= 36$

(b) $14 - (12 + 10)$

$= 14 - 12 - 10$

$= 14 - 22$

$= -8$

$$\begin{aligned}
 \text{(c)} \quad & 14 + (12 - 10) \\
 &= 14 + 12 - 10 \\
 &= 14 + 2 \\
 &= 16
 \end{aligned}$$

$$\begin{aligned}
 \text{(d)} \quad & 14 - (12 - 10) \\
 &= 14 - 12 + 10 \\
 &= 14 - 2 \\
 &= 12
 \end{aligned}$$

$$\begin{aligned}
 \text{(e)} \quad & -14 + 12 - 10 \\
 &= -14 + 2 \\
 &= -12
 \end{aligned}$$

$$\begin{aligned}
 \text{(f)} \quad & 14 - (-12 - 10) \\
 &= 14 + 12 + 10 \\
 &= 14 + 22 \\
 &= 36
 \end{aligned}$$

Question 3.

Find the values of the following expressions. For each pair, first try to guess whether they have the same value. When are the two expressions equal?

(a) $(6 + 10) - 2$ and $6 + (10 - 2)$

(b) $16 - (8 - 3)$ and $(16 - 8) - 3$

(c) $27 - (18 + 4)$ and $27 + (-18 - 4)$

Solution:

(a) $(6 + 10) - 2$ and $6 + (10 - 2)$

$$(6 + 10) - 2 = 16 - 2 = 14$$

$$\text{and } 6 + (10 - 2) = 6 + 8 = 14$$

$$\text{Clearly, } (6 + 10) - 2 = 6 + (10 - 2)$$

Hence, the expressions in part (a) have the same value.

(b) $16 - (8 - 3)$ and $(16 - 8) - 3$

$$16 - (8 - 3) = 16 - 5 = 11$$

$$\text{and } (16 - 8) - 3 = 8 - 3 = 5$$

$$16 - (8 - 3) \neq (16 - 8) - 3$$

Hence, the expressions in part (b) do not have the same value.

(c) $27 - (18 + 4)$ and $27 + (-18 - 4)$

$$27 - (18 + 4) = 27 - 22 = 5$$

$$\text{and } 27 + (-18 - 4) = 27 + (-22) = 5$$

Clearly, $27 - (18 + 4) = 27 + (-18 - 4)$

Hence, the expressions in part (c) have the same value.

Question 4.

In each of the sets of expressions below, identify those that have the same value.

Do not evaluate them, but rather use your understanding of terms.

(a) $319 + 537$, $319 - 537$, $-537 + 319$, $537 - 319$

(b) $87 + 46 - 109$, $87 + 46 - 109$, $87 + 46 - 109$, $87 - 46 + 109$, $87 - (46 + 109)$, $(87 - 46) + 109$

Solution:

(a)

Expressions	Terms
$319 + 537$	319, 537
$319 - 537$	319, -537
$-537 + 319$	319, -537
$537 - 319$	-319, 537

Expressions having the same terms have the same value. Therefore, $319 - 537$ and $-537 + 319$ have the same value.

(b)

Expressions	Terms
$87 + 46 - 109$	87, 46, -109
$87 + 46 - 109$	87, 46, -109
$87 + 46 - 109$	87, 46, -109
$87 - 46 + 109$	87, -46, 109
$87 - (46 + 109)$	87, -46, -109
$(87 - 46) + 109$	87, -46, 109

Expressions having the same terms have equal values.

Therefore, $87 + 46 - 109$, $87 + 46 - 109$, $87 + 46 - 109$ have the same value.

Also, $87 - 46 + 109$ and $(87 - 46) + 109$ have the same value.

Question 5.

Add brackets at appropriate places in the expressions such that they lead to the values indicated.

(a) $34 - 9 + 12 = 13$

(b) $56 - 14 - 8 = 34$

(c) $-22 - 12 + 10 + 22 = -22$

Solution:

(a) $34 - (9 + 12) = 34 - 21 = 13$

(b) $(56 - 14) - 8 = 42 - 8 = 34$

(c) $-22 - (12 + 10) + 22 = -22 - 22 + 22 = -22$

Question 6.

Using only reasoning of how terms change their values, fill the blanks to make the expressions on either side of the equality (=) equal.

(a) $423 + \underline{\hspace{2cm}} = 419 + \underline{\hspace{2cm}}$

(b) $207 - 68 = 210 - \underline{\hspace{2cm}}$

Solution:

(a) $423 + 419 = 419 + 423$

(b) $207 - 68 = 210 - 71$

Question 7.

Using the numbers 2, 3, and 5, and the operators '+' and '-', and brackets, as necessary, generate expressions to give as many different values as possible.

For example, $2 - 3 + 5 = 4$ and $3 - (5 - 2) = 0$

Solution:

Here are a few expressions formed by using numbers 2, 3, and 5 and the operators '+' and '-' and brackets having different values.

$(2 + 3) - 5 = 5 - 5 = 0,$

$5 + (3 - 2) = 5 + 1 = 6,$

$-5 + (2 - 3) = -5 + (-1) = -6,$

$(-2 + 3) - 5 = 1 - 5 = -4, \text{ etc.}$

Question 8.

Whenever Jasoda has to subtract 9 from a number, she subtracts 10 and adds 1 to it.

For example, $36 - 9 = 26 + 1.$

(a) Do you think she always gets the correct answer? Why?

(b) Can you think of other similar strategies? Give some examples.

Solution:

(a) Yes, she will always get the correct answer if she subtracts 10 from a number and then adds 1 to the result instead of directly subtracting 9 from the number, because subtracting 10 and adding 1, i.e., $-10 + 1 = -9$, is equivalent to subtracting 9 from the number.

As $36 - 9 = 27$ or $(36 - 10) + 1 = 26 + 1 = 27$

(b) Do it yourself.

Question 9.

Consider the two expressions:

(a) $73 - 14 + 1$

(b) $73 - 14 - 1$

For each of these expressions, identify the expressions from the following collection that are equal to it.

(a) $73 - (14 + 1)$

(b) $73 - (14 - 1)$

(c) $73 + (-14 + 1)$

(d) $73 + (-14 - 1)$

Solution:

Given expressions:

$$73 - 14 + 1 = 60 \text{ and } 73 - 14 - 1 = 58$$

Now,

(a) $73 - (14 + 1) = 73 - 15 = 58$

(b) $73 - (14 - 1) = 73 - 13 = 60$

(c) $73 + (-14 + 1) = 73 - 13 = 60$

(d) $73 + (-14 - 1) = 73 + (-15) = 58$

Hence, expressions (b) and (c) are equal to the expression $73 - 14 + 1$, and expressions (a) and (d) are equal to the expression $73 - 14 - 1$.

In-Text Questions

1. If another friend, Sangmu, joins them and orders the same items, what will be the expression for the total amount to be paid?

Solution:

If another friend, Sangmu, joins them (Lhamo and Norbu) and orders the same items, then the expression for the total amount will be $3 \times (43 + 24)$.

$5 \times 4 + 3 \neq 5 \times (4 + 3)$. Can you explain why?

Is $5 \times (4 + 3) = 5 \times (3 + 4) = (3 + 4) \times 5$?

Solution:

Expression $5 \times 4 + 3$ means 3 more than 5×4 , which is equal to 23, but $5 \times (4 + 3)$ means 5 times $(4 + 3)$, which is equal to 35.

Hence, $5 \times 4 + 3 \neq 5 \times (4 + 3)$

$5 \times (4 + 3)$, $5 \times (3 + 4)$, and $(3 + 4) \times 5$ have the same meaning, which is 5 times the sum of 3 and 4, and give the same value.

Hence, $5 \times (4 + 3) = 5 \times (3 + 4) = (3 + 4) \times 5$

5. Use this method to find the following products:

(a) 95×8

(b) 104×15

(c) 49×50

Is this quicker than the multiplication procedure you use generally?

Solution:

$$\begin{aligned} \text{(a)} \quad 95 \times 8 &= (100 - 5) \times 8 \\ &= 100 \times 8 - 5 \times 8 \\ &= 800 - 40 \\ &= 760 \end{aligned}$$

$$\begin{aligned} \text{(b)} \quad 104 \times 15 &= (100 + 4) \times 15 \\ &= 100 \times 15 + 4 \times 15 \\ &= 1500 + 60 \\ &= 1560 \end{aligned}$$

$$\begin{aligned} \text{(c)} \quad 49 \times 50 &= (50 - 1) \times 50 \\ &= 50 \times 50 - 50 \times 1 \\ &= 2500 - 50 \\ &= 2450 \end{aligned}$$

Yes, this procedure is quicker than the general multiplication procedure.

Which other products might be quicker to find, like the ones above?

Solution:

Do it yourself.

Figure it Out

Question 1.

Fill in the blanks with numbers and boxes by signs, so that the expressions on both sides are equal.

$$\text{(a)} \quad 3 \times (6 + 7) = 3 \times 6 + 3 \times 7$$

$$\text{(b)} \quad (8 + 3) \times 4 = 8 \times 4 + 3 \times 4$$

$$\text{(c)} \quad 3 \times (5 + 8) = 3 \times 5 \quad \boxed{} \quad 3 \times \underline{\hspace{2cm}}$$

$$\text{(d)} \quad (9 + 2) \times 4 = 9 \times 4 \quad \boxed{} \quad 2 \times \underline{\hspace{2cm}}$$

$$\text{(e)} \quad 3 \times (\underline{\hspace{2cm}} + 4) = 3 \underline{\hspace{2cm}} + \underline{\hspace{2cm}}$$

$$\text{(f)} \quad (\underline{\hspace{2cm}} + 6) \times 4 = 13 \times 4 + \underline{\hspace{2cm}}$$

$$\text{(g)} \quad 3 \times (\underline{\hspace{2cm}} + \underline{\hspace{2cm}}) = 3 \times 5 + 3 \times 2$$

$$\text{(h)} \quad (\underline{\hspace{2cm}} + \underline{\hspace{2cm}}) \times \underline{\hspace{2cm}} = 2 \times 4 + 3 \times 4$$

$$\text{(i)} \quad 5 \times (9 - 2) = 5 \times 9 - 5 \times \underline{\hspace{2cm}}$$

$$\text{(j)} \quad (5 - 2) \times 7 = 5 \times 7 - 2 \times \underline{\hspace{2cm}}$$

$$\text{(k)} \quad 5 \times (8 - 3) = 5 \times 8 \quad \boxed{} \quad 5 \times \underline{\hspace{2cm}}$$

$$\text{(l)} \quad (8 - 3) \times 7 = 8 \times 7 \quad \boxed{} \quad 3 \times 7$$

$$\text{(m)} \quad 5 \times (12 - \underline{\hspace{2cm}}) = \underline{\hspace{2cm}} \quad \boxed{} \quad 5 \times \underline{\hspace{2cm}}$$

$$\text{(n)} \quad (15 - \underline{\hspace{2cm}}) \times 7 = \underline{\hspace{2cm}} \quad \boxed{} \quad 6 \times 7$$

$$(o) 5 \times (\underline{\quad\quad\quad} - \underline{\quad\quad\quad}) = 5 \times 9 - 5 \times 4$$

$$(p) (\underline{\quad\quad\quad} - \underline{\quad\quad\quad}) \times \underline{\quad\quad\quad} = 17 \times 7 - 9 \times 7$$

Solution:

$$(a) 3 \times (6 + 7) = 3 \times 6 + 3 \times 7$$

$$(b) (8 + 3) \times 4 = 8 \times 4 + 3 \times 4$$

$$(c) 3 \times (5 + 8) = 3 \times 5 + 3 \times 8$$

$$(d) (9 + 2) \times 4 = 9 \times 4 + 2 \times 4$$

$$(e) 3 \times (10 + 4) = 30 + 12$$

$$(f) (13 + 6) \times 4 = 13 \times 4 + 24$$

$$(g) 3 \times (5 + 2) = 3 \times 5 + 3 \times 2$$

$$(h) (2 + 3) \times 4 = 2 \times 4 + 3 \times 4$$

$$(i) 5 \times (9 - 2) = 5 \times 9 - 5 \times 2$$

$$(j) (5 - 2) \times 7 = 5 \times 7 - 2 \times 7$$

$$(k) 5 \times (8 - 3) = 5 \times 8 - 5 \times 3$$

$$(l) (8 - 3) \times 7 = 8 \times 7 - 3 \times 7$$

$$(m) 5 \times (12 - 3) = 60 - 5 \times 3$$

$$(n) (15 - 6) \times 7 = 105 - 6 \times 7$$

$$(o) 5 \times (9 - 4) = 5 \times 9 - 5 \times 4$$

$$(p) (17 - 9) \times 7 = 17 \times 7 - 9 \times 7$$

Question 2.

In the boxes below, fill in '<', '>' or '=' after analysing the expressions on the LHS and RHS. Use reasoning and understanding of terms and brackets to figure this out, and not by evaluating the expressions.

$$(a) (8 - 3) \times 29 \quad \boxed{} \quad (3 - 8) \times 29$$

$$(b) 15 + 9 \times 18 \quad \boxed{} \quad (15 + 9) \times 18$$

$$(c) 23 \times (17 - 9) \quad \boxed{} \quad 23 \times 17 + 23 \times 9$$

$$(d) (34 - 28) \times 42 \quad \boxed{} \quad 34 \times 42 - 28 \times 42$$

Solution:

$$(a) (8 - 3) \times 29 > (3 - 8) \times 29$$

$$\text{Because, } (3 - 8) \times 29 = -(8 - 3) \times 29$$

$$\Rightarrow (8 - 3) \times 29 > (3 - 8) \times 29$$

$$(b) 15 + 9 \times 18 < (15 + 9) \times 18$$

$$\text{Because, } (15 + 9) \times 18 = 15 \times 18 + 9 \times 18 \text{ and } 15 \times 18 > 15$$

$$\text{So, } 15 + 9 \times 18 < (15 + 9) \times 18$$

(c) $23 \times (17 - 9) < 23 \times 17 + 23 \times 9$

Because, $23 \times (17 - 9) = 23 \times 17 - 23 \times 9$

Clearly, $23 \times 17 > 23 \times 17 - 23 \times 9$

$\Rightarrow 23 \times (17 - 9) < 23 \times 17 + 23 \times 9$

(d) $(34 - 28) \times 42 = 34 \times 42 - 28 \times 42$

Question 3.

Here is one way to make 14: $2 \times (1 + 6) = 14$. Are there other ways of getting 14? Fill them out below:

(a) $\underline{\hspace{2cm}} \times (\underline{\hspace{2cm}} + \underline{\hspace{2cm}}) = 14$

(b) $\underline{\hspace{2cm}} \times (\underline{\hspace{2cm}} + \underline{\hspace{2cm}}) = 14$

(c) $\underline{\hspace{2cm}} \times (\underline{\hspace{2cm}} + \underline{\hspace{2cm}}) = 14$

(d) $\underline{\hspace{2cm}} \times (\underline{\hspace{2cm}} + \underline{\hspace{2cm}}) = 14$

Solution:

(a) $2 \times (5 + 2) = 14$

(b) $2 \times (3 + 4) = 14$

(c) $2 \times (4 + 3) = 14$

(d) $2 \times (6 + 1) = 14$

Question 4.

Find out the sum of the numbers given in each picture below in at least two different ways. Describe how you solved it through expressions.

Solution:

For I: $5 \times 4 + 4 \times 8 = 20 + 32 = 52$

or $4 \times (4 + 8) + 4 = 4 \times 12 + 4 = 52$

For II: $8 \times (5 + 6) = 8 \times 11 = 88$

or $8 \times 5 + 8 \times 6 = 40 + 48 = 88$

Question 5.

Read the situations given below. Write appropriate expressions for each of them and find their values.

(a) The district market in Begur operates on all seven days of the week. Rahim supplies 9 kg of mangoes each day from his orchard, and Shyam supplies 11 kg of mangoes each day from his orchard to this market. Find the number of mangoes supplied by them in a week to the local district market.

(b) Binu earns ₹ 20,000 per month. She spends ₹ 5,000 on rent, ₹ 5,000 on food, and ₹ 2,000 on other expenses every month. What is the amount Binu will save by the end of the year?

(c) During the daytime, a snail climbs 3 cm up a post, and during the night,

while asleep, accidentally slips down by 2 cm. The post is 10 cm high, and a delicious treat is on top. In how many days will the snail get the treat?

Solution:

(a) Supplies of mangoes by Rahim in the market each day = 9 kg

Supplies of mangoes by Shyam in the market each day = 11 kg

Total supplies of mangoes in the market on each day = $(9 + 11)$ kg

Therefore, total supplies of mangoes in the market in all 7 days = $7 \times (9 + 11)$ kg

$$= 7 \times 20$$

$$= 140 \text{ kg}$$

(b) Binu's per month earning = ₹ 20,000

Binu's total monthly expenditures = ₹ 5,000 on rent + ₹ 5,000 on food + ₹ 2,000 on other expenses

$$= 5,000 + 5,000 + 2,000$$

Therefore, Binu's monthly savings = ₹ 20,000 – ₹ $(5,000 + 5,000 + 2,000)$

$$= ₹ 20,000 - ₹ 12,000$$

$$= ₹ 8,000$$

Thus, Binu's total yearly savings = $12 \times 8000 = 96000$

Hence, Binu will save ₹ 96000 by the end of the year.

(c) Since the snail climbs 3 cm up the post in daytime and slips down by 2 cm at night.

So, the distance climbed by the snail of the post = $3 - 2 = 1$ cm in a day.

∴ The distance climbed in 7 days = 7 cm

The height of the post is 10 cm.

The distance climbed on the 8th day before slipping = $7 + 3 = 10$ cm

So, the snail will take 8 days to reach the top of the post and get the delicious treat.

Question 6.

Melvin reads a two-page story every day except on Tuesdays and Saturdays.

How many stories would he complete reading in 8 weeks? Which of the expressions below describes this scenario?

(a) $5 \times 2 \times 8$

(b) $(7 - 2) \times 8$

(c) 8×7

(d) $7 \times 2 \times 8$

(e) $7 \times 5 - 2$

(f) $(7 + 2) \times 8$

(g) $7 \times 8 - 2 \times 8$

(h) $(7 - 5) \times 8$

Solution:

Number of days in a week except Tuesday and Saturday = $7 - 2$

Since Melvin reads a two-page story every day except Tuesday and Saturday.

Therefore, number of stories read in a week = $1 \times (7 - 2)$

So, number of stories read in 8 weeks = $8 \times 1 \times (7 - 2)$

= $8 \times (7 - 2)$ or $(7 - 2) \times 8$ [Expression (b)]

or $7 \times 8 - 2 \times 8$ [Expression (g)]

Only expressions (b) and (g) describe this scenario.

Question 7.

Find different ways of evaluating the following expressions:

(a) $1 - 2 + 3 - 4 + 5 - 6 + 7 - 8 + 9 - 10$

(b) $1 - 1 + 1 - 1 + 1 - 1 + 1 - 1 + 1 - 1$

Solution:

(a) $1 - 2 + 3 - 4 + 5 - 6 + 7 - 8 + 9 - 10$

= $(1 + 3 + 5 + 7 + 9) + (-2 - 4 - 6 - 8 - 10)$

= $25 + (-30)$

= -5

or

$1 - 2 + 3 - 4 + 5 - 6 + 7 - 8 + 9 - 10$

= $(1 - 2) + (3 - 4) + (5 - 6) + (7 - 8) + (9 - 10)$

= $(-1) + (-1) + (-1) + (-1) + (-1)$

= -5

(b) $1 - 1 + 1 - 1 + 1 - 1 + 1 - 1 + 1 - 1$

= $(1 - 1) + (1 - 1) + (1 - 1) + (1 - 1) + (1 - 1)$

= $0 + 0 + 0 + 0 + 0$

= 0

or

$1 - 1 + 1 - 1 + 1 - 1 + 1 - 1 + 1 - 1$

= $(1 + 1 + 1 + 1 + 1) + (-1 - 1 - 1 - 1 - 1)$

= $5 + (-5)$

= 0

Question 8.

Compare the following pairs of expressions using '<', '>', or '=', or by reasoning.

(a) $49 - 7 + 8$ $49 - 7 + 8$

- (b) $83 \times 42 - 18$ $83 \times 40 - 18$
- (c) $145 - 17 \times 8$ $145 - 17 \times 6$
- (d) $23 \times 48 - 35$ $23 \times (48 - 35)$
- (e) $(16 - 11) \times 12$ $-11 \times 12 + 16 \times 12$
- (f) $(76 - 53) \times 88$ $88 \times (53 - 76)$
- (g) $25 \times (42 + 16)$ $25 \times (43 + 15)$
- (h) $36 \times (28 - 16)$ $35 \times (27 - 15)$

Solution:

(a) $49 - 7 + 8 = 49 - 7 + 8$

($\because$ All the terms on both sides are the same)

(b) $83 \times 42 > 83 \times 40$

$\therefore 83 \times 42 - 18 > 83 \times 40 - 18$

(c) $17 \times 8 > 17 \times 6$

$\Rightarrow -17 \times 8 < -17 \times 6$

$\therefore 145 - 17 \times 8 < 145 - 17 \times 6$

(d) $23 \times (48 - 35) = 23 \times 48 - 23 \times 35$

and $35 < 23 \times 35$ $23 \times 48 - 35 > 23 \times (48 - 35)$

(e) $(16 - 11) \times 12 = 16 \times 12 - 11 \times 12 = -11 \times 12 + 16 \times 12$

$\therefore (16 - 11) \times 12 = -11 \times 12 + 16 \times 12$

(f) $(76 - 53) \times 88 = 76 \times 88 - 53 \times 88 = -(53 - 76) \times 88$

$\therefore (76 - 53) \times 88 > 88 \times (53 - 76)$

(g) $43 + 15 = 42 + 1 + 15 = 42 + 16$

$\Rightarrow 25 \times (43 + 15) = 25 \times (42 + 16)$

$\therefore 25 \times (42 + 16) = 25 \times (43 + 15)$

(h) $35 \times (27 - 15) = 35 \times (28 - 16)$

$\therefore 36 \times (28 - 16) > 35 \times (27 - 15)$

Question 9.

Identify which of the following expressions are equal to the given expression without computation. You may rewrite the expressions using terms or removing brackets. There can be more than one expression that is equal to the given expression.

(a) $83 - 37 - 12$

(i) $84 - 38 - 12$

(ii) $84 - (37 + 12)$

(iii) $83 - 38 - 13$

(iv) $-37 + 83 - 12$

(b) $93 + 37 \times 44 + 76$

(i) $37 + 93 \times 44 + 76$

(ii) $93 + 37 \times 76 + 44$

(iii) $(93 + 37) \times (44 + 76)$

(iv) $37 \times 44 + 93 + 76$

Solution:

(a) $83 - 37 - 12 = 83 - 37 - 12 + (1 - 1)$

$= (83 + 1) - 37 - 1 - 12$

$= 84 - 38 - 12$ (option (i))

$= 34$

Or

$83 - 37 - 12 = -37 + 83 - 12$

$= 46 - 12$

$= 34$ (option (iv))

Hence, (i) and (iv) are equal to the given expression $83 - 37 - 12$.

(b) (iv) $37 \times 44 + 93 + 76$

Rearrange the terms, and we get $93 + 37 \times 44 + 76$, which is equal to the given expression.

Hence, (iv) is equal to the given expression $93 + 37 \times 44 + 76$.

Question 10.

Choose a number and create ten different expressions having that value.

Solution:

Do it yourself.

Practice Time 2.1

Question 1

A notebook costs ₹35. Tanish buys 6 notebooks. Write an arithmetic expression for the total cost of the notebooks. Also, list two more expressions that have the same value.

Solution By Steps

Step 1: Find the total cost expression

Cost of 1 notebook = ₹35

Number of notebooks = 6

Expression = 6×35

Step 2: Write two more equivalent expressions

1. 35×6

2. $30 \times 6 + 5 \times 6$

Final Answer

Expression = 6×35

Two more expressions:

- 35×6
 - $30 \times 6 + 5 \times 6$
-

Question 2

A car travels 60 km in 1 hour. Write a suitable expression to find the distance travelled in 5 hours. Give two other expressions equal to your result.

Solution By Steps

Step 1: Write the expression

Distance travelled in 1 hour = 60 km

Distance in 5 hours = 60×5

Step 2: Write two equivalent expressions

1. 5×60

2. $50 \times 5 + 10 \times 5$

Final Answer

Expression = 60×5

Two more expressions:

- 5×60

- $50 \times 5 + 10 \times 5$

Question 3

A packet contains 24 biscuits. There are 4 such packets. Write an expression for the total number of biscuits. Write two other expressions with the same result.

Solution By Steps

Step 1: Write the expression

Biscuits in one packet = 24

Number of packets = 4

Expression = 24×4

Step 2: Write two equivalent expressions

1. 4×24

2. $(20 + 4) \times 4$

Final Answer

Expression = 24×4

Two more expressions:

- 4×24

- $(20 + 4) \times 4$

Question 4

Each chair in a classroom costs ₹850. A school buys 3 such chairs. Write the expression for the total cost. Find two more expressions with the same value.

Solution By Steps

Step 1: Write the expression

Cost of one chair = ₹850

Number of chairs = 3

Expression = 850×3

Step 2: Write two equivalent expressions

1. 3×850
 2. $(800 + 50) \times 3$
-

Final Answer

Expression = 850×3

Two more expressions:

- 3×850
 - $(800 + 50) \times 3$
-

Question 5

A water tank fills 15 litres every minute. How much water will be filled in 8 minutes? Write the expression. List two different expressions with the same value.

Solution By Steps

Step 1: Write the expression

Water filled in 1 minute = 15 litres

Water filled in 8 minutes = 15×8

Step 2: Write two equivalent expressions

1. 8×15
 2. $(10 + 5) \times 8$
-

Final Answer

Expression = 15×8

Two more expressions:

- 8×15
 - $(10 + 5) \times 8$
-

Question 1

Which is greater: $65 + 28$ or $60 + 34$?

Solution By Steps

Step 1: Evaluate both expressions

$$65 + 28 = 93$$

$$60 + 34 = 94$$

Step 2: Compare

$$93 < 94$$

Final Answer

$$65 + 28 < 60 + 34$$

Question 2

A teacher gave ₹500 to two students. Rehan spent ₹245 and Ayaan spent ₹250. Who has more money left?

Solution By Steps

Step 1: Find money left with Rehan

$$500 - 245 = 255$$

Step 2: Find money left with Ayaan

$$500 - 250 = 250$$

Step 3: Compare

$$255 > 250$$

Final Answer

Rehan has more money left.

Question 3

Which expression has the higher value: 27×3 or 30×2 ?

Solution By Steps

Step 1: Evaluate expressions

$$27 \times 3 = 81$$

$$30 \times 2 = 60$$

Step 2: Compare

$$81 > 60$$

Final Answer

$$27 \times 3 > 30 \times 2$$

So, 27×3 has the higher value.

Question 4

A toy costs ₹120. Which is more: buying 3 toys or 2 toys?

Solution By Steps

Step 1: Find cost of 3 toys

$$3 \times 120 = 360$$

Step 2: Find cost of 2 toys

$$2 \times 120 = 240$$

Step 3: Compare

$$360 > 240$$

Final Answer

Buying 3 toys costs more.

Question 5

Priya read 96 pages in 3 days. Anjali read 108 pages in 4 days. Who read more pages per day?

Solution By Steps

Step 1: Find Priya's reading per day

$$96 \div 3 = 32$$

Step 2: Find Anjali's reading per day

$$108 \div 4 = 27$$

Step 3: Compare

$$32 > 27$$

Final Answer

Priya read more pages per day.

Practice Time 2.3**Question 1**

Aman buys 2 packets of bread at ₹25 each and a jam bottle for ₹40. Write an expression for the total amount spent and solve it.

Solution By Steps

Step 1: Find the cost of bread packets

Cost of 1 packet = ₹25

Number of packets = 2

$$2 \times 25 = 50$$

Step 2: Add the cost of jam bottle

Cost of jam bottle = ₹40

Expression:

$$(2 \times 25) + 40$$

Step 3: Evaluate

$$50 + 40 = 90$$

Final Answer

Expression:

$$(2 \times 25) + 40$$

Total Amount = ₹90

Question 2

Shreya bought pens for ₹32 and markers for ₹38. She paid ₹100 to the shopkeeper. Write an expression using brackets to show how much money she got back.

Solution By Steps

Step 1: Find total money spent

$$32 + 38 = 70$$

Step 2: Write expression for money returned

$$100 - (32 + 38)$$

Step 3: Evaluate

$$100 - 70 = 30$$

Final Answer

Expression:

$$100 - (32 + 38)$$

Money returned = ₹30

Question 3

There are 4 shelves. Each shelf has 3 maths books and 5 science books. Write an expression to find the total number of books.

Solution By Steps

Step 1: Find books in one shelf

$$3 + 5 = 8$$

Step 2: Find books in 4 shelves

Expression:

$$4 \times (3 + 5)$$

Step 3: Evaluate

$$4 \times 8 = 32$$

Final Answer

Expression:

$$4 \times (3 + 5)$$

Total books = 32

Question 4

Ramesh bought 5 pencils at ₹6 each and one eraser for ₹10. Write an expression to show how much he paid in total.

Solution By Steps

Step 1: Find cost of pencils

$$5 \times 6 = 30$$

Step 2: Add eraser cost

Expression:

$$(5 \times 6) + 10$$

Step 3: Evaluate

$$30 + 10 = 40$$

Final Answer

Expression:

$$(5 \times 6) + 10$$

Total amount paid = ₹40

Question 5

A school group includes 6 boys and 4 girls in each van. There are 5 vans. Write an expression to calculate the total number of children.

Solution By Steps

Step 1: Find children in one van

$$6 + 4 = 10$$

Step 2: Find total children in 5 vans

Expression:

$$5 \times (6 + 4)$$

Step 3: Evaluate

$$5 \times 10 = 50$$

Final Answer

Expression:

$$5 \times (6 + 4)$$

Total number of children = 50

Practice Time 2.4

Question 1

Evaluate both forms:

Expression: $12 + (-7)$

Swapped: $(-7) + 12$

Do both give the same result?

Solution By Steps

Step 1: Evaluate first expression

$$12 + (-7) = 12 - 7 = 5$$

Step 2: Evaluate swapped expression

$$(-7) + 12 = 12 - 7 = 5$$

Step 3: Compare results

Both results are equal.

Final Answer

$$12 + (-7) = 5$$

$$(-7) + 12 = 5$$

Yes, both give the same result.

Question 2

Swap the terms and find if the result changes:

Expression: $(-3) + 9$

Swapped: $9 + (-3)$

Solution By Steps

Step 1: Evaluate first expression

$$(-3) + 9 = 6$$

Step 2: Evaluate swapped expression

$$9 + (-3) = 6$$

Step 3: Compare

Both are equal.

Final Answer

The result does not change.

Question 3

Consider the expression: $(-8) + (-2)$

Write the swapped form and compare the results.

Solution By Steps

Step 1: Write swapped form

Swapped form:

$$(-2) + (-8)$$

Step 2: Evaluate original expression

$$(-8) + (-2) = -10$$

Step 3: Evaluate swapped expression

$$(-2) + (-8) = -10$$

Final Answer

Original = -10

Swapped = -10

Both results are the same.

Question 4

Try swapping terms in:

$$15 + (-20)$$

Does the sum remain the same?

Solution By Steps

Step 1: Evaluate original expression

$$15 + (-20) = -5$$

Step 2: Swap terms

$$(-20) + 15 = -5$$

Step 3: Compare

Both sums are equal.

Final Answer

Yes, the sum remains the same.

Question 5

Swap and compare:

Expression: $(-6) + 6$

Swapped: $6 + (-6)$

What do you observe?

Solution By Steps

Step 1: Evaluate first expression

$$(-6) + 6 = 0$$

Step 2: Evaluate swapped expression

$$6 + (-6) = 0$$

Step 3: Observation

Both expressions give the same result.

Final Answer

Both expressions are equal to 0.

Observation: Swapping the order of addition does not change the sum.

Practice Time 2.5

Question 1(i)

Find 98×27 using distributive property.

Solution By Steps

Step 1: Rewrite 98

$$98 = 100 - 2$$

Step 2: Apply distributive property

$$\begin{aligned} 98 \times 27 &= (100 - 2) \times 27 \\ &= 100 \times 27 - 2 \times 27 \end{aligned}$$

Step 3: Calculate

$$\begin{aligned} &= 2700 - 54 \\ &= 2646 \end{aligned}$$

Final Answer

$$98 \times 27 = 2646$$

Question 1(ii)

Use a suitable method to find:

$$103 \times 6$$

Solution By Steps

Step 1: Rewrite 103

$$103 = 100 + 3$$

Step 2: Apply distributive property

$$\begin{aligned} 103 \times 6 &= (100 + 3) \times 6 \\ &= 100 \times 6 + 3 \times 6 \end{aligned}$$

Step 3: Calculate

$$\begin{aligned} &= 600 + 18 \\ &= 618 \end{aligned}$$

Final Answer

$$103 \times 6 = 618$$

Key Concept

Distributive property helps us break numbers into easier parts for multiplication.

Key Concept Explanation

The distributive property states:

$$a \times (b + c) = a \times b + a \times c$$

and

$$a \times (b - c) = a \times b - a \times c$$

This method makes multiplication easier using nearby round numbers such as 100, 50, etc.

Example:

$$\begin{aligned} 98 \times 27 &= (100 - 2) \times 27 \\ &= 100 \times 27 - 2 \times 27 \\ &= 2700 - 54 \\ &= 2646 \end{aligned}$$

Practice Time 2.5 (Continued)

Question 2(i)

An electronics store had ₹5,000 in the cash register. It gave a refund of ₹1,250 to one customer and ₹850 to another. How much money is left in the register?

Solution By Steps

Step 1: Write the expression

Initial money = ₹5000

Refunds given:

- ₹1250
- ₹850

Expression:

$$5000 - (1250 + 850)$$

Step 2: Add the refunds

$$1250 + 850 = 2100$$

Step 3: Subtract from total amount

$$5000 - 2100 = 2900$$

Final Answer

Money left in the register = ₹2900

Question 2(ii)

A warehouse stored 1,200 cartons. It shipped 375 cartons in the morning and 425 in the evening. How many cartons remain in the warehouse?

Solution By Steps

Step 1: Write the expression

$$1200 - (375 + 425)$$

Step 2: Add shipped cartons

$$375 + 425 = 800$$

Step 3: Subtract

$$1200 - 800 = 400$$

Final Answer

400 cartons remain in the warehouse.

Question 2(iii)

A school library bought 800 books. Later, it gave 350 books to Class 6 and 200 to Class 7. How many books are now left in the library?

Solution By Steps

Step 1: Write the expression

$$800 - (350 + 200)$$

Step 2: Add books distributed

$$350 + 200 = 550$$

Step 3: Find remaining books

$$800 - 550 = 250$$

Final Answer

250 books are left in the library.

Question 3(i)

Original Expression:

$$56 - 24 - 11$$

Changed Expression 1:

$$57 - 24 - 11$$

Changed Expression 2:

$$57 - 25 - 11$$

What will happen to the total value?

Solution By Steps

Step 1: Compare changes

- First number increased by 1:

$$56 \rightarrow 57$$

- Second number also increased by 1:

$$24 \rightarrow 25$$

Step 2: Observe effect

Increasing both by the same amount cancels the effect.

So, total value remains unchanged.

Final Answer

The value remains the same.

Correct option: **(c) Remains the same**

Question 3(ii)

Original Expression:

$$-45 - 13 - 8$$

Changed Expression 1:

$$-44 - 13 - 8$$

Changed Expression 2:

$$-44 - 12 - 8$$

What is the net change in value?

Solution By Steps

Step 1: Compare changes

- First number increases by 1:
 $-45 \rightarrow -44$
 - Second number also increases by 1:
 $-13 \rightarrow -12$
-

Step 2: Effect on expression

Increase in first term adds 1.

Increase in subtracted term removes 1.

Net effect:

$$+1 - 1 = 0$$

Final Answer

Net change = 0

Correct option: **(c) 0**

Question 4(i)

A meal combo includes a sandwich for ₹55 and a drink for ₹25. Two people ordered the same combo. Write an expression using brackets and find the total amount paid.

Solution By Steps

Step 1: Find cost of one combo

$$55 + 25 = 80$$

Step 2: For two people

Expression:

$$2 \times (55 + 25)$$

Step 3: Evaluate

$$2 \times 80 = 160$$

Final Answer

Expression:

$$2 \times (55 + 25)$$

Total amount paid = ₹160

Correct option: **(c) ₹160**

Question 4(ii)

There are 3 shelves of storybooks and 2 shelves of comics. Each shelf has 6 books. Which expression shows the total number of books?

Solution By Steps

Step 1: Total shelves

$$3 + 2 = 5$$

Step 2: Multiply by books in each shelf

$$(3 + 2) \times 6$$

Step 3: Evaluate

$$5 \times 6 = 30$$

Final Answer

Correct expression:

$$(3 + 2) \times 6$$

Correct option: **(b)**

Question 4(iii)

A packet has 3 pens costing ₹12 each and 3 pencils costing ₹5 each. What is the total cost of 3 such packets?

Solution By Steps

Step 1: Cost of one packet

Pens:

$$3 \times 12 = 36$$

Pencils:

$$3 \times 5 = 15$$

Total:

$$36 + 15 = 51$$

Step 2: Cost of 3 packets

$$3 \times (12 + 5)$$

or

$$(3 \times 12) + (3 \times 5)$$

Both give same result.

Final Answer

Correct option: **(c) Both a and b**

Exam Time

A. Multiple Choice Questions (MCQs)

Question 1

What is the value of:

$$14 + 3 \times 2$$

Solution By Steps

Step 1: Multiply first

$$3 \times 2 = 6$$

Step 2: Add

$$14 + 6 = 20$$

Final Answer

20

Correct option: **(a)**

Question 2

Which of the following is an arithmetic expression?

Options:

- $5 + 8 \times 2$
 - $5 \times (8 + 2)$
 - $10 \div 2$
-

Solution By Steps

All options contain numbers and arithmetic operations.

Final Answer

All of the above

Correct option: **(d)**

Question 3

What is the expression for finding the total cost if one pencil costs ₹8 and 7 pencils are bought?

Solution By Steps

Cost of one pencil = ₹8

Number of pencils = 7

Expression:

$$8 \times 7$$

Final Answer

$$8 \times 7$$

Correct option: **(b)**

Question 4

If Rahul buys 3 movie tickets at ₹150 each, what is the arithmetic expression for the total cost?

Solution By Steps

Cost of one ticket = ₹150

Number of tickets = 3

Expression:

$$150 \times 3$$

Final Answer

$$150 \times 3$$

Correct option: **(a)**

Question 5

What is the result of:

$$25 - 10 + 5$$

Solution By Steps

Step 1: Subtract

$$25 - 10 = 15$$

Step 2: Add

$$15 + 5 = 20$$

Final Answer

20

Correct option: **(c)**

Key Concept Explanation

B. Fill in the Blanks

Question 1

The expression for the total cost of 6 notebooks, each costing ₹30, is _____.

Solution By Steps

Step 1: Identify cost and quantity

Cost of one notebook = ₹30

Number of notebooks = 6

Step 2: Write the expression

$$6 \times 30$$

Final Answer

$$6 \times 30$$

Question 2

$$25 \div 5 = \underline{\quad}$$

Solution By Steps

Step 1: Divide

$$25 \div 5 = 5$$

Final Answer

$$5$$

Question 3

To find the total cost of 5 items priced at ₹40 each, the expression is _____.

Solution By Steps

Step 1: Multiply quantity by cost

$$5 \times 40$$

Final Answer

$$5 \times 40$$

Question 4

The value of the expression:

$$12 + 15 \times 2$$

is _____.

Solution By Steps

Step 1: Multiply first

$$15 \times 2 = 30$$

Step 2: Add

$$12 + 30 = 42$$

Final Answer

42

Question 5

The result of the expression:

$$9 \times 4$$

is _____.

Solution By Steps

$$9 \times 4 = 36$$

Final Answer

36

C. Write True or False

Question 1

The expression $6 + 2 \times 5$ is equal to 40.

Solution By Steps

Step 1: Multiply first

$$2 \times 5 = 10$$

Step 2: Add

$$6 + 10 = 16$$

Since $16 \neq 40$, the statement is false.

Final Answer

False

Question 2

$$12 \times 5 + 2$$

is the same as

$$(12 \times 5) + 2$$

Solution By Steps

According to order of operations, multiplication is done first.

Both expressions become:

$$60 + 2 = 62$$

Final Answer

True

Question 3

The expression:

$$10 + 3 \times 2$$

equals 26.

Solution By Steps

Step 1: Multiply first

$$3 \times 2 = 6$$

Step 2: Add

$$10 + 6 = 16$$

Since $16 \neq 26$, the statement is false.

Final Answer

False

Question 4

If an expression involves multiplication and addition, we solve the addition first.

Solution By Steps

According to order of operations, multiplication is solved before addition.

Final Answer

False

Question 5

$$15 + 20 \div 5$$

equals 20.

Solution By Steps

Step 1: Divide first

$$20 \div 5 = 4$$

Step 2: Add

$$15 + 4 = 19$$

Since $19 \neq 20$, the statement is false.

Final Answer

False

D. Match the Columns

Column A

(i) $7 \times (5 + 2)$

(ii) $100 - (25 + 50)$

(iii) $5 \times (10 - 5)$

(iv) $8 \times (6 + 1)$

(v) $(14 - 6) \times 5$

Column B

(a) 49

(b) 25

(c) 35

(d) 70

(e) 40

Solution By Steps

(i)

$$\begin{aligned} &7 \times (5 + 2) \\ &= 7 \times 7 \\ &= 49 \end{aligned}$$

Matches with **(a)**

(ii)

$$\begin{aligned} &100 - (25 + 50) \\ &= 100 - 75 \\ &= 25 \end{aligned}$$

Matches with **(b)**

(iii)

$$\begin{aligned} &5 \times (10 - 5) \\ &= 5 \times 5 \\ &= 25 \end{aligned}$$

Matches with **(b)**

(iv)

$$\begin{aligned} &8 \times (6 + 1) \\ &= 8 \times 7 \\ &= 56 \end{aligned}$$

(No matching option given in column B)

(v)

$$\begin{aligned} &(14 - 6) \times 5 \\ &= 8 \times 5 \\ &= 40 \end{aligned}$$

Matches with **(e)**

Final Answer

Column A	Column B
(i)	(a)
(ii)	(b)
(iii)	(b)
(iv)	No matching option
(v)	(e)

E. Very Short Answer Type Questions

Question 1

What is an arithmetic expression?

Solution

An arithmetic expression is a mathematical statement made using numbers and operations like addition, subtraction, multiplication, and division.

Final Answer

An arithmetic expression combines numbers and operations to show a mathematical calculation.

Question 2

What is the value of:

$$12 + 5 \times 2$$

Solution By Steps

Step 1: Multiply first

$$5 \times 2 = 10$$

Step 2: Add

$$12 + 10 = 22$$

Final Answer

22

Question 3

Write one example of an expression using brackets.

Final Answer

Example:

$$5 \times (3 + 2)$$

Question 4

What does the equal sign (=) indicate in an expression?

Final Answer

The equal sign shows that both sides have the same value.

Question 5

Simplify:

$$30 - (10 + 5)$$

Solution By Steps

Step 1: Solve bracket first

$$10 + 5 = 15$$

Step 2: Subtract

$$30 - 15 = 15$$

Final Answer

15

F. Short Answer Type Questions

Question 1

Write any two arithmetic expressions that have the same value as 36.

Solution

Two expressions:

$$30 + 6$$

$$9 \times 4$$

Both equal 36.

Final Answer

$$30 + 6$$

and

$$9 \times 4$$

Question 2

Compare:

$$45 + 20 - 46 + 18$$

Solution By Steps

Step 1: Add and subtract in order

$$45 + 20 = 65$$

$$65 - 46 = 19$$

$$19 + 18 = 37$$

Final Answer

$$45 + 20 - 46 + 18 = 37$$

Question 3

Write an expression for the total cost of 4 apples at ₹15 each and 2 bananas at ₹10 each.

Solution

Cost of apples:

$$4 \times 15$$

Cost of bananas:

$$2 \times 10$$

Total expression:

$$(4 \times 15) + (2 \times 10)$$

Final Answer

$$(4 \times 15) + (2 \times 10)$$

Question 4

Explain with an example how changing one term in an expression can affect its value.

Solution

Example:

$$20 + 5 = 25$$

If we change 5 to 8:

$$20 + 8 = 28$$

The value increases by 3.

Final Answer

Changing a term changes the final value of the expression.

Example:

$$20 + 5 = 25$$

$$20 + 8 = 28$$

Question 5

Simplify using distributive property:

$$8 \times (10 + 5)$$

Solution By Steps

Step 1: Apply distributive property

$$8 \times 10 + 8 \times 5$$

Step 2: Multiply

$$80 + 40$$

Step 3: Add

$$120$$

Final Answer

$$8 \times (10 + 5) = 120$$

G. Long Answer Type Questions

Question 1

A fruit vendor sells 5 baskets of mangoes, each containing 12 mangoes, and 3 baskets of apples, each containing 8 apples. Write an expression for total fruits and find the value.

Solution By Steps

Step 1: Find total mangoes

Number of baskets of mangoes = 5

Mangoes in each basket = 12

$$5 \times 12 = 60$$

Step 2: Find total apples

Number of baskets of apples = 3

Apples in each basket = 8

$$3 \times 8 = 24$$

Step 3: Write the expression

$$(5 \times 12) + (3 \times 8)$$

Step 4: Find total fruits

$$60 + 24 = 84$$

Final Answer

Expression:

$$(5 \times 12) + (3 \times 8)$$

Total fruits = 84

Question 2

A shopkeeper had ₹1,500. He spent ₹450 on groceries and ₹250 on vegetables. Write the expression and find the amount left.

Solution By Steps

Step 1: Write the expression

$$1500 - (450 + 250)$$

Step 2: Add expenses

$$450 + 250 = 700$$

Step 3: Subtract from total money

$$1500 - 700 = 800$$

Final Answer

Expression:

$$1500 - (450 + 250)$$

Amount left = ₹800

Question 3

Riya buys 3 dresses for ₹750 each and 2 pairs of shoes for ₹600 each. Write and simplify the arithmetic expression to find the total cost.

Solution By Steps

Step 1: Find cost of dresses

$$3 \times 750 = 2250$$

Step 2: Find cost of shoes

$$2 \times 600 = 1200$$

Step 3: Write the expression

$$(3 \times 750) + (2 \times 600)$$

Step 4: Find total cost

$$2250 + 1200 = 3450$$

Final Answer

Expression:

$$(3 \times 750) + (2 \times 600)$$

Total cost = ₹3450

Question 4

A library had 1,200 books. It issued 425 books on Monday and 375 on Tuesday. Write an expression and find how many books remain.

Solution By Steps

Step 1: Write the expression

$$1200 - (425 + 375)$$

Step 2: Add issued books

$$425 + 375 = 800$$

Step 3: Subtract

$$1200 - 800 = 400$$

Final Answer

Expression:

$$1200 - (425 + 375)$$

Books remaining = 400

Question 5

Explain the difference between:

$$5 \times (4 + 3)$$

and

$$5 \times 4 + 3$$

with suitable calculations.

Solution By Steps

First Expression

$$5 \times (4 + 3)$$

Step 1: Solve bracket first

$$4 + 3 = 7$$

Step 2: Multiply

$$5 \times 7 = 35$$

Second Expression

$$5 \times 4 + 3$$

Step 1: Multiply first

$$5 \times 4 = 20$$

Step 2: Add

$$20 + 3 = 23$$

Step 3: Compare results

$$35 \neq 23$$

The two expressions are different because brackets change the order of operations.

Final Answer

$$5 \times (4 + 3) = 35$$

$$5 \times 4 + 3 = 23$$

Both expressions have different values.

Question 6

Use the distributive property to find:

$$97 \times 25$$

Hint: $97 = 100 - 3$

Solution By Steps

Step 1: Rewrite 97

$$97 = 100 - 3$$

Step 2: Apply distributive property

$$\begin{aligned} 97 \times 25 &= (100 - 3) \times 25 \\ &= 100 \times 25 - 3 \times 25 \end{aligned}$$

Step 3: Multiply

$$\begin{aligned} 100 \times 25 &= 2500 \\ 3 \times 25 &= 75 \end{aligned}$$

Step 4: Subtract

$$2500 - 75 = 2425$$

Final Answer

$$97 \times 25 = 2425$$

Competency-Based Questions

A. Assertion and Reason Type Questions

Question 1

Assertion (A):

$$3 \times 5 + 2 = 17$$

Reason (R):

According to the order of operations, multiplication is solved first followed by addition.

Solution By Steps

Step 1: Evaluate the expression

$$\begin{aligned} 3 \times 5 &= 15 \\ 15 + 2 &= 17 \end{aligned}$$

Assertion is true.

Step 2: Check the reason

The reason correctly explains the order of operations.

Reason is also true.

Final Answer

Correct option: **(a)**

Both (A) and (R) are true and (R) is the correct explanation of (A).

Question 2

Assertion (A):

$$10 + 5 \times 2 = 20$$

Reason (R):

According to the order of operations, multiplication is performed before addition.

Solution By Steps

Step 1: Evaluate expression

$$5 \times 2 = 10$$

$$10 + 10 = 20$$

Assertion is true.

Step 2: Check reason

The reason is correct.

Final Answer

Correct option: **(a)**

Both (A) and (R) are true and (R) is the correct explanation of (A).

B. Case Study Based Questions

Question

Nina and Arvind are planning a road trip. Their car consumes 12 litres of fuel for every 100 km travelled. How much fuel will they need to travel 250 km?

Write the arithmetic expression and solve it.

Solution By Steps

Step 1: Write the expression

Fuel needed for 100 km = 12 litres

Fuel needed for 250 km:

$$(12 \div 100) \times 250$$

Step 2: Simplify

$$12 \div 100 = 0.12$$

Step 3: Multiply

$$0.12 \times 250 = 30$$

Final Answer

Expression:

$$(12 \div 100) \times 250$$

Fuel needed = 30 litres

Correct option: **(b)**

C. Maths Booster

Question 1: Decode the Hidden Expression

Arjun writes a mystery number as an arithmetic expression.
It uses exactly five symbols and its value is 40.

Solution

One possible expression is:

$$10 \times 4$$

Value:

$$10 \times 4 = 40$$

Final Answer

One possible expression:

$$10 \times 4$$

Question 2: Pizza Party Puzzle

Riya and Kabir are splitting pizzas.

Each pizza costs ₹120.

Riya buys 3 pizzas and Kabir buys 2 pizzas.

Write one arithmetic expression showing the total money spent.

Solution By Steps

Step 1: Total pizzas bought

$$3 + 2 = 5$$

Step 2: Multiply by cost of one pizza

$$(3 + 2) \times 120$$

Step 3: Evaluate

$$5 \times 120 = 600$$

Final Answer

Expression:

$$(3 + 2) \times 120$$

Total money spent = ₹600

NCERT CORNER

In-Text Questions

Q1. Use this method to find the following products

(a) 95×8

Using the distributive property:

$$\begin{aligned} 95 \times 8 &= (100 - 5) \times 8 \\ &= 100 \times 8 - 5 \times 8 \\ &= 800 - 40 \\ &= 760 \end{aligned}$$

Answer: 760

(b) 104×15

$$\begin{aligned} 104 \times 15 &= 104 \times (10 + 5) \\ &= 104 \times 10 + 104 \times 5 \\ &= 1040 + 520 \\ &= 1560 \end{aligned}$$

Answer: 1560

(c) 49×50

$$\begin{aligned} 49 \times 50 &= (50 - 1) \times 50 \\ &= 50 \times 50 - 1 \times 50 \\ &= 2500 - 50 \\ &= 2450 \end{aligned}$$

Answer: 2450

Q2. Is this quicker than the multiplication procedure you use generally?

Answer:

Yes, this method is often quicker when one of the numbers is close to a multiple of 10, 100, etc. It simplifies the calculation by breaking numbers into easier parts and using addition or subtraction. However, for some numbers, the usual multiplication method may be more convenient.

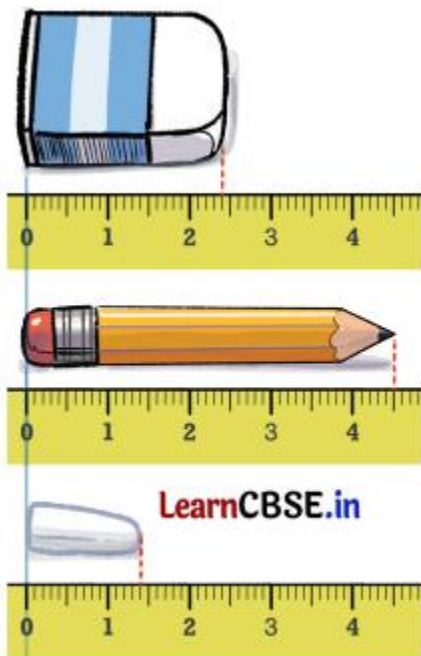
Therefore, the quicker method depends on the numbers being multiplied.

3. Measure the following objects using a scale and write their measurements in centimetres (as shown earlier for the lengths of the screws): pen, sharpener, and any other object of your choice.

Solution:

Do it yourself.

4. Write the measurements of the objects shown in the picture:



Solution:

Length of the eraser is 2cm

Length of the pencil is 4cm

Length of the chalk is 1cm

5. Arrange these lengths in increasing order:

(a) $\frac{9}{10}$ → nine-tenths

(b) $\frac{17}{10}$ → one and seven-tenths or seventeen tenths

(c) $\frac{130}{10}$ → one hundred thirty-tenths

(d) $\frac{131}{10}$ → Thirteen and one-tenths or one hundred thirty-one tenths

(e) $\frac{105}{10}$ → Ten and five-tenths or one hundred five tenths

(f) $\frac{76}{10}$ → Seven and six-tenths or seventh-six tenths

(g) $67/10 \rightarrow$ Six and seven-tenths or sixty-seven tenths

(h) $4/10 \rightarrow$ four-tenths

These fractional units are in increasing order as:

$$\frac{4}{10} < \frac{9}{10} < 1\frac{7}{10} < 6\frac{7}{10} < 7\frac{6}{10} < 10\frac{5}{10} < \frac{130}{10} < 13\frac{1}{10}$$

6. Step 1: Convert mixed numbers into improper fractional units

We rewrite the mixed numbers with denominator 10:

$$4\frac{1}{10} = \frac{41}{10}$$
$$41\frac{1}{10} = \frac{411}{10}$$

Step 2: Compare the numerators

Now compare:

$$\frac{4}{10}, \frac{41}{10}, \frac{41}{10}, \frac{411}{10}$$

Since all have the same denominator, compare numerators:

$$4 < 41 < 411$$

Step 3: Arrange in increasing order

Therefore,

$$\frac{4}{10} < 4\frac{1}{10} = \frac{41}{10} < 41\frac{1}{10}$$

Final Answer

$$\frac{4}{10} < 4\frac{1}{10} = \frac{41}{10} < 41\frac{1}{10}$$

7. Q7. Sonu is measuring some of the body parts.

Length of lower arm = $2\frac{7}{10}$ units

Length of upper arm = $3\frac{6}{10}$ units

Total length of arm

$$\begin{aligned} & 2\frac{7}{10} + 3\frac{6}{10} \\ &= (2 + 3) + \left(\frac{7}{10} + \frac{6}{10}\right) \\ &= 5 + \frac{13}{10} \\ &= 5 + 1\frac{3}{10} \\ &= 6\frac{3}{10} \end{aligned}$$

Answer: $6\frac{3}{10}$ units

8. The lengths of the body parts of a honeybee are given. Find its total length.

Head: $2\frac{3}{10}$ units

Thorax: $5\frac{4}{10}$ units

Abdomen: $7\frac{5}{10}$ units

Solution:

The total length of a honeybee

$$\begin{aligned} &= \text{length of the head} + \text{length of the thorax} + \text{length of the abdomen} \\ &= 2\frac{3}{10} + 5\frac{4}{10} + 7\frac{5}{10} \\ &= (2 + 5 + 7) + \left(\frac{3}{10} + \frac{4}{10} + \frac{5}{10}\right) \\ &= 14 + \frac{12}{10} \end{aligned}$$

$$= 14 + 1\frac{2}{10}$$

$$= 15\frac{2}{10} \text{ units}$$

Q9. Length of the longest (middle) finger

Length of hand = $12\frac{4}{10}$ units

Length of palm = $6\frac{7}{10}$ units

Length of middle finger

$$12\frac{4}{10} - 6\frac{7}{10}$$

Borrow 1 from 12:

$$11\frac{14}{10} - 6\frac{7}{10}$$

$$= (11 - 6) + \left(\frac{14}{10} - \frac{7}{10}\right)$$

$$= 5 + \frac{7}{10}$$

$$= 5\frac{7}{10}$$

Answer: $5\frac{7}{10}$ units

Q10. Compute the difference by converting both lengths to tenths

Length of hand

$$12\frac{4}{10} = \frac{124}{10}$$

Length of palm

$$6\frac{7}{10} = \frac{67}{10}$$

Difference

$$\begin{aligned}
 & \frac{124}{10} - \frac{67}{10} \\
 &= \frac{57}{10} \\
 &= 5 \frac{7}{10}
 \end{aligned}$$

Answer: $5 \frac{7}{10}$ units

11. A Celestial Pearl Danio's length is $2 \frac{4}{10}$ cm, and the length of a Philippine Goby is $\frac{9}{10}$ cm. What is the difference in their lengths?

How big are these fish compared to your figure?

Solution:

The length of a Celestial Pearl Danio fish

$$= 2 \frac{4}{10} \text{ cm} = \frac{24}{10} \text{ cm}$$

The length of a Philippine Goby fish

$$= \frac{9}{10} \text{ cm}$$

So, the difference in their lengths

$$\begin{aligned}
 &= \frac{24}{10} \text{ cm} - \frac{9}{10} \text{ cm} \\
 &= \frac{15}{10} \text{ cm} \\
 &= 1 \frac{5}{10} \text{ cm}
 \end{aligned}$$

12. How big are these fish compared to your figure?

Solution:

Do it yourself.

13. Observe the given sequences of numbers. Identify the change after each term and extend the pattern:

(a)

Since, the sequence is

$$4, 4 + \frac{3}{10} = 4\frac{3}{10}, 4 + \frac{3}{10} + \frac{3}{10} = 4\frac{6}{10}$$

So, further terms are

$$4\frac{6}{10} + \frac{3}{10} = 4\frac{9}{10}, 4\frac{9}{10} + \frac{3}{10} = 4\frac{12}{10}$$

$$\text{LearnCBSE.in} = 4 + 1 + \frac{2}{10} = 5\frac{2}{10}$$

$$5\frac{2}{10} + \frac{3}{10} = 5\frac{5}{10}, 5\frac{5}{10} + \frac{3}{10} = 5\frac{8}{10}$$

So, the pattern is

$$4, 4\frac{3}{10}, 4\frac{6}{10}, \underline{4\frac{9}{10}}, \underline{5\frac{2}{10}}, \underline{5\frac{5}{10}}, \underline{5\frac{8}{10}}$$

b.

Since, the sequence is

$$8\frac{2}{10} + \frac{5}{10} = 8\frac{7}{10}, 8\frac{7}{10} + \frac{5}{10} = 8\frac{12}{10}$$

$$\text{LearnCBSE.in} = 8 + 1 + \frac{2}{10} = 9\frac{2}{10}$$

So, further terms are

$$9\frac{2}{10} + \frac{5}{10} = 9\frac{7}{10}, 9\frac{7}{10} + \frac{5}{10} = 9\frac{12}{10}$$

$$= 9 + 1 + \frac{2}{10} = 10\frac{2}{10}$$

So, the sequence is

$$8\frac{2}{10}, 8\frac{7}{10}, 9\frac{2}{10}, \underline{9\frac{7}{10}}, \underline{10\frac{2}{10}}, \underline{10\frac{7}{10}}, \underline{11\frac{2}{10}}$$

(c)

Solution:

We observe that,

$$5\frac{7}{10} - \frac{4}{10} = 5\frac{3}{10}, \quad 5\frac{3}{10} - \frac{4}{10} = 4 + \frac{13}{10} - \frac{4}{10} = 4\frac{9}{10}, \dots$$

So, subtracting $\frac{4}{10}$ from each previous term, we get the

sequence as follows: [LearnCBSE.in](https://www.learnCBSE.in)

$$5\frac{7}{10}, \quad 5\frac{3}{10}, \quad 4\frac{9}{10}, \quad 4\frac{5}{10}, \quad 4\frac{1}{10}, \quad 3\frac{7}{10}$$

(d)

(d) $5\frac{7}{10}, 5\frac{3}{10}, \underline{\hspace{2cm}}, \underline{\hspace{2cm}}, \underline{\hspace{2cm}}, \underline{\hspace{2cm}}$

Solution:

We observe that,

$$5\frac{7}{10} - \frac{4}{10} = 5\frac{3}{10}, \quad 5\frac{3}{10} - \frac{4}{10} = 4 + \frac{13}{10} - \frac{4}{10} = 4\frac{9}{10}, \dots$$

So, subtracting $\frac{4}{10}$ from each previous term, we get the

sequence as follows: [LearnCBSE.in](https://www.learnCBSE.in)

$$5\frac{7}{10}, \quad 5\frac{3}{10}, \quad 4\frac{9}{10}, \quad 4\frac{5}{10}, \quad 4\frac{1}{10}, \quad 3\frac{7}{10}$$

(e)

(e) $13\frac{5}{10}, 13, 12\frac{5}{10}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}}$

Solution:

$$\begin{aligned}\text{Since, } 13\frac{5}{10} - \frac{5}{10} &= 13, \quad 13 - \frac{5}{10} = 12 + 1 - \frac{5}{10} \\ &= 12 + \frac{10}{10} - \frac{5}{10} = 12\frac{5}{10}\end{aligned}$$

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So, by subtracting $\frac{5}{10}$ from each previous term, we get

the sequence as follows:

$$13\frac{5}{10}, 13, 12\frac{5}{10}, 12, 11\frac{5}{10}, 11, 10\frac{5}{10}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}}$$

(f) Solution:

$$\text{Since, } 11\frac{5}{10} - 1\frac{1}{10} = 10\frac{4}{10}, \quad 10\frac{4}{10} - 1\frac{1}{10} = 9\frac{3}{10}, \dots$$

So, by subtracting $1\frac{1}{10}$ from each previous term, we get
the sequence as

$$11\frac{5}{10}, 10\frac{4}{10}, 9\frac{3}{10}, 8\frac{2}{10}, 7\frac{1}{10}, 6, 4\frac{9}{10}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}}, \underline{\hspace{1cm}}$$

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Q14. What is the length of this smaller part? How many such smaller parts make a unit length?

The next question (Q15) talks about **one-hundredths**, so the smaller division shown in the figure is:

$$\frac{1}{100}$$

unit.

Therefore,

$$\text{Length of one smaller part} = \frac{1}{100}\text{unit} = \mathbf{0.01 \text{ unit}}$$

Number of such parts in 1 unit:

$$1 \div \frac{1}{100} = 100$$

Answer:

- Length of smaller part = $\frac{1}{100}\text{unit}$
 - **100** such parts make **1 unit**
-

Q15. How many one-hundredths make one-tenth?

$$\frac{1}{10} = \frac{10}{100}$$

Therefore,

10 one-hundredths make one-tenth.

Also,

$$\begin{aligned} & 4 + \frac{4}{10} + \frac{5}{100} \\ &= 4 + \frac{40}{100} + \frac{5}{100} \\ &= 4 + \frac{45}{100} \\ &= 4.45 \end{aligned}$$

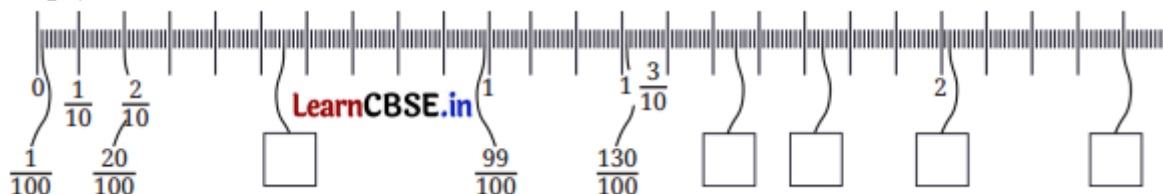
So yes, we can say:

4 units and 45 one-hundredths = 4 units, 4 one-tenths and 5 one-hundredths.

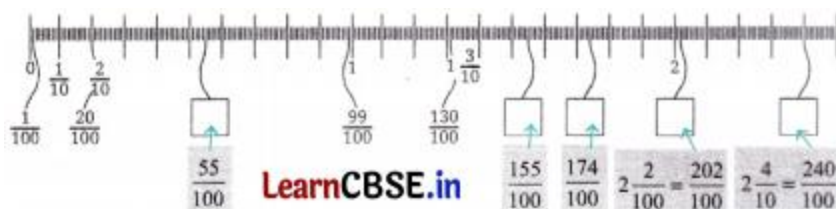
Answer:

1. **10 one-hundredths make one-tenth.**
2. **Yes, $4.45 = 4$ units, 4 one-tenths and 5 one-hundredths.**

16. Observe the figure below. Notice the markings and the corresponding lengths written in the boxes when measured from 0. Fill in the lengths in the empty boxes.



Solution:

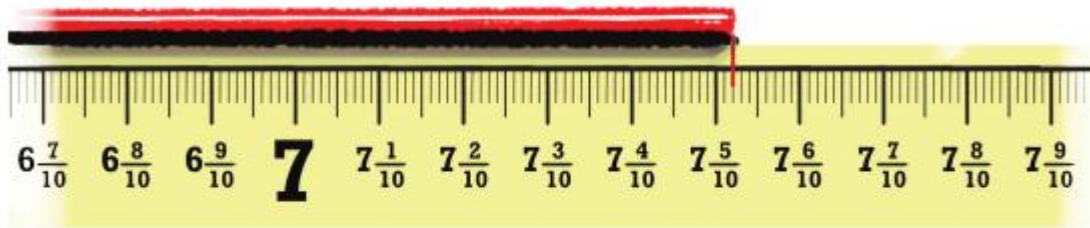


17. For the lengths shown below, write the measurements and read out the measures in words.

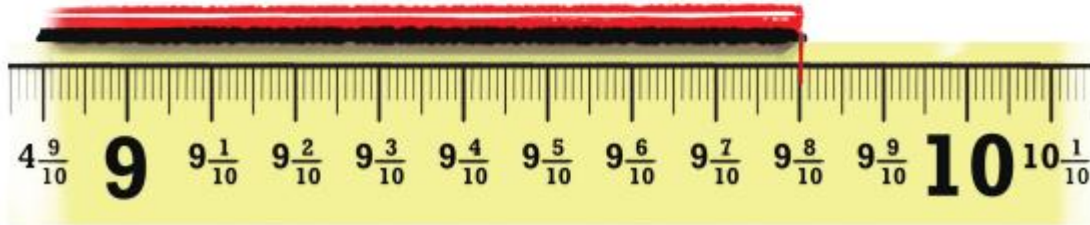


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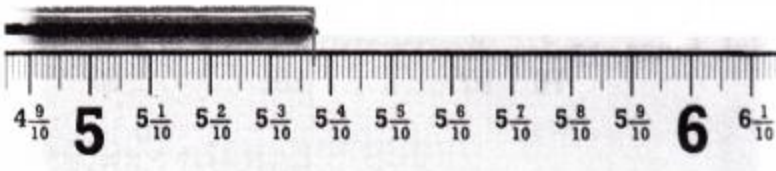




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Solution:



5 $\frac{3}{10}$ $\frac{7}{100}$ Five and three-tenths and seven-hundredths

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Or 5 $\frac{37}{100}$ Five and thirty-seven-hundredths

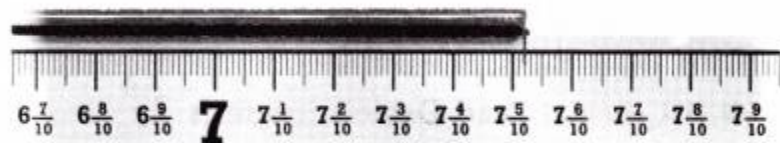
Or $\frac{537}{100}$ Five hundred thirty-seven-hundredths



$15\frac{3}{100}$ Fifteen and three-hundredths

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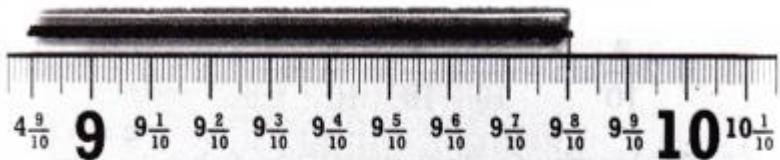
Or $\frac{1503}{100}$ One thousand five hundred three-hundredths



$7\frac{5}{10}\frac{2}{100}$ Seven and five-tenths and two-hundredths

Or $7\frac{52}{100}$ Seven and fifty-two-hundredths

Or $\frac{752}{100}$ Seven hundred fifty-two-hundredths



$9\frac{8}{10}$ Nine and eight-tenths LearnCBSE.in

Or $9\frac{80}{100}$ Nine and eighty-hundredths

Or $\frac{980}{100}$ Nine hundred eighty-hundredths

Intext question

Given:

$$25\frac{9}{10} - 6\frac{4}{10}\frac{7}{100}$$

The second mixed number is:

$$6\frac{4}{10}\frac{7}{100} = 6 + \frac{4}{10} + \frac{7}{100} = 6\frac{47}{100}$$

Convert both numbers to hundredths:

$$25\frac{9}{10} = 25\frac{90}{100}$$
$$6\frac{47}{100} = 6\frac{47}{100}$$

Now subtract:

$$25\frac{90}{100} - 6\frac{47}{100}$$
$$= (25 - 6) + \left(\frac{90}{100} - \frac{47}{100}\right)$$
$$= 19 + \frac{43}{100}$$
$$= 19\frac{43}{100}$$

Answer:

$$\boxed{19\frac{43}{100}}$$

or in decimal form:

$$\boxed{19.43}$$

Figure it Out

Question 1.

Find the sums and differences:

(a) $\frac{3}{10} + 3\frac{4}{100}$

Solution By Steps

Step 1: Convert to the same denominator

$$\frac{3}{10} = \frac{30}{100}$$

So,

$$\frac{30}{100} + 3\frac{4}{100}$$

Step 2: Add the fractional parts

$$\frac{30}{100} + \frac{4}{100} = \frac{34}{100}$$

Step 3: Write the final answer

$$3\frac{34}{100}$$

Final Answer

$$\boxed{3\frac{34}{100}}$$

(b) $9\frac{5}{10}\frac{7}{100} + 2\frac{1}{10}\frac{3}{100}$

This means:

$$9 + \frac{5}{10} + \frac{7}{100} + 2 + \frac{1}{10} + \frac{3}{100}$$

Solution By Steps

Step 1: Add whole numbers

$$9 + 2 = 11$$

Step 2: Add tenths

$$\frac{5}{10} + \frac{1}{10} = \frac{6}{10}$$

Step 3: Add hundredths

$$\frac{\frac{7}{100} + \frac{3}{100}}{\frac{10}{100}} = \frac{\frac{10}{100}}{\frac{1}{10}}$$

Step 4: Add tenths again

$$\frac{6}{10} + \frac{1}{10} = \frac{7}{10}$$

Step 5: Final answer

$$11\frac{7}{10}$$

Final Answer

$$\boxed{11\frac{7}{10}}$$

(c) $15\frac{6}{10}\frac{4}{100} + 14\frac{3}{10}\frac{6}{100}$

Solution By Steps

Step 1: Add whole numbers

$$15 + 14 = 29$$

Step 2: Add tenths

$$\frac{6}{10} + \frac{3}{10} = \frac{9}{10}$$

Step 3: Add hundredths

$$\frac{\frac{4}{100}}{\frac{10}{100}} + \frac{\frac{6}{100}}{\frac{1}{100}} = \frac{10}{100}$$

Step 4: Add the tenths

$$\frac{9}{10} + \frac{1}{10} = \frac{10}{10} = 1$$

Step 5: Add to the whole number

$$29 + 1 = 30$$

Final Answer

$$\boxed{30}$$

(d) $7\frac{7}{100} - 4\frac{4}{100}$

Solution By Steps

Step 1: Subtract whole numbers

$$7 - 4 = 3$$

Step 2: Subtract hundredths

$$\frac{7}{100} - \frac{4}{100} = \frac{3}{100}$$

Step 3: Final answer

$$3\frac{3}{100}$$

Final Answer

$$\boxed{3\frac{3}{100}}$$

(e) $8\frac{6}{100} - 5\frac{3}{100}$

Solution By Steps

Step 1: Subtract whole numbers

$$8 - 5 = 3$$

Step 2: Subtract hundredths

$$\frac{6}{100} - \frac{3}{100} = \frac{3}{100}$$

Step 3: Final answer

$$3\frac{3}{100}$$

Final Answer

$$\boxed{3\frac{3}{100}}$$

(f) $12\frac{6}{100}\frac{2}{100} - \frac{9}{10}\frac{9}{100}$

This means:

$$12 + \frac{6}{100} + \frac{2}{100} - \left(\frac{9}{10} + \frac{9}{100}\right)$$

Solution By Steps

Step 1: Add the hundredths on the left

$$\frac{6}{100} + \frac{2}{100} = \frac{8}{100}$$

So we have:

$$12\frac{8}{100} - \frac{9}{10}\frac{9}{100}$$

Step 2: Convert tenths to hundredths

$$\frac{9}{10} = \frac{90}{100}$$

So,

$$\frac{90}{100} + \frac{9}{100} = \frac{99}{100}$$

Step 3: Subtract

$$12\frac{8}{100} - \frac{99}{100}$$

Borrow 1 from 12:

$$11 + \frac{108}{100} - \frac{99}{100}$$

Step 4: Subtract hundredths

$$\frac{108}{100} - \frac{99}{100} = \frac{9}{100}$$

Step 5: Final answer

$$11\frac{9}{100}$$

Final Answer

$$\boxed{11\frac{9}{100}}$$

In-Text Questions

1. Make a place value table similar to the one above. Write each quantity in decimal form and terms of place value, and read the number:

	Quantity	Decimal form	Place value						Number in words	
			Hundreds	Tens	Ones	Decimal point	Tenths	Hundredths		Thousandths
(a)	2 ones, 3 tenths and 5 hundredths	$2 + \frac{3}{10} + \frac{5}{100} = 2.35$			2×1	.	$3 \times \frac{1}{10}$	$5 \times \frac{1}{100}$		Two point three five
(b)	1 ten and 5 tenths	$10 + \frac{5}{10} = 10.5$		1×10	0×1	.	$5 \times \frac{1}{10}$			Ten point five
(c)	4 ones and 6 hundredths	$4 + 0 + \frac{6}{100} = 4.06$			4×1	.	$0 \times \frac{1}{10}$	$6 \times \frac{1}{100}$		Four point zero six
(d)	1 hundred, 1 one and 1 hundredth	$100 + 0 + 1 + 0 + \frac{1}{100} = 101.01$	1×100	0×10	1×1	.	$0 \times \frac{1}{10}$	$1 \times \frac{1}{100}$		One hundred one point zero one
(e)	$\frac{8}{100}$ and $\frac{9}{10}$	$\frac{9}{10} + \frac{8}{100} = 0.98$	LearnCBSE.in		0×1	.	$9 \times \frac{1}{10}$	$8 \times \frac{1}{100}$		Zero point nine eight
(f)	$\frac{5}{100}$	$\frac{5}{100} = 0.05$			0×1	.	$0 \times \frac{1}{10}$	$5 \times \frac{1}{100}$		Zero point zero five
(g)	$\frac{1}{10}$	$\frac{1}{10} = 0.1$			0×1	.	$1 \times \frac{1}{10}$			Zero point one
(h)	$2\frac{1}{100}$, $4\frac{1}{10}$ and $7\frac{7}{1000}$	$4 + \frac{1}{10} + 2\frac{1}{100} + 7\frac{7}{1000}$ $= (4 + 2 + 7) + \frac{1}{10} + \frac{1}{100} + \frac{7}{1000}$ $= 13.117$		1×10	3×1	.	$1 \times \frac{1}{10}$	$1 \times \frac{1}{100}$	$7 \times \frac{1}{1000}$	Thirteen point one one seven

12 mm = 1.2 cm	56 mm = 5.6 cm	70 mm = _____
_____ = 0.9 cm	134 mm = _____	_____ = 203.6 cm

3.

Solution:

12 mm = 1.2 cm	56 mm = 5.6 cm	70 mm = 7.0 cm
9 mm = 0.9 cm	134 mm = 13.4 cm	2036 mm = 203.6 cm

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4. Fill in the blanks below (cm ↔ m)

36 cm = _____	50 cm = _____	_____ = 0.89 m
4 cm = _____	325 cm = _____	_____ = 2.07 m

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Solution:

36 cm = 0.36 m	50 cm = 0.5 m	89 cm = 0.89 m
4 cm = 0.04 m	325 cm = 3.25 m	207 cm = 2.07 m

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5. Fill in the blanks below (g ↔ kg)

465 g = _____	68 g = _____	1560 g = _____
704 g = _____	_____ = 0.56 kg	_____ = 2.5 kg

Solution:

465 g = 0.465 kg	68 g = 0.068 kg	1560 g = 1.56 kg
704 g = 0.704 kg	560 g = 0.56 kg	2500 g = 2.5 kg

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6.Fill in the blanks below (rupee ↔ paise)

10 p = _____	_____ p = ₹ 0.05	_____ p = ₹ 0.36
_____ = ₹ 0.50	99 p = _____	250 p = _____

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Solution:

10 p = ₹0.1	5 p = ₹0.05	36 p = ₹0.36
50 p = ₹0.50	99 p = ₹0.99	250 p = ₹2.50

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Intext Question

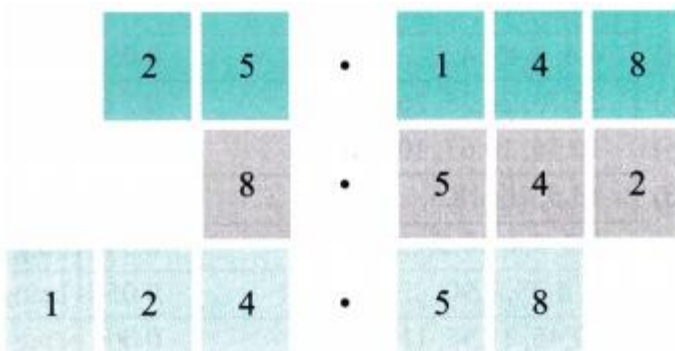
In each case below, use the digits 4, 1, 8, 2, and 5 exactly once and try to make a decimal number as close as possible to 25.



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Solution:

We can make a decimal number closest to 25 using the digits 4, 1, 8, 2, and 5 with the given conditions as follows:



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Figure It Out

Question 1.

Find the sums.

- (a) $5.3 + 2.6$
- (b) $18 + 8.8$
- (c) $2.15 + 5.26$
- (d) $9.01 + 9.10$
- (e) $29.19 + 9.91$
- (f) $0.934 + 0.6$
- (g) $0.75 + 0.03$
- (h) $6.236 + 0.487$

Solution:

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
5.3	18.0	2.15	9.01	29.19	0.934	0.75	6.236
+ 2.6	+ 8.8	+ 5.26	+ 9.10	+ 9.91	+ 0.600	+ 0.03	+ 0.487
= 7.9	= 26.8	= 7.41	= 18.11	= 39.10	= 1.534	= 0.78	= 6.723

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Question 2.

Find the differences.

- (a) $5.6 - 2.3$
- (b) $18 - 8.8$
- (c) $10.4 - 4.5$
- (d) $17 - 16.198$
- (e) $17 - 0.05$
- (f) $34.505 - 18.1$
- (g) $9.9 - 9.09$
- (h) $6.236 - 0.487$

Solution:

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
5.6	18.0	10.4	17.000	17.00	34.505	9.90	6.236
- 2.3	- 8.8	- 4.5	- 16.198	- 0.05	- 18.100	- 9.09	- 0.487
= 3.3	= 9.2	= 5.9	= 0.802	= 16.95	= 16.405	= 0.81	= 5.749

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Intext Question

Similarly, identify the change and write the next 3 terms for each sequence given below. Try to do this computation mentally.

- (a) 4.4, 4.45, 4.5,.....
- (b) 25.75, 26.25, 26.75,.....
- (c) 10.56, 10.67, 10.78,.....
- (d) 13.5, 16, 18.5,.....
- (e) 8.5, 9.4, 10.3,.....

(f) 5, 4.95, 4.90,

(g) 12.45, 11.95, 11.45,

(h) 36.5, 33, 29.5,

Solution:

	Sequence	Rule	LearnCBSE.in	Next 3 terms
(a)	4.4, 4.45, 4.5, ...	0.05 is being added to each term to get the next term		4.55, 4.6, 4.65
(b)	25.75, 26.25, 26.75, ...	0.5 is being added to each term to get the next term		27.25, 27.75, 28.25
(c)	10.56, 10.67, 10.78, ...	0.11 is being added to each term to get the next term		10.89, 11, 11.11
(d)	13.5, 16, 18.5, ...	2.5 is being added to each term to get the next term		21, 23.5, 26
(e)	8.5, 9.4, 10.3, ...	0.9 is being added to each term to get the next term		11.2, 12.1, 13
(f)	5, 4.95, 4.90, ...	0.05 is being subtracted from each term to get the next term		4.85, 4.80, 4.75
(g)	12.45, 11.95, 11.45, ...	0.5 is being subtracted from each term to get the next term		10.95, 10.45, 9.95
(h)	36.5, 33, 29.5, ...	3.5 is being subtracted from each term to get the next term		26, 22.5, 19

First Section: Practice Time 3.1

Solution By Steps

Question 1

A screw's tip is at 0. Its other end reaches the 3 cm mark and 4 small divisions more.

Since each small division = 1 mm,

3 cm 4 mm

Final Answer

Length = 3.4 cm = 34 mm

Question 2

Left end = 2.3 cm

Right end = 5.6 cm

Length of screw

$$5.6 - 2.3 = 3.3$$

Final Answer

Length = 3.3 cm

Question 3

Screw A = 3.3 cm

Screw B = 3.1 cm

Difference

$$3.3 - 3.1 = 0.2$$

Final Answer

Screw A is longer by **0.2 cm = 2 mm**

Question 4

Wire lengths:

1.8 cm and 2.7 cm

Total

$$1.8 + 2.7 = 4.5$$

Final Answer

Total length = **4.5 cm = 45 mm**

Question 5

Slot depth = 3.0 cm

Screw length = 3.4 cm

Extra part

$$3.4 - 3.0 = 0.4$$

Convert to mm

$$0.4 \text{ cm} = 4 \text{ mm}$$

Final Answer

Cut off **4 mm**

Practice Time 3.2

Question 1

Write $\frac{67}{10}$ as:

(a) Units + Tenths

Solution

$$\frac{67}{10} = \frac{60}{10} + \frac{7}{10} = 6 + \frac{7}{10}$$

Answer

6 units 7 tenths

(b) Decimal

$$6 + \frac{7}{10} = 6.7$$

Answer

6.7

Question 2

A box measures

$$2\frac{7}{10}$$

units.

Write the same length as:

(a) Tenths only

Solution

$$2 = \frac{20}{10}$$

So,

$$2\frac{7}{10} = \frac{20}{10} + \frac{7}{10} = \frac{27}{10}$$

Answer

$$\boxed{\frac{27}{10}}$$

(27 tenths)

(b) Decimal

$$2 + \frac{7}{10} = 2.7$$

Answer

$$\boxed{2.7}$$

Question 3

Arrange from smallest to largest:

$$3\frac{4}{10}, 2\frac{9}{10}, \frac{41}{10}, 2\frac{5}{10}, 3\frac{1}{10}$$

Step 1: Convert to decimals

$$3\frac{4}{10} = 3.4$$

$$2\frac{9}{10} = 2.9$$

$$\frac{41}{10} = 4.1$$

$$2\frac{5}{10} = 2.5$$

$$3\frac{1}{10} = 3.1$$

Step 2: Arrange

$$2.5 < 2.9 < 3.1 < 3.4 < 4.1$$

Answer

$2\frac{5}{10}, 2\frac{9}{10}, 3\frac{1}{10}, 3\frac{4}{10}, \frac{41}{10}$

Question 4

Add with regrouping (tenths)

Find:

$$4\frac{8}{10} + 3\frac{6}{10}$$

Step 1: Add tenths

$$\frac{8}{10} + \frac{6}{10} = \frac{14}{10} = 1\frac{4}{10}$$

Step 2: Add whole numbers

$$4 + 3 + 1 = 8$$

Remaining tenths

$$\frac{4}{10}$$

Answer as units + tenths

$$\boxed{8\frac{4}{10}}$$

Answer as decimal

$$\boxed{8.4}$$

Question 5

Find:

$$12\frac{2}{10} + 6\frac{7}{10}$$

Give answer as:

(a) Units + Tenths

(b) Decimal

Step 1: Add tenths

$$\frac{2}{10} + \frac{7}{10} = \frac{9}{10}$$

Step 2: Add units

$$12 + 6 = 18$$

Final Answer

(a)

$$18\frac{9}{10}$$

(b)

$$18.9$$

Question 6

On a scale marked in tenths:

- USB cable = $4\frac{3}{10}$
- Thumb = $1\frac{6}{10}$
- Leaf = $3\frac{7}{10}$

(a) **Total length**

Convert to decimals:

$$4.3, 1.6, 3.7$$

Add:

$$\begin{aligned} &4.3 + 1.6 + 3.7 \\ &= 5.9 + 3.7 \\ &= 9.6 \end{aligned}$$

Answer

$$9.6 \text{ units}$$

(b) **Longest object**

Compare:

4.3, 1.6, 3.7

Largest = 4.3

So USB cable is longest.

Difference between longest and shortest:

$$4.3 - 1.6 = 2.7$$

Answer

USB cable

It is

2.7 units

longer than the shortest object.

Practice Time 3.3

Question 1

Write

$$3\frac{47}{100}$$

as:

(a) Denominator 100

Solution

Convert mixed fraction into an improper fraction.

$$3 = \frac{300}{100}$$

Therefore,

$$3\frac{47}{100} = \frac{300}{100} + \frac{47}{100} = \frac{347}{100}$$

Answer

$$\boxed{\frac{347}{100}}$$

(b) Decimal (two places)

$$3 + \frac{47}{100} = 3.47$$

Answer

$$\boxed{3.47}$$

Question 2

Write 9.06 as:

(a) Units + Tenths + Hundredths

Solution

$$9.06 = 9 + \frac{0}{10} + \frac{6}{100}$$

Answer

9 units 0 tenths 6 hundredths

(b) Fraction with denominator 100

$$9.06 = \frac{906}{100}$$

Answer

$$\boxed{\frac{906}{100}}$$

Question 3

Point P is at:

3 tenths and 4 hundredths from 0

Write its value as:

(a) Hundredths fraction

Solution

3 tenths

$$= \frac{30}{100}$$

4 hundredths

$$= \frac{4}{100}$$

Total

$$\frac{30}{100} + \frac{4}{100} = \frac{34}{100}$$

Answer

$$\boxed{\frac{34}{100}}$$

(b) Decimal

$$\frac{34}{100} = 0.34$$

Answer

0.34

Question 4

Arrange from smallest to largest:

$$\frac{3}{100}, \frac{30}{100}, \frac{33}{100}, \frac{7}{100}, \frac{4}{100}$$

Step 1: Convert to decimals

$$\begin{aligned}\frac{3}{100} &= 0.03 \\ \frac{30}{100} &= 0.30 \\ \frac{33}{100} &= 0.33 \\ \frac{7}{100} &= 0.07 \\ \frac{4}{100} &= 0.04\end{aligned}$$

Step 2: Arrange

$$0.03 < 0.04 < 0.07 < 0.30 < 0.33$$

Answer

$\frac{3}{100}$	$\frac{4}{100}$	$\frac{7}{100}$	$\frac{30}{100}$	$\frac{33}{100}$
-----------------	-----------------	-----------------	------------------	------------------

Number Line Positions

0 ----0.03----0.04----0.07-----0.30--0.33----1

Question 5

Put in increasing order and identify shortest and longest:

$$7\frac{6}{100}, 7\frac{29}{100}, 7\frac{3}{10}, 7\frac{5}{100}$$

Step 1: Convert into decimals

$$7\frac{6}{100} = 7.06$$

$$7\frac{29}{100} = 7.29$$

$$7\frac{3}{10} = 7.30$$

$$7\frac{5}{100} = 7.05$$

Step 2: Arrange

$$7.05 < 7.06 < 7.29 < 7.30$$

Answer

7.05, 7.06, 7.29, 7.30

Shortest

7.05

Longest

7.30

Practice Time 3.4

Question 1

Write **6.08** as:

(a) Units + Tenths + Hundredths

Solution

$$6.08 = 6 + \frac{0}{10} + \frac{8}{100}$$

So,

- Units = 6
- Tenths = 0
- Hundredths = 8

Answer

6 units 0 tenths 8 hundredths

(b) Mixed Fraction

$$\begin{aligned} 6.08 &= 6 + \frac{8}{100} \\ &= 6\frac{8}{100} \end{aligned}$$

Answer

$6\frac{8}{100}$

Question 2

Convert

$$\frac{731}{100}$$

to:

(a) Mixed Form

Solution

Divide 731 by 100.

$$731 = 7 \times 100 + 31$$

Therefore,

$$\frac{731}{100} = 7 \frac{31}{100}$$

Answer

$$\boxed{7 \frac{31}{100}}$$

(b) Decimal

$$\frac{731}{100} = 7.31$$

Answer

$$\boxed{7.31}$$

Question 3

3 tens, 2 units, 4 tenths and 7 hundredths.

Write as:

(a) Decimal

Solution

$$3 \text{ tens} = 30$$

$$2 \text{ units} = 2$$

$$4 \text{ tenths} = 0.4$$

$$7 \text{ hundredths} = 0.07$$

Add:

$$30 + 2 + 0.4 + 0.07 = 32.47$$

Answer

$$\boxed{32.47}$$

(b) Fraction with denominator 100

$$32.47 = \frac{3247}{100}$$

Answer

$$\boxed{\frac{3247}{100}}$$

Question 4

Compute:

(a)

$$2.47 \times 10$$

Solution

When multiplying by 10, decimal point moves one place right.

$$2.47 \times 10 = 24.7$$

Answer

24.7

(b)

$$2.47 \div 10$$

Solution

When dividing by 10, decimal point moves one place left.

$$2.47 \div 10 = 0.247$$

Answer

0.247

(c)

$$0.706 \times 10$$

Solution

Move decimal one place right.

$$0.706 \times 10 = 7.06$$

Answer

7.06

(d)

$$0.706 \div 10$$

Solution

Move decimal one place left.

$$0.706 \div 10 = 0.0706$$

Answer

$$\boxed{0.0706}$$

Question 5

Put in increasing order:

$$6.05, 6.5, 6.50, 6.506$$

Also identify equal numbers.

Step 1

Write all numbers with three decimal places.

$$6.05 = 6.050$$

$$6.5 = 6.500$$

$$6.50 = 6.500$$

$$6.506 = 6.506$$

Step 2 Compare

$$6.050 < 6.500 < 6.506$$

Since

$$6.5 = 6.50$$

they are equal.

Answer

$$\boxed{6.05, 6.5, 6.50, 6.506}$$

Equal numbers:

$$\boxed{6.5 = 6.50}$$

Practice Time 3.5

Question 1

(a) Convert 138 mm to centimetres

Solution

We know:

$$10 \text{ mm} = 1 \text{ cm}$$

Therefore,

$$\begin{aligned} 138 \text{ mm} &= \frac{138}{10} \text{ cm} \\ &= 13.8 \text{ cm} \end{aligned}$$

Answer

$$\boxed{13.8 \text{ cm}}$$

(b) Convert 7.2 cm to millimetres

Solution

We know:

$$\begin{aligned} 1 \text{ cm} &= 10 \text{ mm} \\ 7.2 \times 10 &= 72 \end{aligned}$$

Answer

$$\boxed{72 \text{ mm}}$$

Question 2

(a) Convert 315 cm to metres

Solution

We know:

$$\begin{aligned}100 \text{ cm} &= 1 \text{ m} \\315 \div 100 &= 3.15\end{aligned}$$

Answer

$$\boxed{3.15 \text{ m}}$$

(b) Convert 0.08 m to centimetres

Solution

$$\begin{aligned}1 \text{ m} &= 100 \text{ cm} \\0.08 \times 100 &= 8\end{aligned}$$

Answer

$$\boxed{8 \text{ cm}}$$

Question 3

A pencil is 9.7 cm long and a pen is 85 mm long.

Find the total length in cm and mm.

Solution

Convert 85 mm to cm:

$$85 \div 10 = 8.5 \text{ cm}$$

Now add:

$$9.7 + 8.5 = 18.2 \text{ cm}$$

Convert into mm:

$$18.2 \times 10 = 182 \text{ mm}$$

Answer

$$\boxed{18.2 \text{ cm}}$$

or

$$\boxed{182 \text{ mm}}$$

Question 4

(a) Convert 0.84 kg to grams

Solution

We know:

$$\begin{aligned} 1 \text{ kg} &= 1000 \text{ g} \\ 0.84 \times 1000 &= 840 \end{aligned}$$

Answer

$$\boxed{840 \text{ g}}$$

(b)

A bag has mass 2.1 kg.

After removing 250 g, what is the remaining mass?

Solution

Convert 2.1 kg to grams.

$$2.1 \times 1000 = 2100 \text{ g}$$

Remaining mass:

$$2100 - 250 = 1850 \text{ g}$$

Convert back to kg:

$$1850 \div 1000 = 1.85 \text{ kg}$$

Answer

1.85 kg

Question 5

(a) Write 275 paise in rupees

Solution

We know:

$$\begin{aligned} 100 \text{ paise} &= 1 \text{ rupee} \\ 275 \div 100 &= 2.75 \end{aligned}$$

Answer

₹2.75

(b)

A notebook costs ₹37.85 and a pen costs ₹0.75.

Find the total and the change from ₹50.

Solution

Total cost:

$$37.85 + 0.75 = 38.60$$

Change from ₹50:

$$50.00 - 38.60 = 11.40$$

Answer

Total cost

₹38.60

Change

₹11.40

Question 6

A tailor needs:

- 1.25 m ribbon
- 36 cm ribbon
- 145 mm ribbon

Find the total length in cm and m.

Step 1: Convert all to centimetres

First ribbon

$$1.25 \text{ m} = 125 \text{ cm}$$

Second ribbon

$$36 \text{ cm}$$

Third ribbon

$$145 \text{ mm} = 14.5 \text{ cm}$$

Step 2: Add

$$125 + 36 + 14.5 = 175.5$$

Therefore,

$$\boxed{175.5 \text{ cm}}$$

Step 3: Convert into metres

$$175.5 \div 100 = 1.755$$

Therefore,

$$\boxed{1.755 \text{ m}}$$

Practice Time 3.6**1(a) Mark 1.37 on a 1–2 number line****Solution By Steps**

Step 1: Locate 1.3

Between 1 and 2, divide into 10 equal parts. The 3rd tenth after 1 is 1.3.

Step 2: Locate 1.37

Divide the segment from 1.3 to 1.4 into 10 equal parts (hundredths). Move 7 small divisions after 1.3.

Final Answer

1.37 is the **7th hundredth** after 1.3.

1(b) Mark 2.04 on a 2–3 number line**Solution By Steps**

Step 1: Start at 2.0.

Step 2: Move 4 hundredths to the right.

Final Answer

2.04 is the **4th small division after 2.00**.

2. Find the values of the points

Big marks: 5.1, 5.2, 5.3, 5.4

Each tenth divided into 10 parts.

A = 2nd small tick after 5.1

$$5.10 + 0.02 = 5.12$$

B = 8th small tick after 5.1

$$5.10 + 0.08 = 5.18$$

C = 3rd small tick after 5.2

$$5.20 + 0.03 = 5.23$$

D = 6th small tick after 5.3

$$5.30 + 0.06 = 5.36$$

Final Answer

$$A = 5.12$$

$$B = 5.18$$

$$C = 5.23$$

$$D = 5.36$$

3. Every division between 1.00 and 1.10**Final Answer**

1.00, 1.01, 1.02, 1.03, 1.04, 1.05, 1.06, 1.07, 1.08, 1.09, 1.10

4(a) Do 0.6, 0.60, 0.600 represent the same value?

Yes.

Final Answer

$$0.6 = 0.60 = 0.600$$

4(b) Which is larger: 0.08 or 0.8?

Solution By Steps

Write with equal decimal places:

$0.08 = 8$ hundredths

$0.8 = 80$ hundredths

$80 \text{ hundredths} > 8 \text{ hundredths}$

Final Answer

0.8 is larger.

5(a) Arrange in increasing order

Numbers: 0.3, 0.30, 0.03, 0.300

Since $0.3 = 0.30 = 0.300$

Final Answer

0.03, 0.3, 0.30, 0.300

5(b) Arrange in increasing order

Numbers: 7.06, 7.3, 7.29

Write equally:

7.06, 7.30, 7.29

Final Answer

7.06, 7.29, 7.30

6(a) Which is closest to 1?

Numbers: 0.9, 1.1, 1.01, 1.11

Distances from 1:

$0.9 \rightarrow 0.1$

$1.1 \rightarrow 0.1$

$$1.01 \rightarrow 0.01$$

$$1.11 \rightarrow 0.11$$

Final Answer

$$1.01$$

6(b) Which is closest to 6?

Numbers: 5.92, 6.08, 6.015, 6.2

Distances from 6:

$$5.92 \rightarrow 0.08$$

$$6.08 \rightarrow 0.08$$

$$6.015 \rightarrow 0.015$$

$$6.2 \rightarrow 0.2$$

Final Answer

$$6.015$$

Practice Time 3.7

1. Total cost

$$\text{Milk} = ₹23.75$$

$$\text{Bread} = ₹12.50$$

$$\text{Eggs} = ₹8.40$$

Solution By Steps

$$23.75 + 12.50 = 36.25$$

$$36.25 + 8.40 = 44.65$$

Final Answer

$$₹44.65$$

2. Distance left to ride

$$\text{Total} = 12.4 \text{ km}$$

Already ridden = 3.75 km

$$12.40 - 3.75$$

Solution By Steps

$$12.40 - 3.75 = 8.65$$

Final Answer

8.65 km

3(i) Constant change

$$3.15 \rightarrow 3.42 \rightarrow 3.69 \rightarrow 3.96$$

Difference:

$$3.42 - 3.15 = 0.27$$

$$3.69 - 3.42 = 0.27$$

$$3.96 - 3.69 = 0.27$$

Final Answer

Common difference = 0.27

3(ii) Next three terms

$$3.96 + 0.27 = 4.23$$

$$4.23 + 0.27 = 4.50$$

$$4.50 + 0.27 = 4.77$$

Final Answer

4.23, 4.50, 4.77

4. Add 25.936 and 8.202

(i) Bounds using whole parts

$$25 + 8 = 33$$

Answer: About 33

(ii) One-decimal estimate

$$25.9 + 8.2 = 34.1$$

Answer: About 34.1

(iii) Exact sum

$$25.936 + 8.202$$

$$25.936 + 8.202 = 34.138$$

Final Answer

(i) 33

(ii) 34.1

(iii) 34.138

5. Change from ₹200

Total cost:

$$68.45 + 19.90 + 47.75 = 136.10$$

Change:

$$200.00 - 136.10 = 63.90$$

Final Answer

₹63.90

Practice Time 3.8

1(a) Convert 0.25 g to mg

$$1 \text{ g} = 1000 \text{ mg}$$

$$0.25 \times 1000 = 250$$

Final Answer

250 mg

1(b) Mistaking .25 g as 25 g

Factor:

$$25 \div 0.25 = 100$$

Final Answer

100 times larger

2. Train leaves 2.4 hours after 9:35 a.m.

$$2.4 \text{ hours} = 2 \text{ hours} + 0.4 \text{ hour}$$

$$0.4 \text{ hour} = 0.4 \times 60 = 24 \text{ minutes}$$

$$9:35 + 2 \text{ h} = 11:35$$

$$11:35 + 24 \text{ min} = 11:59$$

Final Answer

11:59 a.m.

3. Find the bill

$$₹287.60 + ₹212.05 + ₹20.50$$

$$= ₹520.15$$

Final Answer

₹520.15

4. Pole and platform

$$\text{Pole} = 1.8 \text{ m}$$

$$\text{Platform} = 90 \text{ cm} = 0.9 \text{ m}$$

Total:

$$1.8 + 0.9 = 2.7 \text{ m}$$

In centimetres:

$$270 \text{ cm}$$

Final Answer

$$2.7 \text{ m} = 270 \text{ cm}$$

5(a) Rewrite 3,75 l in Indian style

Final Answer

3.75 L

5(b) Convert to millilitres

1 L = 1000 mL

$3.75 \times 1000 = 3750$

Final Answer

3750 mL

5(c) Mistake if read as thousands format

3,75 may be interpreted as 375 litres.

Final Answer

The volume could be wrongly read as **375 L instead of 3.75 L**, causing a huge error.

Exam Time

A. Multiple Choice Questions

1. (d) 5.34
 2. (b) $0.2 = 0.20$
 3. (c) 235 paise
 4. (b) 13.4 cm
-

B. Fill in the Blanks

1. 10
2. 100
3. 1,000,000

4. 30

5. 7, 0, 5

C. True or False

1. True

2. True

3. False

4. False

5. True

D. Match the Columns

Column A Column B

3.47 e

0.5 c

7.08 d

24 h a

0.01 b

E. Very Short Answer Questions

1

$3.4 = 3 \text{ units} + 4 \text{ tenths}$

2

$72 \text{ mm} = 7.2 \text{ cm}$

3

$0.2 > 0.182$

4

$1 \text{ tenth} = 10 \text{ hundredths}$

5

$$₹1.75 = 175 \text{ paise}$$

F. Short Answer Questions

1

7.08

Mixed form:

7 units 0 tenths 8 hundredths

Hundredths fraction:

$$\frac{708}{100}$$

$$= 708/100$$

2

0.03, 0.3, 0.30, 0.300

3

$$2.7 - 2.4 = 0.3 \text{ cm}$$

4

$$315 \text{ cm} = 3.15 \text{ m}$$

5

$$4.8 + 2.5 = 7.3$$

G. Long Answer Questions

1

(a)

$$5.1 + 0.34 = 5.44$$

(b)

$$544/100$$

(c)

Point lies at 5.44 between 5.4 and 5.5.

2

Convert all to metres:

$$145 \text{ cm} = 1.45 \text{ m}$$

Total:

$$1.6 + 1.45 + 0.75 = 3.80 \text{ m}$$

In cm:

$$380 \text{ cm}$$

3

(a)

$$₹12.50, ₹8.40, ₹0.75$$

(b)

Total:

$$12.50 + 8.40 + 0.75 = ₹21.65$$

(c)

₹.75 may be misread or altered; ₹0.75 is safer.

4

Distance:

$$3.42 + 4.78 + 0.95$$

$$= 9.15 \text{ km}$$

5

Compare:

4.507 and 4.57

Write as:

4.507 and 4.570

Since 570 thousandths $>$ 507 thousandths:

$4.57 > 4.507$

Trailing zeros do not change value.

Competency-Based Questions

Assertion–Reason 1

Assertion: $0.20 = 20 \rightarrow$ False

Reason: Adding zeros to the right of a decimal does not change value $\rightarrow$ True

Answer: (d) A is false but R is true

Assertion–Reason 2

Assertion: To compare 4.507 and 4.57, it is enough to stop at hundredths place $\rightarrow$ True

Reason: Once a higher place differs, lower places cannot change the comparison $\rightarrow$ True

Answer: (a) Both A and R are true and R correctly explains A

Chapter-4: Expressing Using Letter- Numbers

NCERT CORNER

In-Text Questions

1.

Shabnam is 3 years older than Aftab. When Aftab's age 10 years, Shabnam's age will be 13 years. Now, Aftab's age is 18 years, what will Shabnam's age be?

Solution:

Shabnam's age will be $18 + 3 = 21$ years

2. Use this expression to find Aftab's age if Shabnam's age is 20.

Solution:

According to the expression,

Aftab's age = Shabnam's Age - 3

$\therefore$ Aftab's age = $20 - 3 = 17$ years

3.

Solution:

Cost of 8 coconuts = $8 \times ₹ 35 = ₹ 280$

Cost of 9 kg jaggery = $9 \times ₹ 60 = ₹ 540$

Total cost = $₹ 280 + ₹ 540 = ₹ 820$

4. Solution:

Expression for total amount is $c \times 35 + j \times 60$

Replacing c by 7 and j by 4 in the expression, we get

$c \times 35 + j \times 60 = 7 \times 35 + 4 \times 60$

$= 245 + 240$

$= 485$

Hence, the total amount to be paid for 7 coconuts and 4 kg of jaggery is ₹ 485.

5.

Solution:

We have, perimeter of a square of sidelength $q = 4 \times q$

Perimeter of a square of sidelength 7 cm = $4 \times 7 \text{ cm} = 28 \text{ cm}$

Q6. Let us revise these concepts and find the values of the following expressions

(a) $23 - 10 \times 2$

$$= 23 - 20$$

$$= 3$$

Answer: 3

(b) $83 + 28 - 13 + 32$

$$\begin{aligned} &= 111 - 13 + 32 \\ &= 98 + 32 \\ &= 130 \end{aligned}$$

Answer: 130

(c) $34 - 14 + 20$

$$\begin{aligned} &= 20 + 20 \\ &= 40 \end{aligned}$$

Answer: 40

(d) $42 + 15 - (8 - 7)$

$$\begin{aligned} &= 42 + 15 - 1 \\ &= 57 - 1 \\ &= 56 \end{aligned}$$

Answer: 56

(e) $68 - (18 + 13)$

$$\begin{aligned} &= 68 - 31 \\ &= 37 \end{aligned}$$

Answer: 37

(f) $7 \times 4 + 9 \times 6$

$$= 28 + 54$$

$$= 82$$

Answer: 82

(g) $20 + 8 \times (16 - 6)$

$$= 20 + 8 \times 10$$

$$= 20 + 80$$

$$= 100$$

Answer: 100

Figure it out

Question 1.

(a) Triangle with all sides equal (Equilateral Triangle)

Let the length of one side be a .

Perimeter

$$= a + a + a$$

$$= 3a$$

Formula: $\boxed{3a}$

(b) Regular Pentagon

A regular pentagon has **5 equal sides**.

Let the length of one side be a .

Perimeter

$$= 5a$$

Formula: $\boxed{5a}$

(c) Regular Hexagon

A regular hexagon has **6 equal sides**.

Let the length of one side be a .

Perimeter

$$= 6a$$

Formula: $6a$

Question 2.

Munirathna has a 20 m long pipe. However, he wants a longer watering pipe for his garden. He joins another pipe of some length to this one. Give the expression for the combined length of the pipe. Use the letter-number 'k' to denote the length in meters of the other pipe.

Solution:

Length of pipe Munirathna has = 20 m

Length of another pipe he wants to join in meters = k

The combined length of the pipe = $(20 + k)$ m

Question 3.

What is the total amount Krithika has, if she has the following number of notes ₹ 100, ₹ 20 and ₹ 5? Complete the following table:

No. of ₹100 notes	No. of ₹20 notes	No. of ₹5 notes	Expression and total amount
3	5	6	
			$6 \times 100 + 4 \times 20 + 3 \times 5$ $= 695$
8	4	z	LearnCBSE.in
x	y	z	

Solution:

No. of ₹100 notes	No. ₹20 notes	No. ₹5 notes	Expression and total amount
3	5	6	$3 \times 100 + 5 \times 20 + 6 \times 5 = 430$
6	4	3	$6 \times 100 + 4 \times 20 + 3 \times 5 = 695$
8	4	z	$8 \times 100 + 4 \times 20 + z \times 5 = 880 + 5z$
x	y	z	$x \times 100 + y \times 20 + z \times 5 = 100x + 20y + 5z$

Question 4.

Venkatalakshmi owns a flour mill. It takes 10 seconds for the roller mill to start running. Once it is running, each kg of grain takes 8 seconds to grind into powder. Which of the expressions below describes the time taken to complete grind 'y' kg of grain, assuming the machine is off initially?

- (a) $10 + 8 + y$
- (b) $(10 + 8) \times y$
- (c) $10 \times 8 \times y$
- (d) $10 + 8 \times y$
- (e) $10 \times y + 8$

Solution:

Time taken by the roller mill to start running = 10 seconds

Time taken by the roller mill to grind each kg of grain to powder = 8 seconds

Therefore, expression for the time taken to complete grind y kg of grain = $10 + 8 \times y$

Thus, expression (d) $10 + 8 \times y$ describe the given condition.

Question 5.

Write algebraic expressions using letters of your choice.

- (a) 5 more than a number
- (b) 4 less than a number
- (c) 2 less than 13 times a number
- (d) 13 less than 2 times a number

Solution:

Let letter 'n' represents the number, then

- (a) $n + 5$
- (b) $n - 4$

(c) $13 \times n - 2$

(d) $2 \times n - 13$

Question 6.

Describe situations corresponding to the following algebraic expressions:

(a) $8 \times x + 3 \times y$

(b) $15 \times j - 2 \times k$

Solution:

(a) Kritika bought x number of notebooks and y number of pencils. What is the total amount she has to pay to the shopkeeper, if the cost of each notebook is ₹ 8 and cost of each pencil is ₹ 3?

(b) Rohan earns ₹ 15 per glass by selling lemonade in his school fete. To maintain the cleanliness he further announced ₹ 2 discount on each glass, the customer return to him. If he sold j number of glasses and k number of glasses were returned to him, what is the total earnings at the end of the day?

Question 7.

In a calendar month, if any 2×3 grid full of dates is chosen as shown in the picture, expression for the dates in the blank cells if the bottom middle cell has date 'w'.

November 2024

Mon	Tue	Wed	Thu	Fri	Sat	Sun
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

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$w - 1$	w	

Solution:

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$w - 8$	$w - 7$	$w - 6$
$w - 1$	w	$w + 1$

In-Text Questions

1. Could we have written the initial expression as $(40x + 75y) + (-6x - 10y)$?

Solution:

Yes, as $(40x + 75y) + (-6x - 10y)$

$$= (40x + 75y) - (6x + 10y)$$

$$= (40x + 75y) - (6x + 10y)$$

2. Give some possible scores for Krishita in the three rounds so that they add up to give $23p - 7q$.

Solution:

Some possible scores of Krishita in three rounds may be $8p - 4q$, $9p - 2q$, and $6p - q$

or $7p - 3q$, $10p - 3q$, and $6p - q$

Here $8p - 4q + 9p - 2q + 6p - q$

$$= (8 + 9 + 6)p - (4 + 2 + 1)q$$

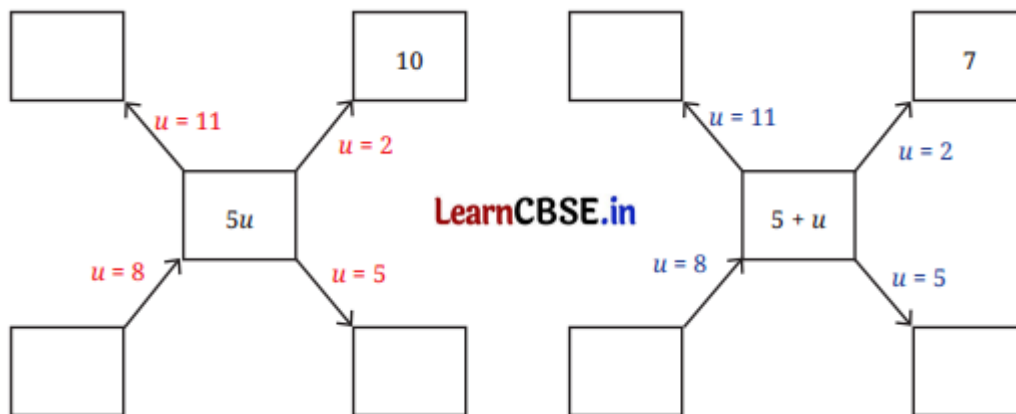
$$= 23p - 7q$$

Also $7p - 3q + 10p - 3q + 6p - q$

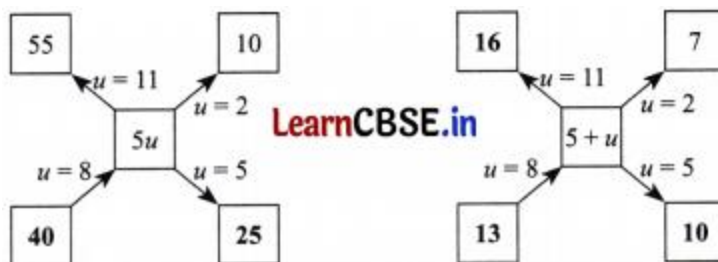
$$= (7 + 10 + 6)p - (3 + 3 + 1)q$$

$$= 23p - 7q$$

3. Fill in the blanks below by replacing the letter-numbers with numbers; an example is shown. Then compare the values that $5u$ and $5 + u$ take.



Solution:



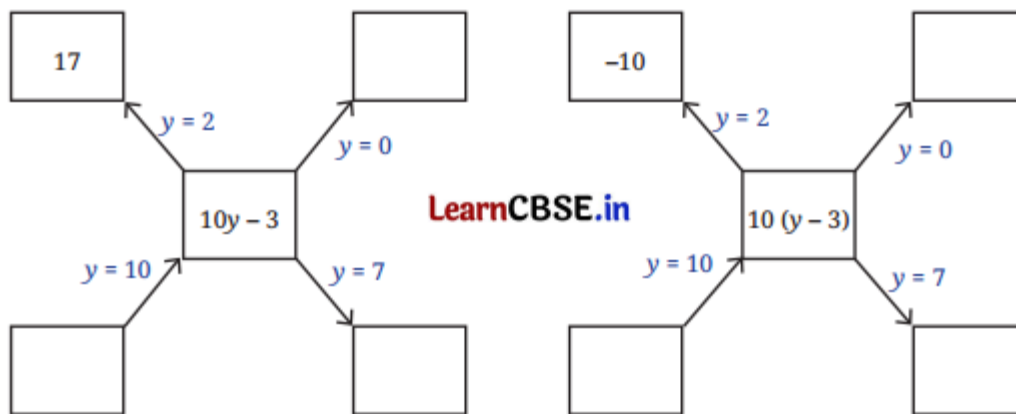
We see that the values of $5u$ and $5 + u$ are not equal for different values of u . So, the expressions $5u$ and $5 + u$ are not equal.

Are the expressions $10y - 3$ and $10(y - 3)$ equal?

$10y - 3$, short for $10 \times y - 3$, means 3 less than 10 times y ,

$10(y - 3)$, short for $10 \times (y - 3)$, means 10 times (3 less than y).

Let us compare the values that these expressions take for different values of y .



Solution:

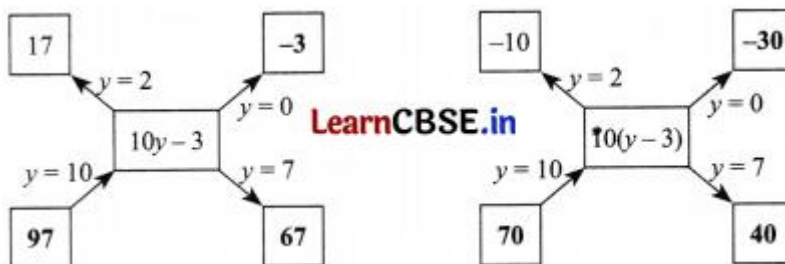
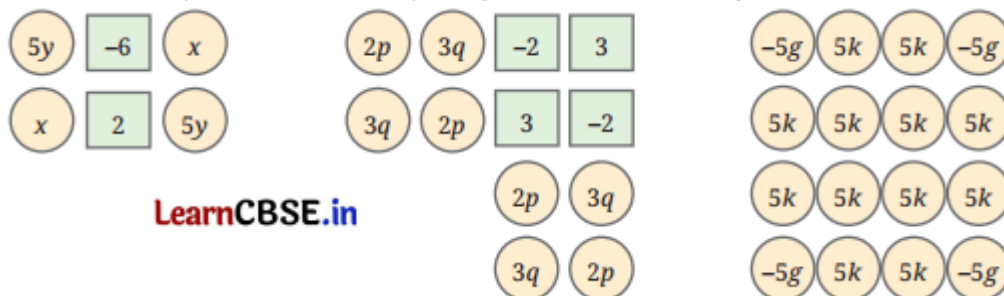


Figure it Out

Question 1.

Add the numbers in each picture below. Write their corresponding expressions and simplify them. Try adding the numbers in each picture in a couple of different ways and see that you get the same thing.



Solution:

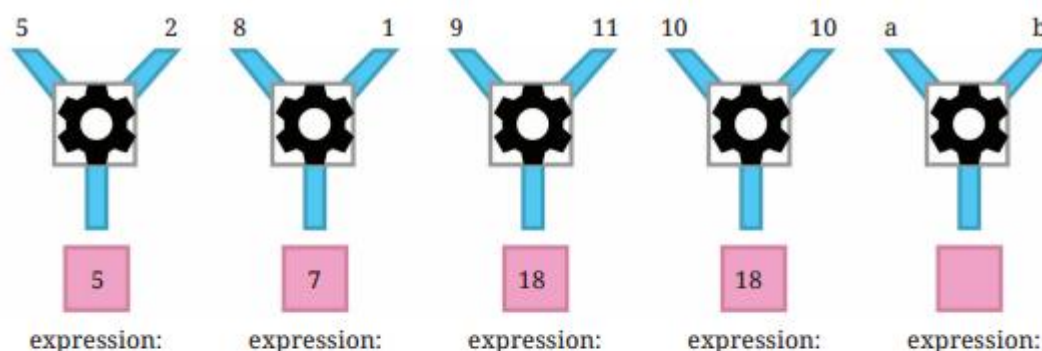
$$(e) 2d - d - (d - c) = c$$

$$2d - (d - d) - c = 2d - c$$

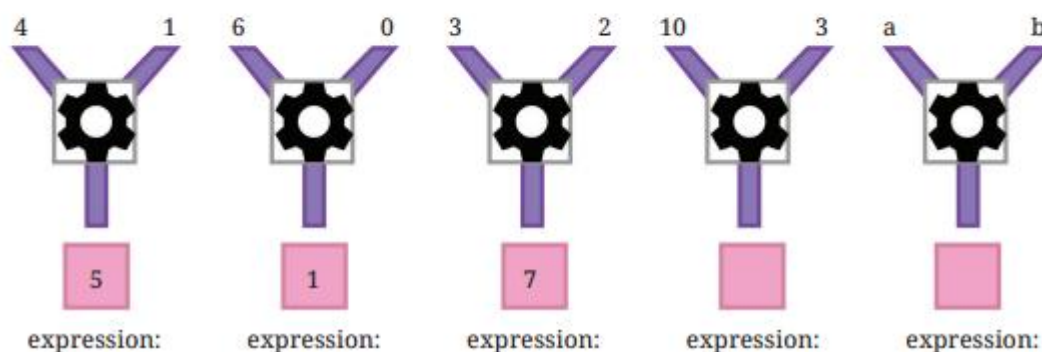
$$(f) 2d - d - c - c = d - 2c$$

Intext Question

1. Find the formulas of the number machines below and write the expression for each set of inputs.



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Solution:

The formula for the number machines in the first row is “sum of first number and second number minus two,” and the expression is $a + b - 2$.

The expression for each set of inputs is:

$$5 + 2 - 2 = 5, 8 + 1 - 2 = 7, 9 + 11 - 2 = 18, 10 + 10 - 2 = 18, \text{ and } a + b - 2$$

The formula for the number machines in the second row is “product of first number and second number plus one,” and the expression is $a \times b + 1$.

The expression for each set of inputs is:

$$4 \times 1 + 1 = 5, 6 \times 0 + 1 = 1, 3 \times 2 + 1 = 7, 10 \times 3 + 1 = 31, \text{ and } a \times b + 1 = ab + 1.$$

Q2. How many matchsticks will there be in Step 33, Step 84, and Step 108?

From the pattern:

- Step 1 = 3 matchsticks
- Each new step adds **2 matchsticks**

Therefore, for Step y :

$$\begin{aligned}\text{Number of matchsticks} &= 3 + 2(y - 1) \\ &= 2y + 1\end{aligned}$$

Step 33

$$2(33) + 1 = 66 + 1 = 67$$

Answer: 67 matchsticks

Step 84

$$2(84) + 1 = 168 + 1 = 169$$

Answer: 169 matchsticks

Step 108

$$2(108) + 1 = 216 + 1 = 217$$

Answer: 217 matchsticks

Q3. Does the above expression also give the number of matchsticks at each step correctly? Are these expressions the same?

Given expressions:

$$3 + 2(y - 1)$$

and

$$2y + 1$$

Simplifying the first expression:

$$\begin{aligned}3 + 2(y - 1) \\ = 3 + 2y - 2\end{aligned}$$

$$= 2y + 1$$

Thus,

$$3 + 2(y - 1) = 2y + 1$$

Both expressions give the same number of matchsticks for every step.

Answer: Yes, both expressions give the correct number of matchsticks. They are equivalent expressions.

Q4. How does the number of matchsticks change as the steps increase? Write an expression for the number of matchsticks at Step y in each orientation. Do the two expressions add up to $2y + 1$?

Orientation 1

- First step has **1 vertical matchstick**.
- Each step adds **1 vertical matchstick**.

So at Step y :

$$y$$

vertical matchsticks.

Orientation 2

- Top and bottom horizontal matchsticks together contribute:
 - Step 1 $\rightarrow$ 2
 - Every new step adds 2 more.

Thus,

$$2y + 1 - y = y + 1$$

horizontal matchsticks.

Therefore the two expressions are:

$$y$$

and

$$y + 1$$

Adding them:

$$\begin{aligned} & y + (y + 1) \\ &= 2y + 1 \end{aligned}$$

Answer:

Expression for first orientation = y

Expression for second orientation = $y + 1$

Their sum is:

$$y + (y + 1) = 2y + 1$$

Yes, the two expressions add up to $2y + 1$.

Figure it out

For the problems asking you to find suitable expression(s), first try to understand the relationship between the different quantities in the situation described. If required, assume some values for the unknowns and try to find the relationship.

Question 1.

One plate of Jowar roti costs ₹ 30, and one plate of Pulao costs ₹ 20. If x plates of Jowar roti and y plates of pulao were ordered in a day, which expression(s) describe the total amount in rupees earned that day?

- (a) $30x + 20y$
- (b) $(30 + 20) \times (x + y)$
- (c) $20x + 30y$
- (d) $(30 + 20) \times x + y$
- (e) $30x - 20y$

Solution:

- (a) The cost of one plate of Jowar roti is ₹30, so the cost of x plates is $30x$.

The cost of one plate of Pulao is ₹20, so the cost of y plates is $20y$.

Therefore, the expression for the total amount earned that day is:

$$30x + 20y.$$

Question 2.

Pushpita sells two types of flowers on Independence Day: champak and marigold. 'p' customers only bought champak, 'q' customers only bought marigold, and 'r' customers bought both. On the same day, she gave away a tiny national flag to every customer. How many flags did she give away that day?

- (a) $p + q + r$
- (b) $p + q + 2r$
- (c) $2 \times (p + q + r)$
- (d) $p + q + r + 2$
- (e) $p + q + r + 1$
- (f) $2 \times (p + q)$

Solution:

(a) Let the number of customers who bought only Champak be p , those who bought only Marigold be q , and those who bought both flowers be r .

Since Pushpita gave one tiny national flag to every customer, the total number of flags she distributed that day is:

$$p + q + r.$$

Question 3.

A snail is trying to climb up the wall of a deep well. During the day it climbs up 'u' cm and during the night it slowly slips down 'd' cm. This happens for 10 days and 10 nights.

- (a) Write an expression describing how far away the snail is from its starting position.
- (b) What can we say about the snail's movement if $d > u$?

Solution:

(a) During the daytime, the snail climbs u cm, and during the night it slips down d cm.

So, the net distance covered in one full day is $u - d$.

In 10 days and 10 nights, the snail will cover a net distance of:

$$10(u - d) \text{ cm.}$$

Thus, the expression that shows how far the snail is from its starting point after this duration is $10(u - d)$ cm.

(b) If $d > u$, the snail slips down more than it climbs up.

In this situation, the snail will never be able to reach the top.

Question 4.

Radha is preparing for a cycling race and practices daily. The first week, she cycles 5 km every day. Every week, she increases the daily distance cycled by 'z' km. How many kilometers would Radha have cycled after 3 weeks?

Solution:

In the first week, Radha cycled 5 km each day.

So, in 7 days she cycled:

$$5 \times 7 = 35 \text{ km}$$

In the second week, she cycled $(5 + z)$ km per day.

Thus, the total for the week is:

$$(5 + z) \times 7 = 35 + 7z \text{ km}$$

In the third week, her daily distance becomes $5 + z + z = 5 + 2z$ km.

So, in that week she cycles:

$$(5 + 2z) \times 7 = 35 + 14z \text{ km}$$

Therefore, the total distance Radha cycles in three weeks is:

$$35 + (35 + 7z) + (35 + 14z)$$

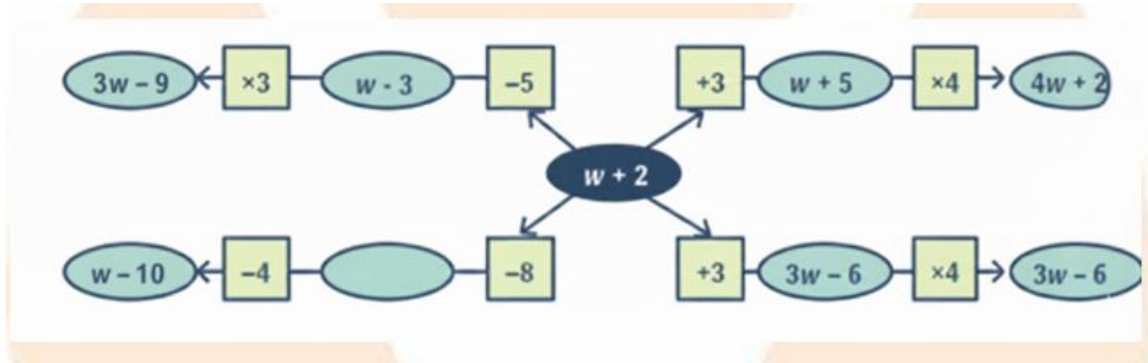
$$= (35 + 35 + 35) + (7z + 14z)$$

$$= 105 + 21z \text{ km}$$

Question 5.

In the following figure, observe how the expression $w + 2$ becomes $4w + 20$ along one path. Fill in the missing blanks on the remaining paths. The ovals contain expressions, and the boxes contain operations.

Solution:



Question 6.

A local train from Yahapur to Vahapur stops at three stations at equal distances along the way. The time taken in minutes to travel from one station to the next station is the same and is denoted by t . The train stops for 2 minutes at each of the three stations.

- If $t = 4$, what is the time taken to travel from Yahapur to Vahapur?
- What is the algebraic expression for the time taken to travel from Yahapur to Vahapur?

Solution:

- The train travelling from Yahapur to Vahapur stops at 3 stations, and at each station it stops for 2 minutes.

Time taken for travelling between the stations = $4t$.

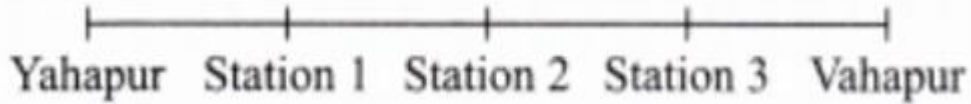
For $t = 4$, the travelling time becomes:

$$4 \times 4 = 16 \text{ minutes}$$

$$\text{Time spent during the stoppages} = 3 \times 2 = 6 \text{ minutes}$$

Therefore, the total time taken to travel from Yahapur to Vahapur is:

$$16 + 6 = 22 \text{ minutes}$$



(b)

Let the time taken to travel between two consecutive stations be t .

Then the total travelling time from Yahanpur to Vahapur is $4t$.

Since the train stops 3 times, and each stop lasts 2 minutes, the total stoppage time is:

$$3 \times 2 = 6 \text{ minutes}$$

Thus, the algebraic expression for the total travel time is:

$$4t + 6.$$

Question 7.

Simplify the following expressions:

(a) $3a + 9b - 6 + 8a - 4b - 7a + 16$

(b) $3(3a - 3b) - 8a - 4b - 16$

(c) $2(2x - 3) + 8x + 12$

(d) $8x - (2x - 3) + 12$

(e) $8h - (5 + 7h) + 9$

(f) $23 + 4(6m - 3n) - 8n - 3m - 18$

Solution:

(a) $3a + 9b - 6 + 8a - 4b - 7a + 16$
 $= (3a + 8a - 7a) + (9b - 4b) + (-6 + 16)$
 $= 4a + 5b + 10$

(b) $3(3a - 3b) - 8a - 4b - 16$
 $= 9a - 9b - 8a - 4b - 16$
 $= (9a - 8a) + (-9b - 4b) - 16$
 $= a - 13b - 16$

(c) $2(2x - 3) + 8x + 12$
 $= 4x - 6 + 8x + 12$

$$= (4x + 8x) + (-6 + 12)$$

$$= 12x + 6$$

$$(d) 8x - (2x - 3) + 12$$

$$= 8x - 2x + 3 + 12$$

$$= 6x + 15$$

$$(e) 8h - (5 + 7h) + 9$$

$$= 8b - 5 - 7b + 9$$

$$= (8b - 7b) + (-5 + 9)$$

$$= b + 4$$

$$(f) 23 + 4(6m - 3n) - 8n - 3m - 18$$

$$= 23 + 24m - 12n - 8n - 3m - 18$$

$$= (23 - 18) + (24m - 3m) + (-12n - 8n)$$

$$= 5 + 21m - 20n$$

Question 8.

Add the expressions given below:

- (a) $4d - 7c + 9$ and $8c - 11 + 9d$
- (b) $-6f + 19 - 8s$ and $-23 + 13f + 12s$
- (c) $8d - 14c + 9$ and $16c - (11 + 9d)$
- (d) $6f - 20 + 8s$ and $23 - 13f - 12s$
- (e) $13m - 12n$ and $12n - 13m$
- (f) $-26m + 24n$ and $26m - 24n$

Solution:

$$(a) 4d - 7c + 9 \text{ and } 8c - 11 + 9d$$

$$= 4d - 7c + 9 + 8c - 11 + 9d$$

$$= (4d + 9d) + (-7c + 8c) + (9 - 11)$$

$$= 13d + c - 2$$

$$(b) -6f + 19 - 8s \text{ and } -23 + 13f + 12s$$

$$= -6f + 19 - 8s + -23 + 13f + 12s$$

$$= (-6f + 13f) + (-8s + 12s) + (19 - 23)$$

$$= 7f + 4s - 4$$

$$(c) 8d - 14c + 9 \text{ and } 16c - (11 + 9d)$$

$$= 8d - 14c + 9 + 16c - 11 - 9d$$

$$= 8d - 9d - 14c + 16c + 9 - 11$$

$$= -d + 2c - 2$$

$$= 2c - d - 2$$

$$(d) 6f - 20 + 8s \text{ and } 23 - 13f - 12s$$

$$= 6f - 20 + 8s + 23 - 13f - 12s$$

$$= (6f - 13f) + (8s - 12s) + (-20 + 23)$$

$$= -7f - 4s + 3$$

(e) $13m - 12n$ and $12n - 13m$

$$= 13m - 12n + 12n - 13m$$

$$= (13m - 13m) + (-12n + 12n)$$

$$= 0$$

(f) $-26m + 24n$ and $26m - 24n$

$$= -26m + 24n + 26m - 24n$$

$$= (-26m + 26m) + (24n - 24n)$$

$$= 0$$

Question 9.

Subtract the expressions given below:

(a) $9a - 6b + 14$ from $6a + 9b - 18$

(b) $-15x + 13 - 9y$ from $7y - 10 + 3x$

(c) $17g + 9 - 7h$ from $11 - 10g + 3h$

(d) $9a - 6b + 14$ from $6a - (9b + 18)$

(e) $10x + 2 + 10y$ from $-3y + 8 - 3x$

(f) $8g + 4h - 10$ from $7h - 8g + 20$

Solution:

(a) $(6a + 9b - 18) - (9a - 6b + 14)$

$$= 6a + 9b - 18 - 9a + 6b - 14$$

$$= (6a - 9a) + (9b + 6b) + (-18 - 14)$$

$$= -3a + 15b - 32$$

(b) $(7y - 10 + 3x) - (-15x + 13 - 9y)$

$$= 7y - 10 + 3x + 15x - 13 + 9y$$

$$= (7y + 9y) + (3x + 15x) + (-10 - 13)$$

$$= 16y + 18x - 23$$

(c) $(11 - 10g + 3h) - (17g + 9 - 7h)$

$$= 11 - 10g + 3h - 17g - 9 + 7h$$

$$= (11 - 9) + (-10g - 17g) + (3h + 7h)$$

$$= 2 - 27g + 10h$$

$$= 10h - 27g + 2$$

(d) $6a - (9b + 18) - (9a - 6b + 14)$

$$= 6a - 9b - 18 - 9a + 6b - 14$$

$$= (6a - 9a) + (-9b + 6b) + (-18 - 14)$$

$$= -3a - 3b - 32$$

$$= -(3a + 3b + 32)$$

$$\begin{aligned}
 & \text{(e) } (-3y + 8 - 3x) - (10x + 2 + 10y) \\
 &= -3y + 8 - 3x - 10x - 2 - 10y \\
 &= (-3y - 10y) + (-3x - 10x) + (8 - 2) \\
 &= -13y - 13x + 6
 \end{aligned}$$

$$\begin{aligned}
 & \text{(f) } (7h - 8g + 20) - (8g + 4h - 10) \\
 &= 7h - 8g + 20 - 8g - 4h + 10 \\
 &= (7h - 4h) + (-8g - 8g) + (20 + 10) \\
 &= 3h - 16g + 30
 \end{aligned}$$

Question 10.

Describe situations corresponding to the following algebraic expressions:

(a) $8x + 3y$

(b) $15x - 2x$

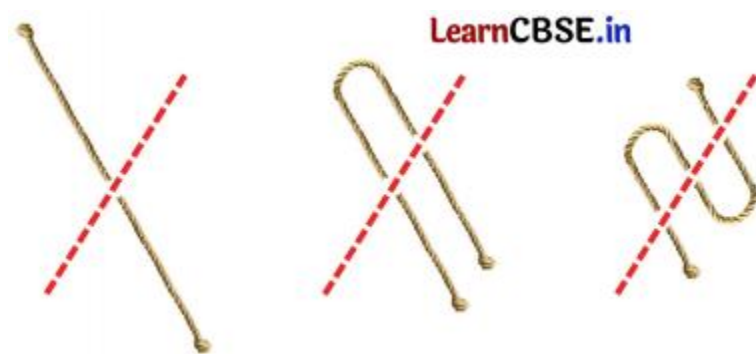
Solution:

(a) A notebook costs ₹ 8 and a pen costs ₹ 3. If you buy x notebooks and y pens. Then the total cost bear by you is ₹ $(8x + 3y)$.

(b) A fruit seller has 15 boxes of apples, each box containing x apples. Before selling them, he found that 2 boxes of apples were rotten. The number of fresh apples left is $15x - 2x$.

Question 11.

Imagine a straight rope. If it is cut once as shown in the picture, we get 2 pieces. If the rope is folded once and then cut as shown, we get 3 pieces. Observe the pattern and find the number of pieces if the rope is folded 10 times and cut. What is the expression for the number of pieces when the rope is folded r times and cut?



Solution:

Step 1 (0 fold): We get $0 + 2 = 2$ pieces

Step 2 (1 fold): We get $1 + 2 = 3$ pieces

Step 3 (2 folds): We get $2 + 2 = 4$ pieces

In the same way, if the rope is folded 10 times and cut, we get $10 + 2 = 12$

pieces.

In the same way, when the rope is folded r times and cut, we get $r + 2$ pieces.

Question 12.

Look at the matchstick pattern below. Observe and identify the pattern. How many matchsticks are required to make 10 such squares? How many are required to make w squares?



Solution:

Step 1: To make 1 square, we need 4 matchsticks.

Step 2: To make 2 squares, we need $4 + 3 = 7$ matchsticks

Step 3: To make 3 squares, we need $4 + 3 + 3 = 10$ matchsticks.

And to make w squares we need $= 4 + (w - 1) \times 3$

$$= 4 + 3(w - 1)$$

$$= (4 + 3w - 3)$$

$$= 3w + 1 \text{ matchsticks.}$$

To make 10 squares, substitute 10 for w :

$$3(10) + 1 = 30 + 1 = 31 \text{ matchsticks}$$

Question 13.

Have you noticed how the colours change in a traffic signal? The sequence of colour changes is shown below. Find the colour at positions 90, 190, and 343.

Write expressions to describe the positions for each colour.



Solution:

The sequence of red light: 1, 5, 9,

In general, $4n - 3$ positions

The sequence of green light: 3, 7, 11,

In general; $4n - 1$ positions

The sequence of yellow light: 2, 4, 6,

In general, $2n$ positions

Since 90 and 190 are even numbers, it will be $2n$ positions.

Now, $343 \div 4 = 85$ quotient + 3 remainder.

So, it matches a $4n-1$ position.

So, colour at positions 90, 190, and 343 are yellow, yellow, and green, respectively.

Question 14.

Observe the pattern below. How many squares will be there in Step 4, Step 10, Step 50? Write a general formula. How would the formula change if we want to count the number of vertices of all the squares?



Solution:

Number of squares in step 1 = 5

Number of squares in step 2 = $5 + 4 = 9$

Number of squares in step 3 = $5 + 4 + 4 = 5 + 2 \times 4 = 13$

So, number of squares in step 4 = $5 + 4 + 4 + 4 = 5 + 3 \times 4 = 17$

So, number of squares in step 10 = $5 + 9 \times 4 = 41$

And, number of squares in step 50 = $5 + 49 \times 4 = 201$

So, the general formula = $5 + (n - 1) \times 4 = 5 + 4(n - 1) = 5 + 4n - 4 = 4n + 1$.

Since 1 square has 4 vertices, the number of vertices $(4n + 1)$ squares have $4(4n + 1) = 16n + 4$.

Question 15.

Numbers are written in a particular sequence in this endless 4-column grid.

1	2	3	4
1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

(a) Give expressions to generate all the numbers in a given column (1, 2, 3, 4).

(b) In which row and column will the following numbers appear:

(i) 124

(ii) 147

(iii) 201

(c) What number appears in row r and column c ?

(d) Observe the positions of multiples of 3.

Do you see any pattern in it? List other patterns that you see.

Solution:

(a) Expression to generate all the numbers in a given column (1, 2, 3, 4)

Let r be the row number.

Column 1: 1, 5, 9, 13,..... which starts at 1 and adds 4 each row.

So, number in the r th row of column 1 = $4 \times (r - 1) + 1$

Column 2: $4 \times (r - 1) + 2$

Column 3: $4 \times (r - 1) + 3$

Column 4: $4 \times (r - 1) + 4$

If c is the column number, then the general formula to generate all numbers is $4 \times (r - 1) + c$.

(b) (i) We divide each number by 4 to find its row and column

$124 \div 4 \Rightarrow \text{Quotient} = 31$ and remainder is 0

$\therefore 124 = 4 \times 31 + 0$ or $4 \times 30 + 4$

Comparing it with $4 \times (r - 1) + c$, we get

$r - 1 = 30, c = 4$

So, $r = 31$ and $c = 4$

So, row is 31 and column is 4

(ii) $147 \div 4 \Rightarrow \text{Quotient} = 36$ and remainder is 3

$\therefore 147 = 4 \times 36 + 3$

Comparing it with $4 \times (r - 1) + c$, we get

$r - 1 = 36, c = 3$

So, 147 will appear at row $36 + 1 = 37$ and column 3

(iii) $201 \div 4 \Rightarrow \text{Quotient} = 50$ and remainder is 1

$\therefore 201 = 4 \times 50 + 1$

Comparing it with $4 \times (r - 1) + c$, we get

$r - 1 = 50, c = 1$

So, 201 will appear at row 51 and column 1.

(c) The number that appears in row r and column c is $4(r - 1) + c$.

(d) Every third number is a multiple of 3.

We can observe that even numbers always appear in column 2 and column 4.

Odd numbers always appear in column 1 and column 3.

Every row has 2 odd and 2 even numbers.

The sum of each row increases by 16.

(e.g., Row 1: $1 + 2 + 3 + 4 = 10$, Row 2: $5 + 6 + 7 + 8 = 26$, Row 3: $9 + 10 + 11 + 12 = 42$)

Practice Time 4.1

1. A student earns ₹20 for each hour of tutoring.

(a) $h = 3$

Solution By Steps

Step 1: Expression for earnings

$$20h$$

Step 2: Substitute $h = 3$

$$20 \times 3 = 60$$

Final Answer

₹60

(b) $h = 6$

Solution By Steps

$$\begin{aligned} 20h &= 20 \times 6 \\ &= 120 \end{aligned}$$

Final Answer

₹120

2. A cab driver charges ₹100 per ride.

(a) $r = 5$

Solution By Steps

Expression:

$$100r$$

Substitute $r = 5$

$$100 \times 5 = 500$$

Final Answer

₹500

(b) $r = 9$

Solution By Steps

$$100 \times 9 = 900$$

Final Answer

₹900

3. A factory produces 150 boxes every day.

(a) $d = 2$

Solution By Steps

Expression:

$$150d$$

Substitute $d = 2$

$$150 \times 2 = 300$$

Final Answer

300 boxes

(b) $d = 7$

Solution By Steps

$$150 \times 7 = 1050$$

Final Answer

1050 boxes

4. Cost of one pen = ₹15

(a) $p = 4$

Solution By Steps

Expression:

$$15p$$
$$15 \times 4 = 60$$

Final Answer

₹60

(b) $p = 10$

Solution By Steps

$$15 \times 10 = 150$$

Final Answer

₹150

5. Taxi charges ₹12 per kilometre.

(a) $k = 7$

Solution By Steps

Expression:

$$12k$$
$$12 \times 7 = 84$$

Final Answer

₹84

(b) $k = 15$

Solution By Steps

$$12 \times 15 = 180$$

Final Answer

₹180

Practice Time 4.2

1. Find the value of

$$24 \div 4 + 6 \times 2$$

Solution By Steps

Using BODMAS:

$$24 \div 4 = 6$$

$$6 \times 2 = 12$$

$$6 + 12 = 18$$

Final Answer

18

2. Find the value of

$$45 - 5 \times 3 + 4$$

Solution By Steps

$$5 \times 3 = 15$$

$$45 - 15 + 4$$

$$30 + 4 = 34$$

Final Answer

3. Find the value of

$$18 + (12 \div 3) \times 2$$

Solution By Steps

$$12 \div 3 = 4$$

$$4 \times 2 = 8$$

$$18 + 8 = 26$$

Final Answer26

4. Verify

$$(8 + 2) + 5 = 8 + (2 + 5)$$

Solution By Steps

LHS:

$$10 + 5 = 15$$

RHS:

$$8 + 7 = 15$$

LHS = RHS

Final Answer

Verified.

Property: **Associative Property of Addition**

5. Verify

$$7 \times 3 = 3 \times 7$$

Solution By Steps

LHS:

$$21$$

RHS:

$$21$$

$$\text{LHS} = \text{RHS}$$

Final Answer

Verified.

Property: **Commutative Property of Multiplication**

Practice Time 4.3

1. Write $7 \times m$ in algebraic shorthand.

Solution

$$7m$$

Final Answer

$$7m$$

2. Write $2 \times x \times y$ without multiplication sign.

Solution

$$2xy$$

Final Answer

$$2xy$$

3. Convert $9 \times p \times q \times r$

Solution

$$9pqr$$

Final Answer

$$9pqr$$

4. Write $6 \times z$ in standard algebraic notation.

Solution

$$6z$$

Final Answer

$$6z$$

5. Convert $x \times y \times 8$

Solution

Number comes first.

$$8xy$$

Final Answer

$$8xy$$

Practice Time 4.4

1. Simplify

$$5(x - 7)$$

Solution By Steps

Step 1: Apply distributive property.

$$5(x - 7) = 5(x) + 5(-7)$$

Step 2: Multiply.

$$= 5x - 35$$

Final Answer

$$5x - 35$$

2. Simplify

$$-2(p + 6q)$$

Solution By Steps

Step 1: Multiply -2 by each term.

$$-2(p + 6q) = (-2)p + (-2)(6q)$$

Step 2: Simplify.

$$= -2p - 12q$$

Final Answer

$$-2p - 12q$$

3. Simplify

$$3y(4 - y)$$

Solution By Steps

Step 1: Apply distributive property.

$$3y(4 - y) = 3y(4) - 3y(y)$$

Step 2: Multiply.

$$= 12y - 3y^2$$

Final Answer

$$12y - 3y^2$$

4. The side of a square is p . Find its area.

Solution By Steps

Area of square

$$= \text{side} \times \text{side}$$

$$= p \times p$$

$$= p^2$$

Final Answer

$$p^2$$

5. A rectangle has length $2a$ and breadth $3b$. Find its perimeter.

Solution By Steps

Perimeter of rectangle

$$= 2(\text{length} + \text{breadth})$$

Substitute values:

$$= 2(2a + 3b)$$

Apply distributive property:

$$= 4a + 6b$$

Final Answer

$$4a + 6b$$

Practice Time 4.5

1. First row has 5 chairs, second row 10 chairs, third row 15 chairs. Write an expression for the number of chairs in the n th row.

Solution By Steps

Pattern:

$$5, 10, 15, 20, \dots$$

Each term is a multiple of 5.

$$5 \times n$$

Final Answer

$$5n$$

2. Each stair step is decorated with 2 lights. How many lights are needed for n steps?

Solution By Steps

Lights per step = 2

For n steps:

$$2 \times n$$

Final Answer

$$2n$$

3. A pattern of bricks has:

1st layer = 7 bricks

2nd layer = 11 bricks

3rd layer = 15 bricks

Find the n th layer.

Solution By Steps

Pattern:

7, 11, 15, ...

Common difference:

$$11 - 7 = 4$$

Arithmetic sequence formula:

$$a_n = a + (n - 1)d$$

Substitute:

$$\begin{aligned} a &= 7, d = 4 \\ a_n &= 7 + 4(n - 1) \\ &= 7 + 4n - 4 \\ &= 4n + 3 \end{aligned}$$

Final Answer

$$4n + 3$$

4. A student earns ₹20 on the first day, ₹25 on the second day, ₹30 on the third day and so on. Write a formula for the amount earned on the n th day.

Solution By Steps

Pattern:

20,25,30, ...

Common difference = 5

Formula:

$$a_n = a + (n - 1)d$$

Substitute:

$$a = 20, d = 5$$

$$a_n = 20 + 5(n - 1)$$

$$= 20 + 5n - 5$$

$$= 5n + 15$$

Final Answer

$$5n + 15$$

5. Number Machine

Given:

a b Output

4 3 5

6 2 7

8 1 9

Find the rule.

Solution By Steps

Check first row:

$$4 + 3 - 2 = 5$$

Second row:

$$6 + 2 - 1 = 7$$

Third row:

$$8 + 1 - 0 = 9$$

Rule fitting all rows:

$$a + b - 2$$

Final Answer

$$\boxed{a + b - 2}$$

EXAM TIME

A. Multiple Choice Questions

1. In $7x + 5$, the coefficient of x is

Solution By Steps

Step 1: Identify the coefficient

The coefficient is the number multiplying the variable.

$$7x + 5$$

The coefficient of x is 7.

Final Answer

(b) 7

2. The expression for “₹30 per kg for w kg apples” is

Solution By Steps

Cost = Rate $\times$ Quantity

$$30 \times w = 30w$$

Final Answer

(c) $30w$

3. Which property is shown by

$$(a + b) + c = a + (b + c)$$

Solution By Steps

Only the grouping changes.

This is the Associative Property of Addition.

Final Answer

(b) Associative Property of Addition

4. Standard algebraic notation for $2 \times x \times y$

Solution By Steps

Multiplication signs are omitted.

$$2xy$$

Final Answer

(c) $2xy$

5. If side of a square is p , area is

Solution By Steps

Area of square

$$\begin{aligned} &= \text{side} \times \text{side} \\ &= p \times p \\ &= p^2 \end{aligned}$$

Final Answer

(b) p^2

B. Fill in the Blanks

1.

$$4 \times n = 4n$$

Answer: $4n$

2.

Terms in $9y - 7$

Answer: $9y, -7$

3.

$$36 \div 6 + 8$$

Using BODMAS:

$$36 \div 6 = 6$$

$$6 + 8 = 14$$

Answer: 14

4.

$$a(b - c) = ab - ac$$

Answer: $ab - ac$

5.

Rectangle perimeter

$$2(l + b)$$

Answer: $2(l + b)$

C. True or False

1.

$$a + b = b + a$$

Commutative property of addition.

Answer: True

2.

Variables are always written before numbers.

Example:

$$3x$$

Not $x3$.

Answer: False

3.

Like terms are added by adding coefficients.

Example:

$$5x + 2x = 7x$$

Answer: True

4.

Brackets are solved after addition and subtraction.

Actually brackets are solved first.

Answer: False

5.

Pattern 6,11,16, ...

Difference = 5

Answer: True

D. Match the Columns

Column A

Column B

$$4(a + b)$$

$$4a + 4b$$

$$7x + 5$$

Expression with variable x

Side = $p \rightarrow$ Area

$$p^2$$

Lights for n steps

$$2n$$

Chairs in n th row

$$5n$$

Answers

1 $\rightarrow$ c

2 $\rightarrow$ d

3 $\rightarrow$ e

4 $\rightarrow$ b

5 $\rightarrow$ a

E. Very Short Answer Questions

1. Write $6 \times y$ in algebraic shorthand.

$$6y$$

Answer: $6y$

2. Coefficient of x in $9x + 7$

Answer: 9

3. Simplify

$$\begin{aligned} 3p + 2p \\ = 5p \end{aligned}$$

Answer: $5p$

4. If $x = 5$, find $4x$

$$4(5) = 20$$

Answer: 20

5. Perimeter of square with side s

$$4s$$

Answer: $4s$

F. Short Answer Questions

1. Simplify

$$9p + 4q - 3p - q$$

Combine like terms:

$$\begin{aligned} (9p - 3p) + (4q - q) \\ = 6p + 3q \end{aligned}$$

Answer: $6p + 3q$

2. Find $7m + 5$ when $m = 3$

$$\begin{aligned} 7(3) + 5 \\ 21 + 5 = 26 \end{aligned}$$

Answer: 26

3. Total cost of 3 pencils at ₹x each and 2 erasers at ₹y each

$$3x + 2y$$

Answer: $3x + 2y$

4. Perimeter of triangle with sides a, b, c

$$a + b + c$$

Answer: $a + b + c$

5. Simplify

$$2a(b + 3)$$

Distributive law:

$$= 2ab + 6a$$

Answer: $2ab + 6a$

Long Answer Type Questions

1. A cab charges ₹12 per km. Write an expression for fare for k km and find fare when $k = 18$.

Solution By Steps

Expression:

$$12k$$

Substitute $k = 18$:

$$\begin{aligned} &12 \times 18 \\ &= 216 \end{aligned}$$

Final Answer

Expression:

$$12k$$

Fare for 18 km:

$$₹216$$

2. Student earns ₹20, ₹25, ₹30, ... Find earning on the 10th day.

Solution By Steps

Arithmetic pattern:

$$20, 25, 30, \dots$$

First term = 20

Difference = 5

Formula:

$$a_n = 20 + 5(n - 1)$$

For $n = 10$:

$$20 + 5(9)$$

$$20 + 45$$

$$65$$

Final Answer

$$₹65$$

3. Shopkeeper sells notebooks at ₹a and pens at ₹b. Customer buys 5 notebooks and 3 pens.

Expression

$$5a + 3b$$

Given:

$$a = 40, b = 10$$

Substitute:

$$\begin{aligned} &5(40) + 3(10) \\ &200 + 30 \\ &230 \end{aligned}$$

Final Answer

Expression:

$$5a + 3b$$

Total Cost:

$$₹230$$

4. Simplify

$$3x(4 - x) + 2(x + 5)$$

Solution By Steps

Expand first bracket:

$$12x - 3x^2$$

Expand second bracket:

$$2x + 10$$

Combine:

$$\begin{aligned} &12x - 3x^2 + 2x + 10 \\ &= -3x^2 + 14x + 10 \end{aligned}$$

Final Answer

$$-3x^2 + 14x + 10$$

5. Matchstick Pattern

First design = 7 matchsticks

Each new design adds 6 matchsticks.

Find formula and 15th design.

Solution By Steps

Formula:

$$\begin{aligned}a_n &= 7 + (n - 1)6 \\&= 7 + 6n - 6 \\&= 6n + 1\end{aligned}$$

For 15th design:

$$\begin{aligned}6(15) + 1 \\90 + 1 \\91\end{aligned}$$

Final Answer

Formula:

$$6n + 1$$

15th design:

91 matchsticks

COMPETENCY-BASED QUESTIONS**A. Assertion–Reasoning**

1.

Assertion:

$$(4 + 6) \times 2 = 20$$

True.

Reason:

Brackets are evaluated before multiplication.

True.

Reason correctly explains Assertion.

Answer: (a)

2.

Assertion:

$$a(b + c) = ab + ac$$

True.

Reason:

This is distributive property.

True.

Correct explanation.

Answer: (a)

B. Case-Based Question

Table:

a	b	O
5	2	8
8	1	15

a	b	O
9	11	7
10	10	10
6	4	8

1. Find rule

Observe:

$$2a - b$$

Check first row:

$$2(5) - 2 = 8$$

Correct.

Second row:

$$2(8) - 1 = 15$$

Correct.

Answer

$$O = 2a - b$$

2. Verify for $a = 8, b = 1$

$$\begin{aligned}
 O &= 2(8) - 1 \\
 &= 16 - 1 \\
 &= 15
 \end{aligned}$$

Answer: 15

3. Find O for $(12, 3)$

$$O = 2(12) - 3$$

$$\begin{aligned} &= 24 - 3 \\ &= 21 \end{aligned}$$

Answer: 21

C. Maths Booster

1. Student earns ₹20 per hour

Expression:

$$20h$$

Given:

$$80 < 20h < 120$$

Divide by 20:

$$4 < h < 6$$

Whole number value:

$$h = 5$$

Earning:

$$20 \times 5 = 100$$

Answer

$$h = 5, \text{earning} = ₹100$$

2. Sister is 5 years older

$$s = g + 5$$

Given:

- Sister between 10 and 20
- Girl's age even

Possible sister ages:

11,12,13,14,15,16,17,18,19

Corresponding girl ages:

6,7,8,9,10,11,12,13,14

Keeping only even girl ages:

6,8,10,12,14

Therefore:

Girl	Sister
6	11
8	13
10	15
12	17
14	19

Final Answer

Possible pairs:

(6,11), (8,13), (10,15), (12,17), (14,19)

Chapter – 5: Parallel and Intersecting Lines

NCERT CORNER

In-Text Questions

1. Can two straight lines intersect at more than one point?

Solution:

No, two straight lines can only intersect at one point. If they are parallel, they never intersect. But if two lines appear to intersect at more than one point, it means they are the same.

2. Do it yourself

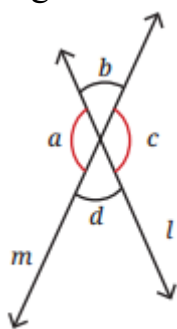
3. Is this always true for any pair of intersecting lines?

Solution:

Yes. When two lines intersect, they form four angles at a point of intersection. The angles directly opposite each other at this point are called vertically opposite angles, and they are always equal in measure.

Figure it Out

1. List all the linear pairs and vertically opposite angles you observe from Figure:



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Linear Pairs	$\angle a$ and $\angle b$, ...
Pairs of Vertically Opposite Angles	$\angle b$ and $\angle d$, ...

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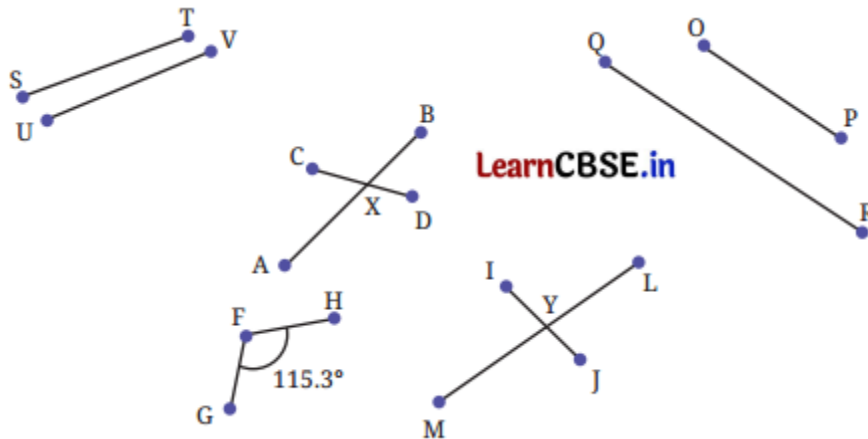
Solution:

Linear Pairs	$\angle a$ and $\angle b$, $\angle b$ and $\angle c$, $\angle c$ and $\angle d$, $\angle d$ and $\angle a$.
Pairs of Vertically Opposite Angles	$\angle b$ and $\angle d$, $\angle a$ and $\angle c$ LearnCBSE.in

In-Text Questions

1. Observe Figure and describe the way the line segments meet or cross each other in each case, with appropriate mathematical words (a point, an endpoint, the midpoint, meet, intersect) and the degree measure of each angle.

For example, line segments FG and FH meet at the endpoint F at an angle of 115.3° .



Are line segments ST and UV likely to meet if they are extended?

Solution:

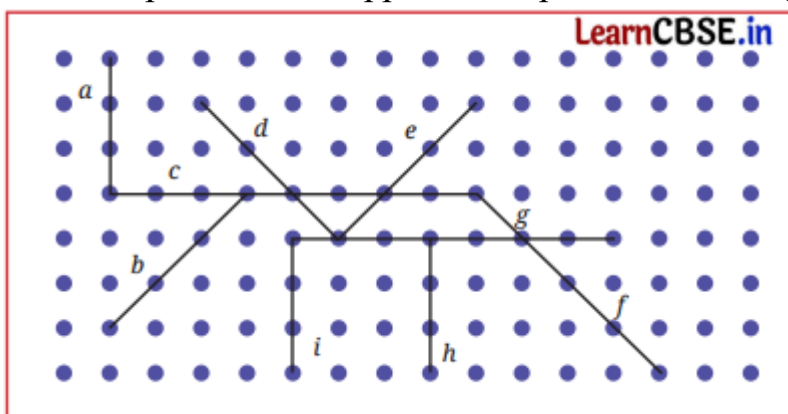
If the lines are not parallel, they will likely intersect at some point. Thus, line segments ST and UV are likely to meet when extended, as they are not parallel.

Are line segments OP and QR likely to meet if they are extended?

Solution:

If two lines are parallel, they will never meet, regardless of how far they are extended. Thus, line segments OP and QR didn't meet when extended, as they are parallel.

2. Which pairs of lines appear to be parallel in the Figure below?



Solution:

Two lines are said to be parallel when they do not meet at any point.

Here, lines a, i, and h are parallel to each other;

Line c is parallel to line g;

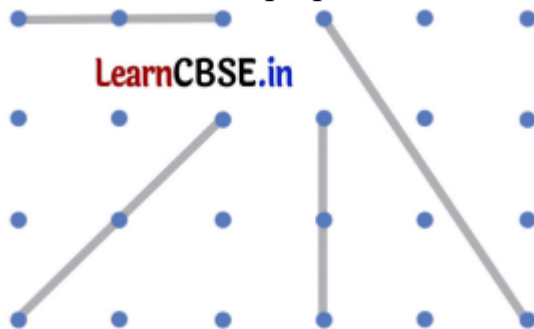
Line d is parallel to line f;

Line e is parallel to line b.

Figure it Out

Question 1.

Draw some lines perpendicular to the lines given on the dot paper in the Figure.

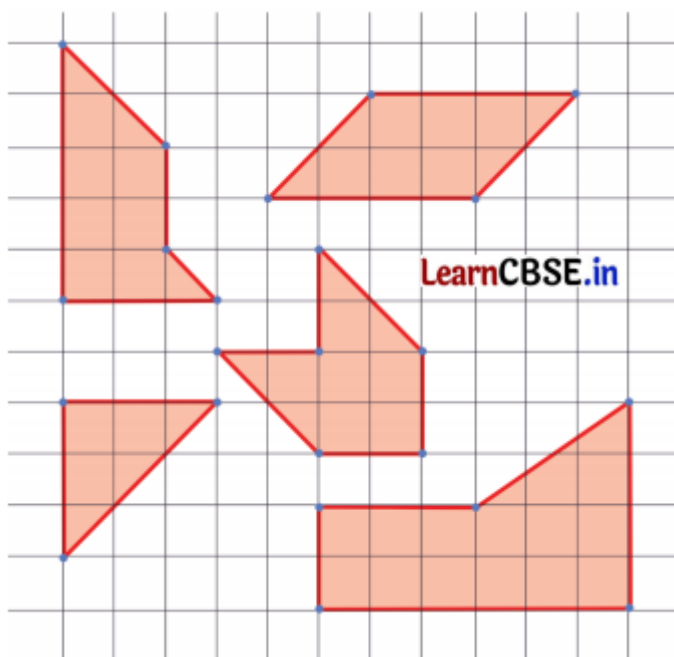


Solution:

Do it yourself.

Question 2.

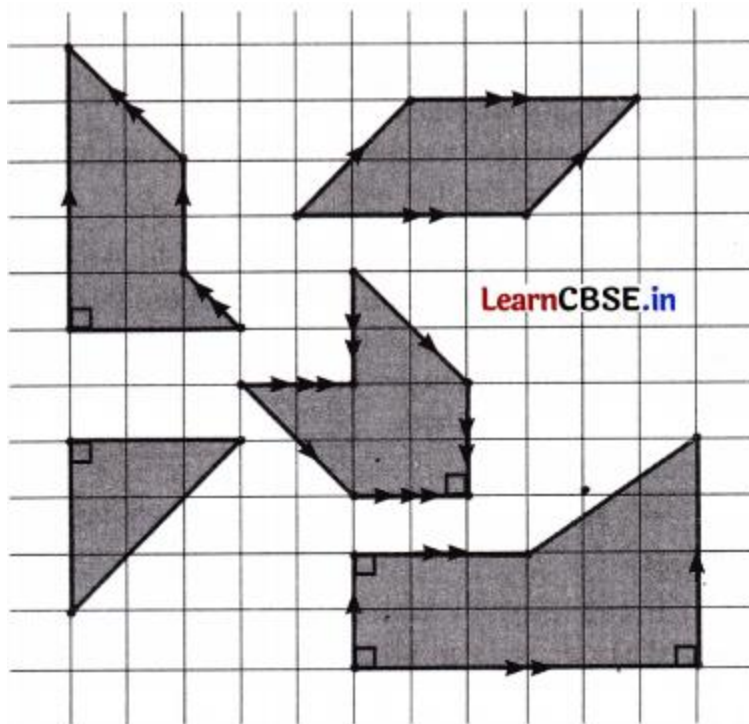
In the given figure, mark the parallel lines using the notation given above (single arrow, double arrow, etc). Mark the angle between perpendicular lines with a square symbol.



(a) How did you spot the perpendicular lines?

(b) How did you spot the parallel lines?

Solution:



- (a) To spot perpendicular lines in a geometric figure, observe if lines intersect at a 90° angle.
- (b) To spot parallel lines in a geometric figure, observe if lines never intersect at any point.

Question 3.

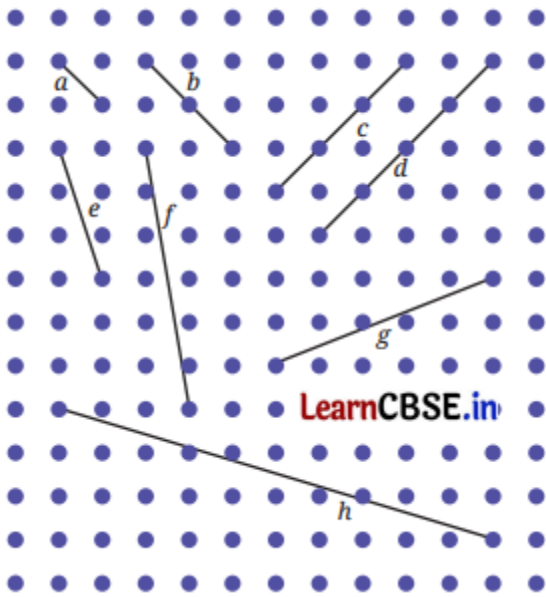
In the dot paper following, draw different sets of parallel lines. The line segments can be of different lengths but should have dots as endpoints.

Solution:

Do it Yourself.

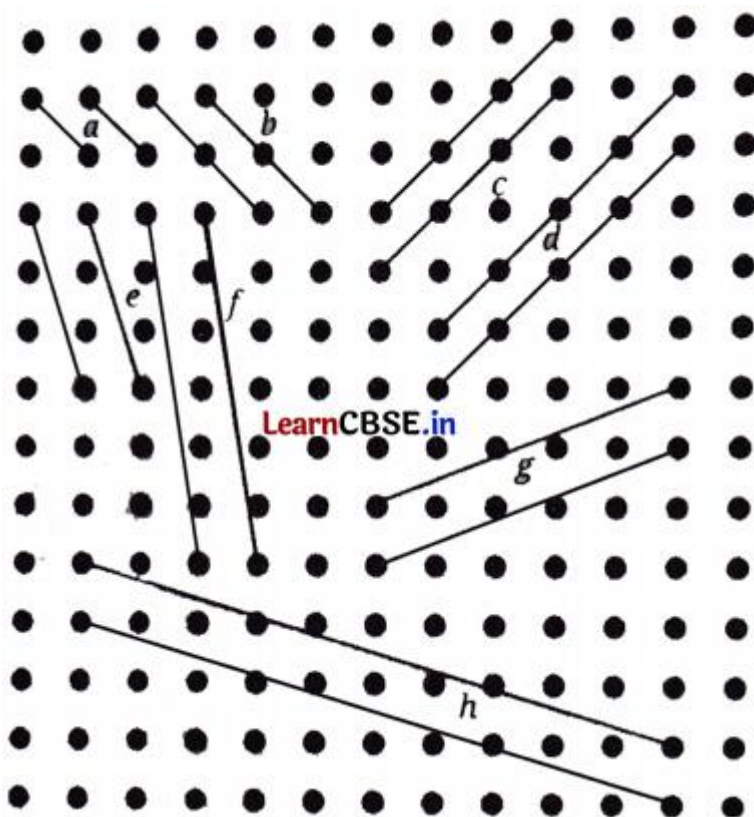
Question 4.

Using your sense of how parallel lines look, try to draw lines parallel to the line segments on this dot paper.



- (a) Did you find it challenging to draw some of them?
- (b) Which ones?
- (c) How did you do it?

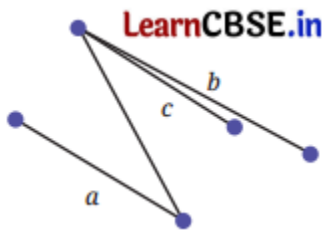
Solution:



- (a) – (c) Do it yourself

Question 5.

In the figure, which line is parallel to line a—line b or line c? How do you decide this?

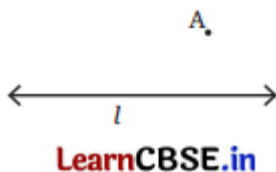


Solution:

In the given figure, line a is parallel to line c because these two lines are always the same distance apart and never meet, no matter how far they go.

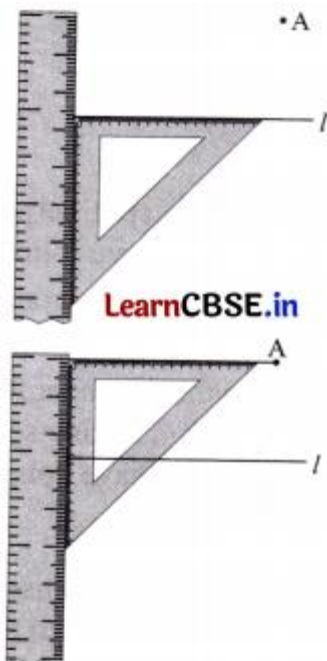
Figure it Out

1. Can you draw a line parallel to l , that goes through point A ? How will you do it with the tools from your geometry box? Describe your method.



Solution:

Tools needed: Ruler, Set-squares (right-angled triangle), Pencil



Steps:

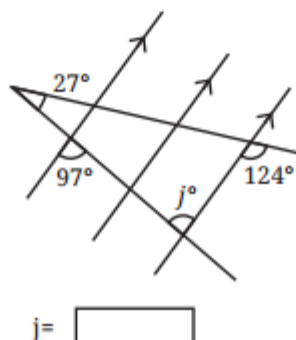
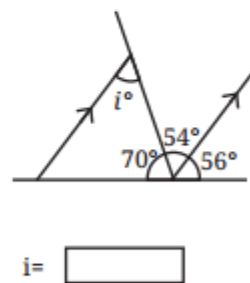
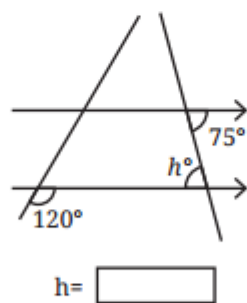
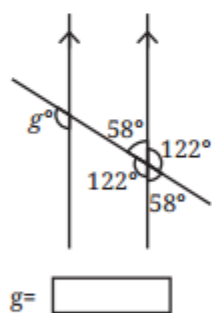
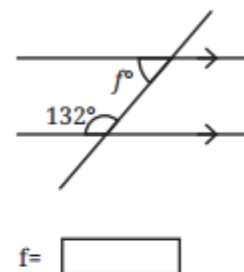
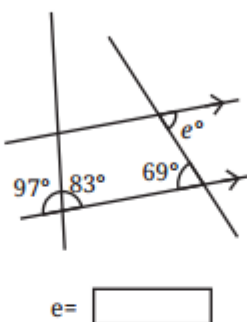
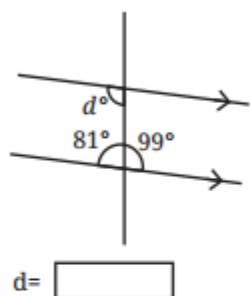
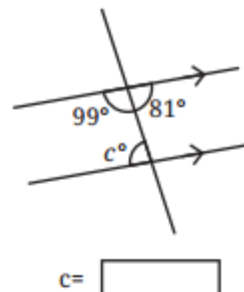
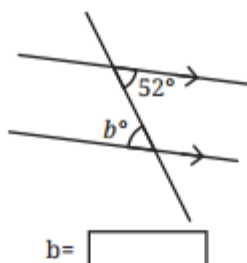
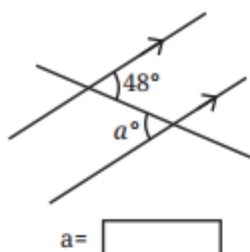
1. Place the set square so that one side is along the line l .
2. Hold the ruler against the other side of the set square (the ruler won't move).
3. Slide the set square along the ruler until one side reaches point A .
4. Draw a line along the edge of the set square through point A .

5. This new line is parallel to line l and passes through point A.

Figure it Out

Question 1.

Find the angles marked below.



Solution:

Since alternate interior angles formed by a transversal intersecting a pair of parallel lines are always equal to each other. Therefore, $a = 48^\circ$.

Since alternate angles formed by a transversal intersecting a pair of parallel lines are always equal to each other. Therefore, $b = 52^\circ$.

The sum of the interior angles on the same side of the transversal always adds up to 180° .

So, $180^\circ - 99^\circ = 81^\circ$. Therefore, $c = 81^\circ$.

The sum of the interior angles on the same side of the transversal always adds up to 180° .

So, $180^\circ - 81^\circ = 99^\circ$. Therefore, $d = 99^\circ$.

Alternate interior angles formed by a transversal intersecting a pair of parallel lines are always equal to each other. Therefore, $e = 69^\circ$.

The sum of the interior angles on the same side of the transversal always adds up to 180° . So, $180^\circ - 132^\circ = 48^\circ$. Therefore, $f = 48^\circ$.

Corresponding angles formed by a transversal intersecting a pair of parallel lines are always equal to each other. Therefore, $g = 122^\circ$.

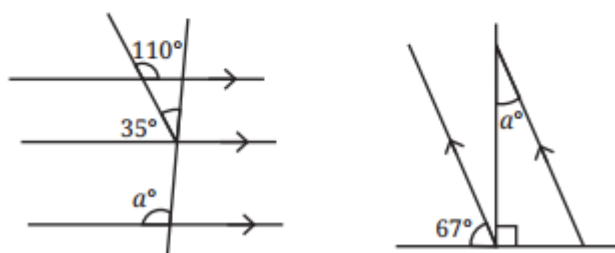
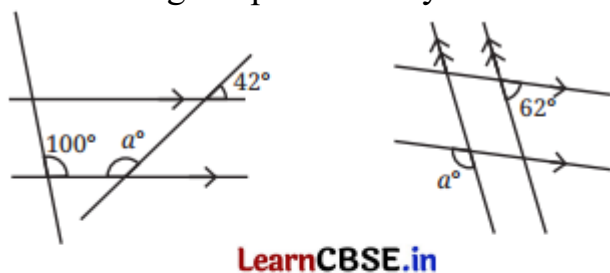
Alternate interior angles formed by a transversal intersecting a pair of parallel lines are always equal to each other. Therefore, $h = 15^\circ$.

Alternate interior angles formed by a transversal intersecting a pair of parallel lines are always equal to each other. Therefore, $i = 54^\circ$.

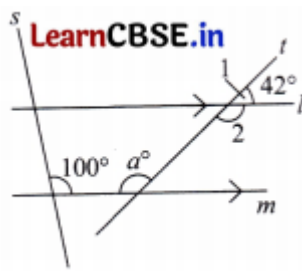
Alternate interior angles formed by a transversal intersecting a pair of parallel lines are always equal to each other. Therefore, $j = 97^\circ$.

Question 2.

Find the angle represented by a.



Solution:

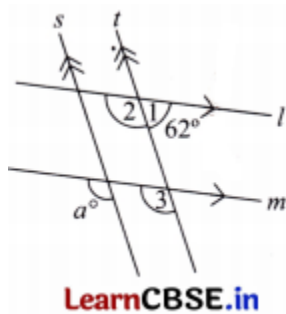


Here, $\angle 1$ is 42° , so $\angle 2$ is $180^\circ - 42^\circ = 138^\circ$, because $\angle 1$ and $\angle 2$ form a linear pair and linear pair always add up to 180° .

Now, since lines l and m are parallel and t is a transversal.

Therefore, $\angle 2$ and a are alternate angles and equal.

Thus, $a = 138^\circ$



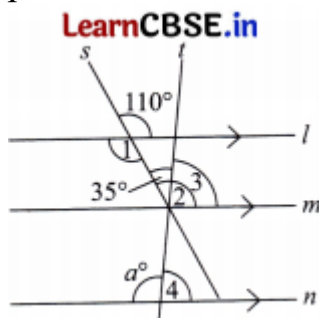
Here, $\angle 1$ is 62° , and $\angle 1$ and $\angle 2$ form a linear pair, and a linear pair always adds up to 180° .

So, $\angle 2$ is $180^\circ - 62^\circ = 118^\circ$.

Now, $\angle 2$ and $\angle 3$ are corresponding angles, and equal lines l and m are parallel, and t is a transversal.

So, $\angle 3 = 118^\circ$

Now, $\angle 3$ and a are corresponding angles and equal since lines s and t are parallel and line m is a transversal. Thus, $a = 118^\circ$



Here, lines s and l are intersecting lines.

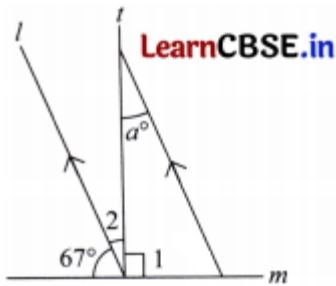
So, $\angle 1 = 110^\circ$ [Vertically opposite angles]

And $\angle 1 = \angle 2 = 110^\circ$ because lines l and m are parallel and line s is a transversal.

Therefore $\angle 3 = \angle 2 - 35^\circ = 110^\circ - 35^\circ = 75^\circ$

Also, $\angle 3 = \angle 4 = 75^\circ$ [Corresponding angles]

So, $a^\circ = 180^\circ - 75^\circ = 105^\circ$ [Linear pair angles]



Using angles on a straight line, we have

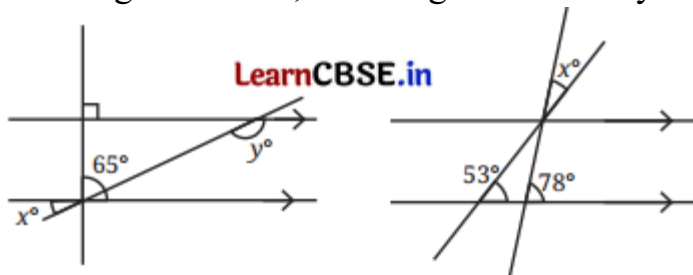
$$\angle 1 + \angle 2 + 67^\circ = 180^\circ$$

$$\angle 2 = 180^\circ - 67^\circ - 90^\circ = 23^\circ \text{ [Since } \angle 1 = 90^\circ \text{]}$$

Thus, $a = 23^\circ$ as $\angle 2 = \angle a$ [Alternate angles as lines l and t are parallel]

Question 3.

In the figures below, what angles do x and y stand for?



Solution:



Since lines l and m are perpendicular to each other.

$$\text{So } \angle 2 = 90^\circ$$

$$\text{Now, } \angle 2 + 65^\circ + x^\circ = 180^\circ \text{ [Linear Pair]}$$

$$\text{So, } x^\circ = 180^\circ - 90^\circ - 65^\circ = 25^\circ$$

Now, lines t and m are two intersecting lines.

$$\text{So, } x = \angle 1 = 25^\circ. \text{ [Vertically Opposite Angles]}$$

Lines l and m are parallel to each other, and t is a transversal.

$$\text{So, } y^\circ = \angle 2 + 65^\circ = 90^\circ + 65^\circ = 155^\circ \text{ [Alternate angles]}$$

Therefore, $y = 155^\circ$.



Since lines l and m are parallel and line s is a transversal.

So, $\angle 3 = 78^\circ$ [Alternate Angles]

Also, lines l and m are parallel, and line t is a transversal.

So, $\angle 1 = 53^\circ$ [Alternate Angles]

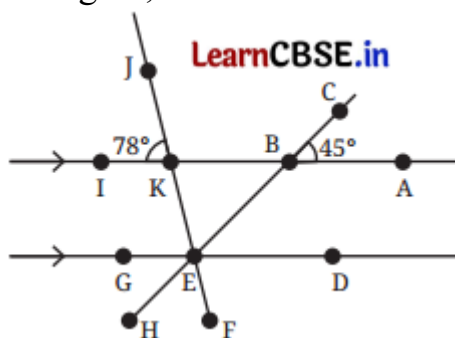
Therefore, $\angle 2 = \angle 3 - \angle 1 = 78^\circ - 53^\circ = 25^\circ$

Lines s and t are intersecting lines.

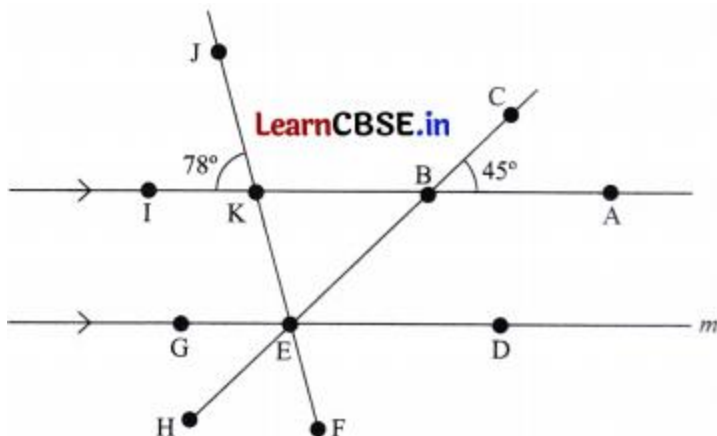
Therefore, $x^\circ = \angle 2 = 25^\circ$ [Vertically Opposite Angles]

Question 4.

In Figure, $\angle ABC = 45^\circ$ and $\angle IKJ = 78^\circ$. Find angles $\angle GEH$, $\angle HEF$, $\angle FED$.



Solution:



Line segments IA and HC intersect at point B .

So, $\angle ABC = \angle KBE = 45^\circ$ [Vertically Opposite Angles]

Similarly, line segments JF and IA intersect at point K .

So, $\angle IKJ = \angle BKE = 78^\circ$ [Vertically Opposite Angles]

$\angle KBE = \angle GEH = 45^\circ$ [Corresponding Angles]

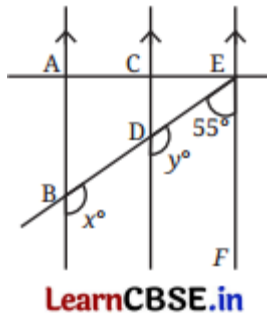
Similarly, $\angle BKE = \angle FED = 78^\circ$ [Corresponding Angles]

Now, $\angle GEH + \angle HEF + \angle FED = 180^\circ$ [Linear Pair]

$$\angle HEF = 180^\circ - 45^\circ - 78^\circ = 57^\circ$$

Question 5.

In the Figure, AB is parallel to CD, and CD is parallel to EF. Also, EA is perpendicular to AB. If $\angle BEF = 55^\circ$, find the values of x and y.



Solution:

Given AB is parallel to CD and CD is parallel to EF.

So, AB is parallel to EF.

Now, EF is parallel to CD, and DE is a transversal.

So, $y^\circ + 55^\circ = 180^\circ$ [Sum of interior angles]

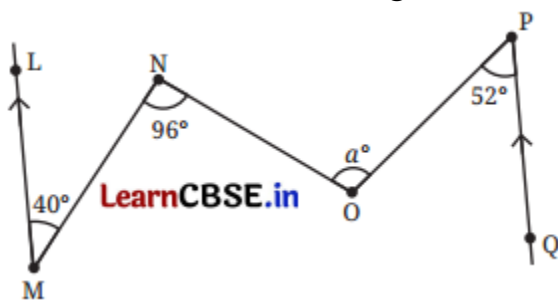
$$y = 125^\circ$$

Now, AB is parallel to CD, and BD is a transversal.

So, $x^\circ = y^\circ = 125^\circ$ [Corresponding Angles]

Question 6.

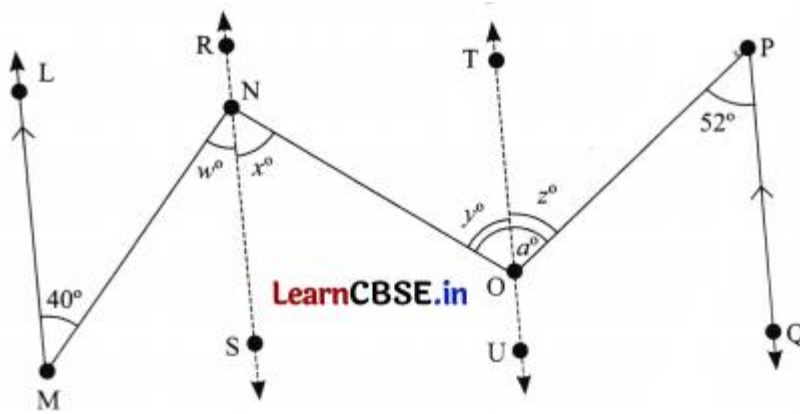
What is the measure of angle $\angle NOP$ in the given figure?



[Hint: Draw lines parallel to LM and PQ through points N and O]

Solution:

Draw a line RS through N, which is parallel to line LM, and line TU through O, which is parallel to line PQ.



$\angle LMN = \angle MNS$ [Alternate Angles]

Therefore, $w^\circ = 56^\circ$

Given, $\angle MNO = 96^\circ$

$$w^\circ + x^\circ = 96^\circ$$

$$x^\circ = 96^\circ - 40^\circ = 56^\circ$$

Now, RS is parallel to TU, and NO is a transversal.

So, $\angle SNO = \angle NOT$ [Alternate Angles]

Therefore, $y^\circ = x^\circ = 56^\circ$

Now TU is parallel to PQ, and OP is a transversal.

So, $\angle TOP = \angle OPQ$ [Alternate Angles]

$$z^\circ = 52^\circ \text{ [Given } \angle OPQ = 52^\circ]$$

$$\text{Thus, } a^\circ = y^\circ + z^\circ = 56^\circ + 52^\circ = 108^\circ$$

Practice Time 5.1

1. If $\angle PQR = 136^\circ$, find adjacent angle $\angle RQS$.

Solution

Linear pair angles sum to 180° .

$$\begin{aligned} \angle RQS &= 180^\circ - 136^\circ \\ &= 44^\circ \end{aligned}$$

Answer: 44°

2. If $\angle 1 = 103^\circ$

Vertically opposite angles are equal.

$$\angle 3 = 103^\circ$$

Adjacent angles:

$$\begin{aligned}\angle 2 &= 180^\circ - 103^\circ = 77^\circ \\ \angle 4 &= 77^\circ\end{aligned}$$

Answer:

$$\angle 2 = 77^\circ, \angle 3 = 103^\circ, \angle 4 = 77^\circ$$

3. $\angle x$ and $\angle y$ form a linear pair and $\angle x = 3y$

$$\begin{aligned}3y + y &= 180^\circ \\ 4y &= 180^\circ \\ y &= 45^\circ \\ x &= 135^\circ\end{aligned}$$

Answer:

$$x = 135^\circ, y = 45^\circ$$

4. $\angle a = (2x+10)^\circ$, $\angle b = (3x-20)^\circ$ are vertically opposite

$$\begin{aligned}2x + 10 &= 3x - 20 \\ x &= 30 \\ \angle a &= 70^\circ \\ \angle b &= 70^\circ\end{aligned}$$

Answer:

$$x = 30, \angle a = \angle b = 70^\circ$$

5. If $\angle POQ = (4x+12)^\circ$ and adjacent angle $\angle QOR = (2x+48)^\circ$

Linear pair:

$$\begin{aligned}(4x + 12) + (2x + 48) &= 180 \\ 6x + 60 &= 180 \\ x &= 20\end{aligned}$$

Angles:

$$\angle POQ = 92^\circ$$

$$\angle QOR = 88^\circ$$

Other two angles:

$$92^\circ, 88^\circ$$

Answer: $92^\circ, 88^\circ, 92^\circ, 88^\circ$

Practice Time 5.2

1. One angle = 90°

All four angles become 90° .

Answer: $90^\circ, 90^\circ, 90^\circ, 90^\circ$

2. $\angle 1 = (2x + 10)^\circ$

Perpendicular lines $\Rightarrow$ angle = 90°

$$2x + 10 = 90$$

$$x = 40$$

Answer: $x = 40$

All angles = 90°

3. Adjacent angles = $(3x - 15)^\circ$ and $(x + 45)^\circ$

Linear pair:

$$(3x - 15) + (x + 45) = 180$$

$$4x + 30 = 180$$

$$x = 37.5$$

Angles:

97.5°, 82.5°

Not perpendicular.

4. Vertically opposite angles

$$5x - 25 = 3x + 15$$

$$2x = 40$$

$$x = 20$$

Angle:

75°

Adjacent angle:

105°

Not perpendicular.

5. Road junction angle = 88°

(a) Roads perpendicular? **No**

(b) Other angles:

92°, 88°, 92°

Practice Time 5.3

1. FG and FH meet at F

Vertex: F

They meet at endpoint.

2. AB and BC share point B

Answer: They are connected line segments.

B is the common endpoint.

3. Gap between lines is not constant

1.8 cm at one place and 2.1 cm elsewhere.

Answer: Not parallel.

4. Classify

(a) PQ and RS cross inside both segments

Intersecting segments

(b) MN lies partly over MO

Overlapping segments

(c) JK and LM remain same distance apart

Parallel segments

5. XY: X(0,1), Y(6,1)

UV: U(2,4), V(8,4)

Both horizontal.

Slope:

$$m = \frac{1 - 1}{6 - 0} = 0$$
$$m = \frac{4 - 4}{8 - 2} = 0$$

Equal slopes.

Answer: Parallel.

Practice Time 5.4

1(a)

Horizontal crease H is parallel to top and bottom edges.

1(b)

H and V intersect at centre.

1(c)

Angle formed = 90°

2(a)

Parallel creases:

H₁, H₂, H₃

2(b)

Perpendicular to V:

H₁, H₂, H₃

2(c)

Each intersection gives 4 right angles.

3 intersections:

$$3 \times 4 = 12$$

Answer: 12 right angles.

3

D₁ and D₂ are diagonals of square.

Answer: They are perpendicular.

Practice Time 5.5

1. If $\angle 2 = 75^\circ$ and $\angle 2 = \angle 4$

$$\angle 4 = 75^\circ$$

Property: Vertically opposite angles.

2. $\angle x = (3k+8)^\circ$, $\angle y = (5k-28)^\circ$

Vertically opposite:

$$3k + 8 = 5k - 28$$

$$2k = 36$$

$$k = 18$$

$$x = y = 62^\circ$$

3. $\angle 1 = (4x+20)^\circ$, $\angle 2 = (5x-20)^\circ$

Linear pair:

$$4x + 20 + 5x - 20 = 180$$

$$9x = 180$$

$$x = 20$$

$$\angle 1 = 100^\circ$$

Vertically opposite angle:

$$\angle 3 = 100^\circ$$

4. Vertically opposite pairs

$$(\angle 1, \angle 3), (\angle 2, \angle 4), (\angle 5, \angle 7), (\angle 6, \angle 8)$$

5. Given

$$\angle 5 = 122^\circ$$

$$\angle 5 = \angle 7$$

So

$$\angle 7 = 122^\circ$$

Linear pair:

$$\angle 6 = 58^\circ$$

Vertically opposite:

$$\angle 8 = 58^\circ$$

Practice Time 5.6

1.

$$\angle 3 = 110^\circ$$

Corresponding angle:

$$\angle 7 = 110^\circ$$

2.

$$\angle 2 = 73^\circ, \angle 6 = 73^\circ$$

These are corresponding angles.

Equal corresponding angles $\Rightarrow$ lines are parallel.

Answer: Yes, $l \parallel m$.

Exam Time

MCQs

1. (c) 90°
2. (b) Parallel lines
3. (b) Vertically opposite angles
4. (a) 110°
5. (a) Parallel

Fill in the Blanks

1. Four
 2. Linear pair
 3. Equal
 4. Perpendicular
 5. Parallel
-

True / False

1. True
 2. False
 3. True
 4. False
 5. True
-

Match the Columns

Column A	Column B
Linear pair	Sum = 180°
Vertically opposite angles	Equal and opposite angles
Parallel lines	Lines that never meet
Perpendicular lines	Angle = 90°
Corresponding angles	Same relative position

E. Very Short Answer Type Questions

1. What is the sum of angles in a linear pair?

Solution

Angles in a linear pair always form a straight line.

180°

Answer: 180°

2. Vertically opposite angles are always _____.

Answer: Equal

3. What symbol is used for perpendicular lines?

Answer: $\perp$

4. How many angles are formed when two lines intersect?

Answer: 4 angles

5. If $\angle 3 = 110^\circ$ in parallel lines, what is $\angle 7$?

Corresponding angles are equal.

$$\angle 7 = \angle 3 = 110^\circ$$

Answer: 110°

F. Short Answer Type Questions

1. Define a transversal with an example.

Solution

A transversal is a line that intersects two or more lines at different points.

Example: A road crossing two parallel railway tracks.

Answer: A transversal is a line that cuts two or more lines at distinct points.

2. If $\angle 4 = 125^\circ$, find its adjacent linear pair angle.

Solution

Linear pair angles sum to 180° .

$$180^\circ - 125^\circ = 55^\circ$$

Answer: 55°

3. Why are vertically opposite angles always equal?

Solution

When two lines intersect, adjacent angles form linear pairs (sum = 180°).

Since both vertically opposite angles are supplementary to the same angle, they must be equal.

Answer: Vertically opposite angles are equal because each forms a linear pair with the same adjacent angle.

4. How do you identify parallel lines in a window grill diagram?

Solution

Check whether the bars:

- Remain the same distance apart
- Never meet even when extended

Answer: Lines that stay equidistant and never intersect are parallel.

5. If $\angle 5 = 60^\circ$ in a transversal figure, find $\angle 7$.

Solution

$\angle 5$ and $\angle 7$ are vertically opposite angles.

$$\angle 7 = \angle 5$$

$$\angle 7 = 60^\circ$$

Answer: 60°

G. Long Answer Type Questions

1. Two lines intersect at a point. One angle is 90° . Prove the lines are perpendicular and find the other three angles.

Solution By Steps

Step 1: Given

One angle = 90°

Step 2: Vertically opposite angle

Vertically opposite angles are equal.

$$90^\circ$$

Step 3: Adjacent angles

Linear pair:

$$180^\circ - 90^\circ = 90^\circ$$

Both adjacent angles are 90° .

Step 4: Conclusion

All four angles are 90° .

Therefore the lines are perpendicular.

Final Answer

The other three angles are:

$$90^\circ, 90^\circ, 90^\circ$$

The lines are perpendicular.

2. A transversal cuts two lines. Give all angle pairs and explain parallelism using:

(a) Corresponding angles

Angles in same relative position:

$$(\angle 1, \angle 5), (\angle 2, \angle 6), (\angle 3, \angle 7), (\angle 4, \angle 8)$$

If corresponding angles are equal, the lines are parallel.

(b) Alternate Interior Angles

Pairs:

$(\angle 3, \angle 6)$

$(\angle 4, \angle 5)$

If alternate interior angles are equal, the lines are parallel.

(c) Co-interior Angles

Pairs:

$(\angle 3, \angle 5)$

$(\angle 4, \angle 6)$

If co-interior angles add to 180° , the lines are parallel.

3. Using a ruler and set square, explain how to draw a line parallel to a given line through point A not on it.

Solution

1. Draw the given line l .
2. Place a ruler along line l .
3. Put a set square against the ruler.
4. Hold the ruler fixed.
5. Slide the set square until one edge passes through point A.
6. Draw the new line.

Answer

The drawn line passes through A and is parallel to the given line.

4. Alternate interior angles are $(5x - 10)^\circ$ and $(3x + 26)^\circ$. Find x and all relevant angles.

Solution By Steps

Alternate interior angles are equal.

$$5x - 10 = 3x + 26$$

$$2x = 36$$

$$x = 18$$

Angle value:

$$5(18) - 10$$

$$90 - 10$$

$$80^\circ$$

Other interior supplementary angle:

$$180^\circ - 80^\circ = 100^\circ$$

Final Answer

$$x = 18$$

Equal angles:

$$80^\circ$$

Supplementary angles:

$$100^\circ$$

Thus the eight angles are:

$$80^\circ, 100^\circ, 80^\circ, 100^\circ, 80^\circ, 100^\circ, 80^\circ, 100^\circ$$

5. Describe how paper folding helps identify parallel and perpendicular lines.

Solution

Horizontal Fold

Creates a horizontal crease.

Vertical Fold

Creates a vertical crease.

Horizontal and vertical creases intersect at:

$$90^\circ$$

Hence they are perpendicular.

Diagonal Fold

Creates diagonal creases.

Two diagonal creases of a square intersect at right angles.

Multiple horizontal folds remain equally spaced and never meet, so they are parallel.

Final Answer

Paper folding helps visualize:

- Parallel lines through equally spaced folds.
- Perpendicular lines through vertical and horizontal folds.
- Diagonal relationships through diagonal creases.

Competency-Based Questions

Assertion–Reason

1

Assertion: True

Reason: True

Reason correctly explains assertion.

Answer: (a)

2

Assertion: False

Reason: True

Answer: (d)

Case-Based Question

Given:

$$\angle 1 = 110^\circ$$

(a)

Corresponding angles:

$$\angle 5 = 110^\circ$$

(b)

Vertically opposite:

$$\angle 4 = 110^\circ$$

(c)

Adjacent angle:

$$180 - 110 = 70^\circ$$

(d)

$$\angle 3, \angle 5$$

are **co-interior**/interior same-side angles.

(e)

Yes.

$$\angle 6 = \angle 2$$

because corresponding angles are equal in parallel lines.

Chapter -6: Number Play

NCERT CORNER

In-Text Questions

What do the numbers in the figure below tell us?



Solution:

Yes, the number each child says matches this rule in both arrangements.

Write down the number each child should say based on this rule for the arrangement shown below.



Solution:

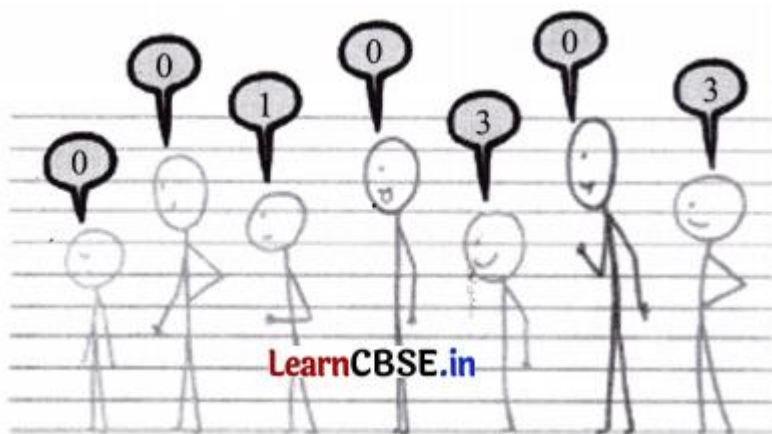


Figure it Out

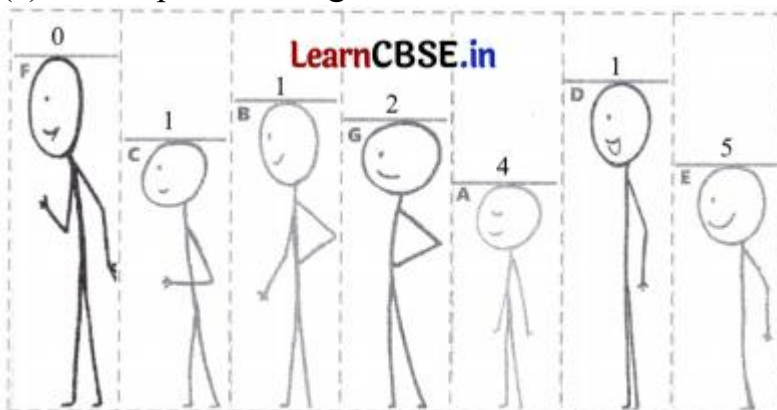
Question 1.

Arrange the stick figure cutouts given at the end, or draw a height arrangement such that the sequence reads:

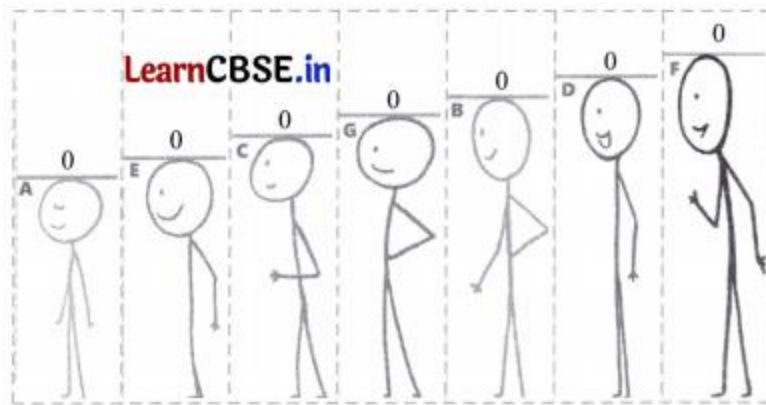
- (a) 0, 1, 1, 2, 4, 1, 5
- (b) 0, 0, 0, 0, 0, 0, 0
- (c) 0, 1, 2, 3, 4, 5, 6
- (d) 0, 1, 0, 1, 0, 1, 0
- (e) 0, 1, 1, 1, 1, 1, 1
- (f) 0, 0, 0, 3, 3, 3, 3

Solution:

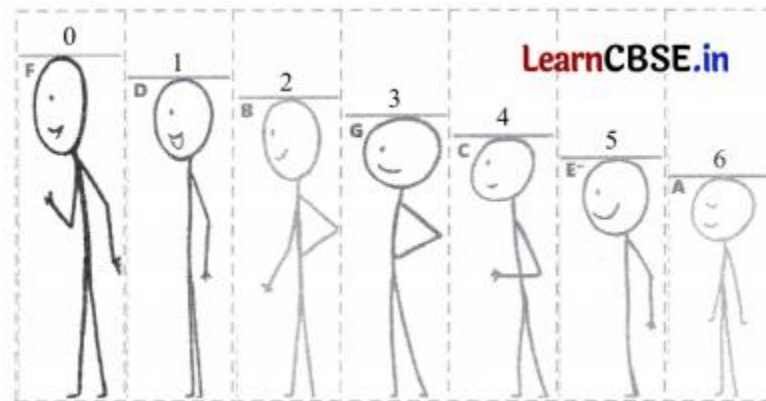
(a) The required arrangement is FCBGADE.



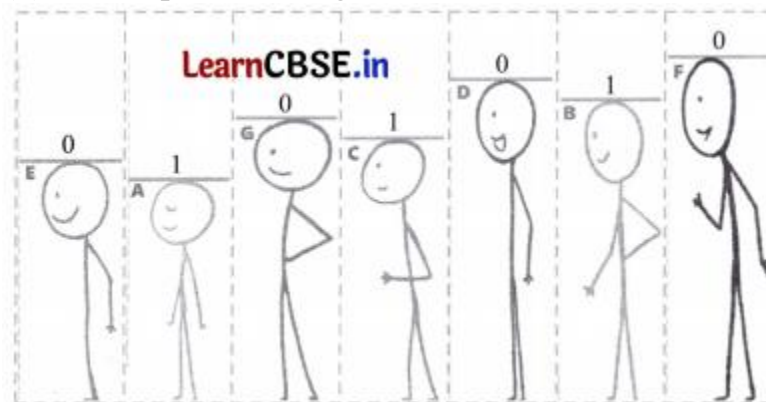
(b) The required arrangement is AECGBDF.



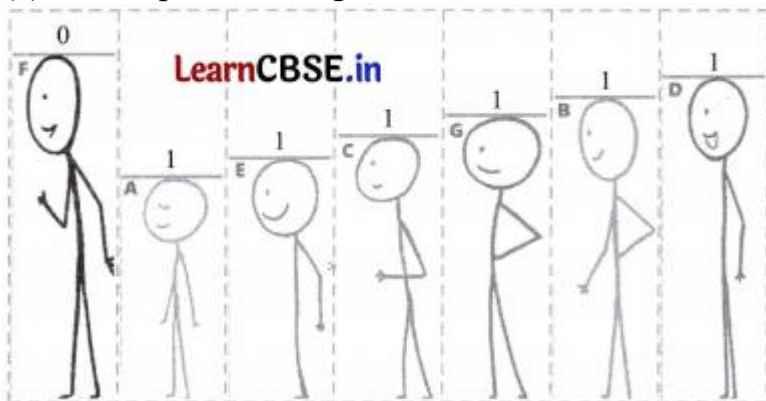
(c) The required arrangement is FDBGCEA.



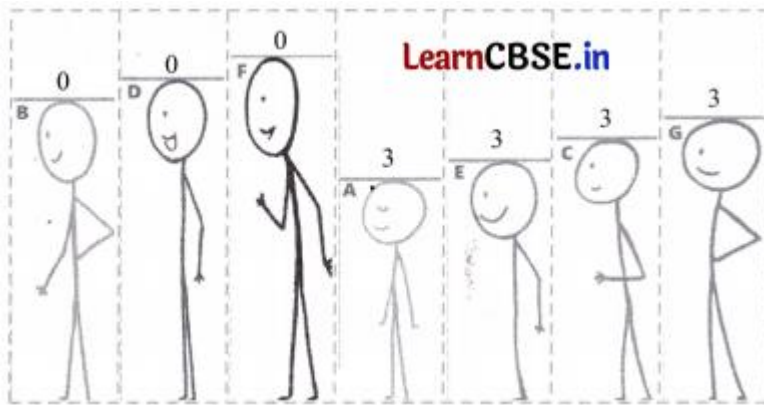
(d) The required arrangement is EAGCDBF.



(e) The required arrangement is FAECGBD.



(f) The required arrangement is BDFAECG.



Question 2.

For each of the statements given below, think and identify if it is Always True, Only Sometimes True, or Never True. Share your reasoning.

- (a) If a person says '0', then they are the tallest in the group.
- (b) If a person is the tallest, then their number is '0'.
- (c) The first person's number is '0'.
- (d) If a person is not first or last in line (i.e., if they are standing somewhere in between), then they cannot say '0'.
- (e) The person who calls out the largest number is the shortest.
- (f) What is the largest number possible in a group of 8 people?

Solution:

(a) Only Sometimes True: A person says '0' when they see no one taller than themselves. The tallest person will always say '0', but a shorter person can also say '0' if they are at the front or in a position where no one taller is ahead of them. Thus, the given statement is only sometimes true.

(b) Always True: If a person is the tallest, then no one is taller than them, so they will always say '0'. So, the given statement is always true.

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(c) Always True: Each person is assigned a number that represents how many taller people are ahead of them. Since there is no one ahead of the first person, their number will always be '0'. Hence, the given statement is always true.

(d) Only Sometimes True: The statement is only sometimes true. A person standing in between can still be assigned '0' if there are no taller people ahead of them.

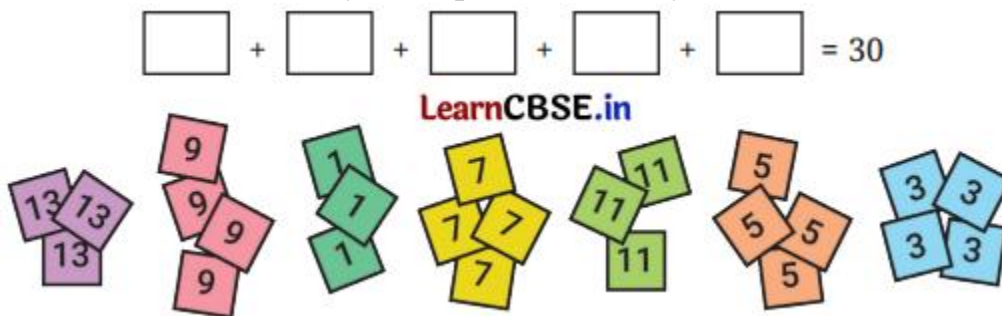
(e) Only Sometimes True: The statement is only sometimes true. A person who calls out the largest number has many taller people in front but may not be the shortest overall. For example, if the shortest person is standing at the front, they

will call out '0'. Meanwhile, the second shortest person could be at the back and might call out the largest number.

(f) If there are 8 people, then the shortest person will see 7 taller people. So the maximum number someone can say is 7.

In-Text Questions

1. Kishor has some number cards and is working on a puzzle: There are 5 boxes, and each box should contain exactly 1 number card. The numbers in the boxes should sum to 30. Can you help him find a way to do it?



Can you figure out which 5 cards add to 30? Is it possible?

Solution:

No, it is not possible, as the sum of 5 odd numbers is always odd and 30 is an even number.

2. In a 3×3 grid, there are 9 small squares, which is an odd number.

Meanwhile, in a 3×4 grid, there are 12 small squares, which is an even number.



Given the dimensions of a grid, can you tell the parity of the number of small squares without calculating the product?

Solution:

Yes, we can determine the parity of the number of small squares in a grid without directly calculating the full product, simply by observing the parity of the dimensions.

Rule: The product of two numbers is:

- Even if at least one of the numbers is even.

- Odd if both numbers are odd.

Find the parity of the number of small squares in these grids:

- (a) 27×13
- (b) 42×78
- (c) 135×654

Solution:

- (a) Both 27 and 13 are odd numbers, and $\text{Odd} \times \text{Odd} = \text{Odd}$.
So, the parity of the number of small squares is odd.
- (b) Both 42 and 78 are even numbers, and $\text{Even} \times \text{Even} = \text{Even}$.
So, the parity of the number of small squares is even.
- (c) 135 is odd, 654 is even, and $\text{Odd} \times \text{Even} = \text{Even}$.
So, the parity of the number of small squares is even.

Figure it Out

Question 1.

Using your understanding of the pictorial representation of odd and even numbers, find out the parity of the following sums:

- (a) Sum of 2 even numbers and 2 odd numbers (e.g., $\text{even} + \text{even} + \text{odd} + \text{odd}$)
- (b) Sum of 2 odd numbers and 3 even numbers
- (c) Sum of 5 even numbers
- (d) Sum of 8 odd numbers

Solution:

- (a) $\text{Even} + \text{Even} = \text{Even}$ and $\text{Odd} + \text{Odd} = \text{Even}$.
Adding the two results, we get $\text{Even} + \text{Even} = \text{Even}$.
The parity of the result is even.

Example: $2 + 4 + 3 + 5 = 6 + 8 = 14$ (Even)

- (b) $\text{Odd} + \text{Odd} = \text{Even}$ and $\text{Even} + \text{Even} + \text{Even} = \text{Even}$.
Adding the two results, we get $\text{Even} + \text{Even} = \text{Even}$.
The parity of the result is even.

Example: $3 + 5 + 2 + 4 + 6 = 8 + 12 = 20$ (Even)

- (c) Adding any 5 even numbers always gives an even number.
The parity of the result is even.

Example: $2 + 4 + 6 + 8 + 10 = 30$ (Even)

- (d) $\text{Odd} + \text{Odd} = \text{Even}$ (4 such pairs).

Adding the 4 such results, we get

$\text{Even} + \text{Even} + \text{Even} + \text{Even} = \text{Even}$

The parity of the result is even.

Example: $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 = 64$ (Even)

Question 2.

Lakpa has an odd number of ₹ 1 coins, an odd number of ₹ 5 coins, and an even number of ₹ 10 coins in his piggy bank. He calculated the total and got ₹ 205.

Did he make a mistake? If he did, explain why. If he didn't, how many coins of each type could he have?

Solution:

Lakpa has an odd number of ₹ 1 coins, so their total value is odd.

He also has an odd number of ₹ 5 coins, so their total is also odd.

The ₹ 10 coins are even in numbers, so their total is even.

Now, adding two odd sums, we get

Odd (from ₹ 1) + Odd (from ₹ 5) = Even

Adding the ₹ 10 coins' total (even sum) to this even sum,

Even + Even = Even

Since 205 is an odd number, the total of ₹ 205 is not possible with an odd number of ₹ 1 and ₹ 5 coins and an even number of ₹ 10 coins. Therefore, Lakpa made a mistake.

Question 3.

We know that:

(a) even + even = even

(b) odd + odd = odd

(c) even + odd = odd

Similarly, find out the parity for the following scenarios:

(d) even – even = _____

(e) odd – odd = _____

(f) even – odd = _____

(g) odd – even = _____

Solution:

(d) even – even

Example:

$$6 - 2 = 4 \rightarrow \text{even}$$

$$8 - 4 = 4 \rightarrow \text{even}$$

Parity of result = even

∴ even – even = even

(e) odd-odd

Example:

$$7 - 3 = 4 \rightarrow \text{even}$$

$$9 - 5 = 4 \rightarrow \text{even}$$

Parity of result = even

$\therefore$ odd – odd = even

(f) even-odd

Example:

$$8 - 3 = 5$$

$$12 - 5 = 7$$

Parity of result = odd

$\therefore$ even – odd = odd

(g) odd-even

Example:

$$7 - 2 = 5$$

$$9 - 6 = 3$$

Parity of result = odd

$\therefore$ odd – even = odd

In-Text Questions

1. Solution

9	1	3	(13)	7	8	9	(24)
8	2	4	(14)	4	6	5	(15)
7	6	5	(18)	1	2	3	(6)
(24)	(9)	(12)	LearnCBSE.in	(12)	(16)	(17)	

Figure it Out

Question 1.

How many different magic squares can be made using numbers 1-9?

Solution:

Using the numbers 1-9, there is exactly one unique magic square (excluding rotations and reflections).

8	1	6
3	5	7
4	9	2

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If transformations like rotations are allowed, then there are 8 variations of this magic square.

Question 2.

Create a magic square using numbers 2-10. What strategy would you use for this? Compare it with the magic squares made using 1-9.

Solution:

The numbers 2-10 are 9 consecutive numbers, just like 1-9, but increased by 1.

8	1	6
3	5	7
4	9	2

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Strategy: Start with the classic 1-9 magic square, and add 1 to each number.

Original: After adding 1 to each:

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9	2	7
4	6	8
5	10	3

The magic square for numbers 2-10 would have a different magic sum (18) compared to numbers 1-9 (15). The structure remains similar, but the values are shifted up by 1.

Question 3.

Take a magic square, and

(a) Increase each number by 1

(b) Double each number

In each case, is the resulting grid also a magic square? How do the magic sums change in each case?

Solution:

Original:

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8	1	6
3	5	7
4	9	2

(a) After increasing each number by 1:

This is still a magic square.

New magic sum = 18

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9	2	7
4	6	8
5	10	3

(b) After doubling each number

Still a magic square

New magic sum = 30

16	2	12
6	10	14
8	18	4

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In case (a), adding a constant to every number, $\rightarrow$ magic sum increases by $3 \times$ that constant.

In case (b), multiplying all by a constant $\rightarrow$ magic sum multiplied by that constant.

Question 4.

What other operations can be performed on a magic square to yield another magic square?

Solution:

Do it yourself.

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Question 5.

Discuss ways of creating a magic square using any set of 9 consecutive numbers (like 2-10, 3-11, 9-17, etc.).

Solution:

The magic square for numbers 2-10 can be seen in solution 2 above.

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10	3	8
5	7	9
6	11	4

For the magic square using numbers 3-11, add 2 to each number in the original, and we get the adjoining magic square.

16	9	14
11	13	15
12	17	10

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Here, magic sum = 21

For the magic square using numbers 9-17, add 8 to each number in the original, and we get a square as shown alongside.

Here, magic sum = 39

In-Text Questions

1. Choose any magic square that you have made so far using consecutive numbers. If m is the letter-number of the number in the centre, express how other numbers are related to m , how much more or less than m .

[Hint: Remember how we described a 2×2 grid of a calendar month in the Algebraic Expressions chapter].

Solution:

Consider the magic square

8	1	6
3	5	7
4	9	2

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We can express it using the letter-number m as:

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$m + 3$	$m - 4$	$m + 1$
$m - 2$	m	$m + 2$
$m - 1$	$m + 4$	$m - 3$

2.

The first ever recorded 4×4 magic square is found in a 10th-century inscription at the Parshvanath Jain temple in Khajuraho, India, and is known as the Chautisa Yantra



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7	12	1	14
2	13	8	11
16	3	10	5
9	6	15	4

The first ever recorded 4×4 magic square, the Chautisa Yantra, at Khajuraho, India

Chautis means 34. Why do you think they called it the Chautisa Yantra?

Every row, column, and diagonal in this magic square adds up to 34.

Can you find other patterns of four numbers in the square that add up to 34?

Solution:

Yes, we can find different combinations of 4 numbers that add up 34 in the given square.

- Sum of 4 corner numbers: $7 + 14 + 4 + 9 = 34$

- Sum of 4 central numbers: $13 + 8 + 10 + 3 = 34$
- Sum of 4 numbers in any 2×2 squares:
- For example, top-left square: $7 + 12 + 13 + 2 = 34$

Figure it Out

Question 1.

Using this generalised form, find a magic square if the centre number is 25.

Solution:

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$25 + 3$	$25 - 4$	$25 + 1$
$25 - 2$	25	$25 + 2$
$25 - 1$	$25 + 4$	$25 - 3$

→

28	21	26
23	25	27
24	29	22

Question 2.

What is the expression obtained by adding the 3 terms of any row, column, or diagonal?

Solution:

Row sum (1st row) = $28 + 21 + 26 = 75$

Column sum (1st column) = $28 + 23 + 24 = 75$

Diagonal sum (1st column) = $28 + 25 + 22 = 75$

The expression obtained = $3 \times m$

where m is the letter-number representing the number in the centre.

Question 3.

Write the result obtained by

- Adding 1 to every term in the generalised form.
- Doubling every term in the generalised form.

Solution:

(a)

$m + 4$	$m - 3$	$m + 2$
$m - 1$	$m + 1$	$m + 3$
m	$m + 5$	$m - 2$

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(b)

$2m + 6$	$2m - 8$	$2m + 2$
$2m - 4$	$2m$	$2m + 4$
$2m - 2$	$2m + 8$	$2m - 6$

Question 4.

Create a magic square whose magic sum is 60.

Solution:

A 3×3 magic square's sum is $3 \times$ the middle element.

So, for a sum of 60, the middle element should be $= 20$.

To get a magic sum of 60, we will multiply the original magic square by 4, i.e.,

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8	1	6	→	8×4	1×4	6×4	→	32	4	24
3	5	7		3×4	5×4	7×4		12	20	28
4	9	2		4×4	9×4	2×4		16	36	8

Question 5.

Is it possible to get a magic square by filling nine non-consecutive numbers?

Solution:

Yes, it is possible.

Justification: Let us consider the two magic squares with a magic sum 45.

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18	11	16	and	24	3	18
13	15	17		9	15	21
14	19	12		12	27	6

9 consecutive numbers 9 non-consecutive numbers

6. Use the systematic method to write down all 6-beat rhythms, i.e., write 6 as the sum of 1's and 2's in all possible ways. Did you get 13 ways?

Solution:

Here $n = 6$

Write a '1+' in front of all rhythms having 5 beats and then a '2+' in front of all rhythms having 4 beats. This gives us all the rhythms having 6 beats.

1 + 1 + 1 + 1 + 1 + 1	2 + 2 + 1 + 1
1 + 1 + 1 + 1 + 2	2 + 1 + 2 + 1
1 + 1 + 1 + 2 + 1	2 + 1 + 1 + 2
1 + 1 + 2 + 1 + 1	1 + 2 + 1 + 2
1 + 2 + 1 + 1 + 1	2 + 2 + 2
2 + 1 + 1 + 1 + 1	
1 + 1 + 2 + 2	
1 + 2 + 2 + 1	

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Yes, we get a total of 13 ways.

7. Write the next 3 numbers in the sequence:

1, 2, 3, 5, 8, 13, 21, 34, 55, 89, _____, _____, _____,

If you have to write one more number in the sequence above, can you tell whether it will be an odd number or an even number (without adding the two

previous numbers)?

Solution:

The next 3 terms in the sequence are:

$$55 + 89 = 144$$

$$89 + 144 = 233$$

$$144 + 233 = 377$$

To determine if the next number after 377 is odd or even without adding the previous terms, let's examine the parity of the sequence.

Parity pattern: 1 (odd), 2 (even), 3 (odd), 5 (odd), 8 (even), 13 (odd), 21 (odd), 34 (even), 55 (odd), 89 (odd), 144 (even), 233 (odd), 377 (odd).

8. What is the parity of each term in the sequence? Do you notice any pattern in the sequence of parities?

Solution:

Here, the parity alternates as follows:

odd, odd, even i.e., two odd numbers are followed by one even number.

So, the next number (after 377) will be even, as per the repeating parity cycle.

The pattern of parities: Repeats every 3 terms as Odd, Odd, Even.

9. Let us look at one more example shown on the right.

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K2

+ K2

HMM

Here, K2 means that the number is a 2-digit number having the digit '2' in the units place and 'K' in the tens place. K2 is added to itself to give a 3-digit sum HMM. What digit should the letter M correspond to?

Both the tens place and the units place of the sum have the same digit.

$$\begin{array}{r} 72 \\ + 72 \\ \hline 144 \end{array}$$

What about H? Can it be 2? Can it be 3?

Solution:

The possible value of two 2-digit numbers 72 with unit digit 2 is $72 + 72 = 144$.

M corresponds to 4 and H corresponds to 1.

So, H cannot be 2 or 3.

10. These types of questions can be interesting and fun to solve! Here are some more questions like this for you to try out. Find out what each letter stands for. Share how you thought about each question with your classmates; you may find

some new approaches.

$$\begin{array}{r}
 YY \\
 + \quad Z \\
 \hline
 ZOO
 \end{array}
 \qquad
 \begin{array}{r}
 B5 \\
 + \quad 3D \\
 \hline
 ED5
 \end{array}
 \qquad
 \begin{array}{r}
 KP \\
 + \quad KP \\
 \hline
 PRR
 \end{array}
 \qquad
 \begin{array}{r}
 C1 \\
 + \quad C \\
 \hline
 1FF
 \end{array}$$

Solution:

YY is a 1 two-digit number where both digits are the same.

So it can be 99, 88,.....

But, Z is a 1-digit number and ZOO is a 1 3-digit number.

So, $Y = 9$, $Z = 1$, and $O = 0$.

$$\begin{array}{r}
 Y \quad Y \\
 + \quad \quad Z \\
 \hline
 Z \quad O \quad O
 \end{array}
 \qquad
 \begin{array}{r}
 9 \quad 9 \\
 + \quad \quad 1 \\
 \hline
 1 \quad 0 \quad 0
 \end{array}$$

Here, $5 + D = 5 \Rightarrow D = 0$

Now, $B + 3 = E0 \Rightarrow B = 7$

If $B = 7$, then $E = 1$

So, we have $B = 7$, $D = 0$, and $E = 1$

$$\begin{array}{r}
 B \quad 5 \\
 + \quad 3 \quad D \\
 \hline
 E \quad D \quad 5
 \end{array}
 \qquad
 \begin{array}{r}
 7 \quad 5 \\
 + \quad 3 \quad 0 \\
 \hline
 1 \quad 0 \quad 5
 \end{array}$$

Here, KP is a 2-digit number and PRR is a 3-digit number.

Basically, $2 \times (KP) = PRR$. So, $P = 1$.

If $P = 1$, then $R = 2$.

Hence, $K = 6$, $P = 1$, $R = 2$.

$$\begin{array}{r}
 K \quad P \\
 + \quad K \quad P \\
 \hline
 P \quad R \quad R
 \end{array}
 \qquad
 \begin{array}{r}
 6 \quad 1 \\
 + \quad 6 \quad 1 \\
 \hline
 1 \quad 2 \quad 2
 \end{array}$$

Here, $C + 1$ is a two-digit number i.e., 10.

So, $C = 9 \Rightarrow F = 0$

$$\begin{array}{r}
 C \quad I \\
 + \quad \quad C \\
 \hline
 I \quad F \quad F
 \end{array}
 \qquad
 \begin{array}{r}
 9 \quad 1 \\
 + \quad \quad 9 \\
 \hline
 1 \quad 0 \quad 0
 \end{array}$$

Figure it Out

Question 1.

A light bulb is ON. Doijee toggles its switch 77 times. Will the bulb be on or off? Why?

Solution:

Dorjee toggles the switch 77 times.

Each toggle changes the state of the bulb (ON to OFF or OFF to ON).

Starting from ON:

An odd number of toggles will leave the bulb OFF, and an even number of toggles will leave the bulb ON.

Since 77 is odd, after 77 toggles, the bulb will be OFF.

Question 2.

Liswini has a large old encyclopaedia. When she opened it, several loose pages fell out of it. She counted 50 sheets in total, each printed on both sides. Can the sum of the page numbers of the loose sheets be 6000? Why or why not?

Solution:

Suppose there are 50 random sheets from a book. Each sheet has two page numbers, one odd page number on the front in the form $2n - 1$, one even page number on the back, in the form $2n$.

So, the total of both page numbers on one sheet is: $(2n - 1) + (2n) = 4n - 1$

For 50 sheets, if $n_1, n_2, \dots, n_{50}$ are the respective sheet numbers (not necessarily consecutive), then the total sum of all 50 sheets is:

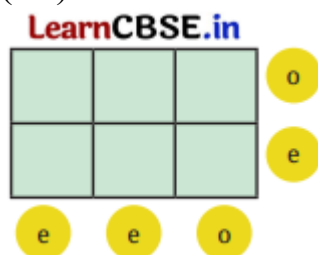
$$(4n_1 - 1) + (4n_2 - 1) + \dots + (4n_{50} - 1)$$

This can be written as: $4(n_1 + n_2 + \dots + n_{50}) - 50$

Now, $4(n_1 + n_2 + \dots + n_{50})$ is always divisible by 4 because it is a multiple of 4. But when we subtract 50 from it, the result is not divisible by 4 (because 50 is not a multiple of 4). So, the total sum of the 50 page numbers will not be divisible by 4. Hence, the sum of the page numbers of the loose sheets can never be 6000, because 6000 is divisible by 4 (since $6000 \div 4 = 1500$).

Question 3.

Here is a 2×3 grid. For each row and column, the parity of the sum is written in the circle; 'e' for even and 'o' for odd. Fill the 6 boxes with 3 odd numbers ('o') and 3 even numbers ('e') to satisfy the parity of the row and column sums.



Solution:

Let's label the cells as:

A	B	C
D	E	F

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So the constraints are:

- Row 1 (A, B, C): sum is odd
- Row 2 (D, E, F): sum is even
- Column 1 (A, D): sum is even
- Column 2 (B, E): sum is even
- Column 3 (C, F): sum is odd

We'll track parities only (o or e), not actual numbers.

Row 1: $A = o, B = e, C = e$, then $o + e + e = \text{odd}$

Column 1 (A, D) = e means A must be paired with D to get the sum as even.

So, if $A = o, D = o$, then $o + o = \text{even}$

Similarly, if $B = e, E = e$, then $e + e = \text{even}$

Again, if $C = e, F = o$, then $e + o = \text{odd}$

So, the 6 boxes with 3 odd numbers and 3 even numbers are as follows:

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<i>o</i>	<i>e</i>	<i>e</i>	<i>o</i>		<i>1</i>	<i>2</i>	<i>4</i>	<i>o</i>
<i>o</i>	<i>e</i>	<i>o</i>	<i>e</i>	as	<i>3</i>	<i>6</i>	<i>9</i>	<i>e</i>
<i>e</i>	<i>e</i>	<i>o</i>			<i>e</i>	<i>e</i>	<i>o</i>	

Question 4.

Make a 3×3 magic square with 0 as the magic sum. All numbers can not be zero. Use negative numbers, as needed.

Solution:

It is given that

- The magic square is 3×3 .
- The magic sum is 0.
- All numbers in the square cannot be zero; we can use negative numbers as needed.

So, we will use the numbers (-4) to 4 to create a magic square whose magic sum is 0.

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-3	2	1
4	0	-4
-1	-2	3

Question 5.

Fill in the following blanks with 'odd' or 'even':

- (a) Sum of an odd number of even numbers is _____
- (b) Sum of an even number of odd numbers is _____
- (c) Sum of an even number of even numbers is _____
- (d) Sum of an odd number of odd numbers is _____

Solution:

- (a) Sum of odd number of even numbers is even.
- (b) Sum of even number of odd numbers is even.
- (c) Sum of even number of even numbers is even.
- (d) Sum of odd number of odd numbers is odd.

Question 6.

What is the parity of the sum of numbers from 1 to 100?

Solution:

The sum of numbers from 1 to 100 is as follows:

$$1 + 2 = \frac{2 \times 3}{2} = 3$$

$$1 + 2 + 3 = \frac{3 \times 4}{2} = 6$$

$$1 + 2 + 3 + 4 = \frac{4 \times 5}{2} = 10$$

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$$1 + 2 + 3 + \dots + 100 = \frac{100 \times 101}{2} = 5050$$

Since 5050 is an even number, the parity is even.

Question 7.

Two consecutive numbers in the Virahanka sequence are 987 and 1597. What are the next 2 numbers in the sequence? What are the previous 2 numbers in the sequence?

Solution:

The given numbers are 987 and 1597.

In the Virahanka sequence, each number is the sum of the two preceding numbers.

The next two numbers are:

$$987 + 1597 = 2584$$

$$1597 + 2584 = 4181$$

The previous two numbers are:

$$1597 - 987 = 610$$

$$987 - 610 = 377$$

The sequence is,377, 610, 987, 1597, 2584, 4181,.....

Question 8.

Angaan wants to climb an 8-step staircase. His playful rule is that he can take either 1 step or 2 steps at a time. For example, one of his paths is 1, 2, 2, 1, 2. In how many different ways can he reach the top?

Solution:

Ways in which Angaan can climb 8 steps with 1 or 2 steps are as follows:

For $n = 8$

Different ways	Number of Ways
$1 + 1 + 1 + 1 + 1 + 1 + 1 + 1$	1
$1 + 1 + 1 + 1 + 1 + 1 + 2$ $1 + 1 + 1 + 1 + 1 + 2 + 1$ $1 + 1 + 1 + 1 + 2 + 1 + 1$ $1 + 1 + 1 + 2 + 1 + 1 + 1$ $1 + 1 + 2 + 1 + 1 + 1 + 1$ $1 + 2 + 1 + 1 + 1 + 1 + 1$ $2 + 1 + 1 + 1 + 1 + 1 + 1$	7
$1 + 1 + 1 + 1 + 2 + 2$ $1 + 1 + 1 + 2 + 1 + 2$ $1 + 1 + 2 + 1 + 1 + 2$ $1 + 2 + 1 + 1 + 1 + 2$ $2 + 1 + 1 + 1 + 1 + 2$ $1 + 1 + 1 + 2 + 2 + 1$ $1 + 1 + 2 + 1 + 2 + 1$ $1 + 2 + 1 + 1 + 2 + 1$ $2 + 1 + 1 + 1 + 2 + 1$ $1 + 1 + 2 + 2 + 1 + 1$ $1 + 2 + 1 + 2 + 1 + 1$ $2 + 1 + 1 + 2 + 1 + 1$ $1 + 2 + 2 + 1 + 1 + 1$ $2 + 1 + 2 + 1 + 1 + 1$ $2 + 2 + 1 + 1 + 1 + 1$	15

$1 + 1 + 2 + 2 + 2$ $1 + 2 + 2 + 2 + 1$ $2 + 2 + 2 + 1 + 1$ $1 + 2 + 1 + 2 + 2$ $2 + 1 + 1 + 2 + 2$ $2 + 1 + 2 + 2 + 1$ $1 + 2 + 2 + 1 + 2$ $2 + 1 + 2 + 1 + 2$ $2 + 2 + 1 + 1 + 2$ $2 + 1 + 1 + 2 + 2$	10
$2 + 2 + 2 + 2$	1

So, the total ways in which Angaan reaches the top = $1 + 7 + 15 + 10 + 1 = 34$ ways.

Question 9.

What is the parity of the 20th term of the Virahanka sequence?

Solution:

Consider the Virahanka sequence given below:

1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987,.....

Let us observe the pattern of odd/even in Virahanka numbers given above:

Here $1 \rightarrow \text{odd}$

$2 \rightarrow \text{even}$

$3 \rightarrow \text{odd}$

$5 \rightarrow \text{odd}$

$8 \rightarrow \text{even}$

$13 \rightarrow \text{odd}$

$21 \rightarrow \text{odd}$

$34 \rightarrow \text{even}$

So parity cycle is: odd, even, odd, (repeats every 3 terms)

So the 20th term of the Virahanka sequence is even.

Question 10.

Identify the true statements.

(a) The expression $4m - 1$ always gives odd numbers.

(b) All even numbers can be expressed as $6j - 4$.

(c) Both expressions $2p + 1$ and $2q - 1$ describe all odd numbers.

(d) The expression $2f + 3$ gives both even and odd numbers.

Solution:

(a) Substituting $m = 1$ in $4m - 1 = 4 \times 1 - 1 = 3$ (odd).

Substituting $m = 2$ in $4m - 1 = 4 \times 2 - 1 = 7$ (odd).

Thus, the expression $4m - 1$ always gives odd numbers.

This statement is true.

(b) Substituting $j = 1$ in $6j - 4 = 6 \times 1 - 4 = 2$ (even).

Substituting $j = 2$ in $6j - 4 = 6 \times 2 - 4 = 8$ (even).

This expression produces even numbers, but it does not produce all even numbers (for e.g., it skips 4 and 6).

This statement is false.

(c) Substituting $p = 1, 2, 3, \dots$ in $2p + 1$, we get 3, 5, 7,.....

Substituting $q = 1, 2, 3, \dots$ in $2q - 1$, we get 1, 3, 5, 7,.....

Here, $2q - 1$ describes all the odd numbers but $2p + 1$ does not describe 1.

Thus, this statement is false.

(d) Substituting $f = 1$, $2f + 3 = 2 \times 1 + 3 = 5$ (odd).

Substituting $f = 2$, $2f + 3 = 2 \times 2 + 3 = 7$ (odd).

The expression $2f + 3$ always gives odd numbers because $2f$ is even and adding 3 makes it odd.

This statement is false.

Question 11.

Solve this cryptarithm:

$$\begin{array}{r} \text{UT} \\ + \text{TA} \\ \hline \text{TAT} \end{array}$$

Solution:

Here, T is at hundreds place, so $T = 1$

$\Rightarrow A = 0$ and $U = 9$.

So, we have $U = 9$, $T = 1$, and $A = 0$.

$$\begin{array}{r} \text{U T} \\ + \text{T A} \\ \hline \text{T A T} \end{array} \quad \text{LearnCBSE.in} \quad \begin{array}{r} 9 \ 1 \\ + \ 1 \ 0 \\ \hline 1 \ 0 \ 1 \end{array}$$

Practice Time 6.1

1. Arrange the cut-outs so the sequence matches.

Possible height orders (Tallest = T, Shortest = S):

(a) 0,1,2,3,3,2,1 $\rightarrow$ Possible order: T, next, next, S, next, next, next

(b) 0,0,0,1,2,3,4 $\rightarrow$ One tallest among first three, shortest at end

(c) 0,2,2,2,2,2 $\rightarrow$ One tallest at front, others arranged suitably

(d) 0,1,1,1,2,2,2 $\rightarrow$ Valid arrangement with equal counts repeated

(e) 0,1,0,1,0,1,0,1 $\rightarrow$ Alternate tall-short arrangement

(f) 0,0,0,0,4,4,4,4 $\rightarrow$ Four tallest first, four shortest later

2. Think and Reason

(a) Tallest person always says 0.

Answer: Always True

(b) Shortest person always says the largest number.

Answer: Sometimes True

(c) First person in line can sometimes say a number greater than 0.

Answer: Never True

(d) Two different people can say the same number.

Answer: Always True

(e) In a group of 5 children, largest possible number is 4.

Answer: Always True

(f) If two children have the same height, they always say the same number.

Answer: Never True

Practice Time 6.2

1. Decide parity

(a) Sum of 3 even numbers = Even

(b) Sum of 3 odd numbers = Odd

(c) Sum of 2 even + 1 odd = Odd

(d) Sum of 4 odd + 2 even = Even

2. Asha's coins

- Even number of ₹2 coins → Even amount
- Odd number of ₹5 coins → Odd amount
- Odd number of ₹10 coins → Even amount

Total:

Even + Odd + Even = Odd

137 is odd.

Answer: Yes, she calculated correctly.

Practice Time 6.3

1. Decide parity

(a)

$$19 \times 21$$

Odd $\times$ Odd = Odd

Answer: Odd

(b)

$$18 \times 27$$

Even $\times$ Odd = Even

Answer: Even

(c)

$$33 \times 40$$

Odd $\times$ Even = Even

Answer: Even

2. Odd product

Possible:

✓ (odd, odd)

Not possible:

✗ (even, odd)

✗ (even, even)

3. Smallest even value of $a \times 17$

Smallest even $a = 2$

$$2 \times 17 = 34$$

Answer: 34

4. If $a \times b$ is even and a is odd

Then b must be even.

5. Three pairs with odd totals

(1,2)

(3,4)

(5,6)

6. Three pairs with even totals but both not even

(1,3)

(5,7)

(9,11)

7. Board = $25 \times k$

25 is odd.

Total odd $\Rightarrow k$ must be odd.

Among $\{22, 23, 24, 25\}$

Answer: $k = 23$ or 25

8. If $a \times b$ is odd, then $a + b$ is even?

Odd product $\Rightarrow$ both odd.

Odd + Odd = Even.

Answer: True

Practice Time 6.4

1. Show row sums = 45

Numbers 1–9 sum to

$$1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 = 45$$

Three rows each sum to magic sum M

$$3M = 45$$

Hence

$$M = 15$$

2. Derive magic sum

$$\frac{45}{3} = 15$$

Answer: 15

3. Centre cannot be 9 or 1

Centre must balance all rows, columns and diagonals.

Only 5 works.

4. Fill a 3×3 grid

One example:

$$\begin{pmatrix} 4 & 9 & 2 \\ 3 & 5 & 7 \\ 8 & 1 & 6 \end{pmatrix}$$

All rows, columns and diagonals sum to 15.

5. Double every entry

Magic sum:

15

After doubling:

30

Answer: Magic sum doubles.

Practice Time 6.5

1. Rhythms for 3 beats

Possible:

111

12

21

Total = 3

2. Rhythms for 4 beats

1111

112

121

211

22

Total = 5

Matches Virahanka sequence.

3. Find rhythms for 7 beats

Virahanka sequence:

1,2,3,5,8,13,21

$$V_7 = 21$$

Answer: 21

4. 9-beat line

$$V_9 = 55$$

Answer: 55 rhythms

5. Next three terms

1,2,3,5,8,13,21

Next:

34, 55, 89

6. Daisy with 34 petals

34 is a Virahanka/Fibonacci number.

Examples:

21 petals, 55 petals, 89 petals.

Practice Time 6.6

1. Solve $A + A = B$

B two-digit

$$2A \geq 10$$

Smallest:

$$A = 5, B = 10$$

2. Find digits

$$C + C + C = DC$$

$$3C = 10D + C$$

$$2C = 10D$$

Possible:

$$C = 5, D = 1$$

since

$$5 + 5 + 5 = 15$$

Answer: $C = 5, D = 1$

3. Solve

$$M2 + M2 = N44$$

$$2(10M + 2) = 100N + 44$$

$$20M + 4 = 100N + 44$$

$$20M = 100N + 40$$

$$M = 5N + 2$$

Taking $N = 1$

$$M = 7$$

Check:

$$72 + 72 = 144$$

Answer: $M = 7, N = 1$

4. If $XY + XY = ZZZ$

$$2(10X + Y) = 111Z$$

Only possibility:

$$37 + 37 = 74$$

No 3-digit result possible.

Answer: No solution in digits.

5. $AB + AB = CDE$

Example:

$$55 + 55 = 110$$

Thus

$$A = 5, B = 5, C = 1, D = 1, E = 0$$

6. $PQ + R = RSS$

One solution:

$$95 + 4 = 99$$

So

$$P = 9, Q = 5, R = 4, S = 9$$

7. $K1 + K1 = MM$

$$\begin{aligned} 2(10K + 1) &= 11M \\ 20K + 2 &= 11M \end{aligned}$$

Try $K = 3$:

$$31 + 31 = 62$$

Not same digits.

Try $K = 4$:

$$41 + 41 = 82$$

Not.

Try $K = 5$:

$$51 + 51 = 102$$

No.

No valid repeated-digit solution.

Answer: No solution.

Q8

Challenge:

$$SEND + MORE = MONEY$$

This is the famous cryptarithm where each letter represents a unique digit.

Step 1: Find the digits

The correct assignment is:

Letter Digit

S 9

E 5

N 6

D 7

M 1

O 0

R 8

Y 2

Step 2: Substitute the digits

$$SEND = 9567$$

$$MORE = 1085$$

$$MONEY = 10652$$

Step 3: Verify

$$9567 + 1085$$

$$= 10652$$

Thus,

$$\boxed{9567 + 1085 = 10652}$$

Answer

$$\boxed{S = 9, E = 5, N = 6, D = 7, M = 1, O = 0, R = 8, Y = 2}$$

and

$$\boxed{9567 + 1085 = 10652}$$

✓ Cryptarithm solved.

EXAM TIME

A. Multiple Choice Questions (MCQs)

1. Sum of two odd numbers is always:

Answer: (b) Even

2. Magic sum of a 3×3 magic square using 1–9:

Answer: (b) 15

3. Number of rhythms for 6 beats in Virahanka-Fibonacci sequence:

Sequence: 1, 2, 3, 5, 8, **13**

Answer: (b) 13

4. Grid dimensions 27×13 :

$$27 \times 13 = 351$$

351 is odd.

Answer: (b) odd

$$5. T + T + T = UT$$

$$3T = 10U + T$$

$$2T = 10U$$

$$T = 5, U = 1$$

Answer: (b) 5

B. Fill in the Blanks

1. The sum of two consecutive numbers is always **odd**.
2. The 10th term of Virahanka-Fibonacci sequence:

1,2,3,5,8,13,21,34,55,89

Answer: 89

3. In a 3×3 magic square, the centre number is always **5**.
4. $\text{Odd} \times \text{Odd} = \text{Odd}$
5. $K^2 + K^2 = HMM$

$$72 + 72 = 144$$

So $K = 7, H = 1, M = 4$

Answer: 4

C. True / False

1. Product of two even numbers is always even.
True
2. Sum of five odd numbers can be even.
False

3. Every row, column and diagonal in Chautisa Yantra adds to 34.

True

4. The 20th Virahanka-Fibonacci term is 6765.

True

5. Same letter can stand for different digits in a cryptarithm.

False

D. Match the Columns

Column A

Odd + Odd

Even $\times$ Odd

Magic sum of 3×3 square 15

V (Virahanka number)

Sequence: 3,2,3,1,1,0

Column B

Even

Even

Height Pattern

Height Pattern

Answers

1 $\rightarrow$ b

2 $\rightarrow$ e

3 $\rightarrow$ a

4 $\rightarrow$ c

5 $\rightarrow$ d

E. Very Short Answer Questions

1. Centre number of a 3×3 magic square?

Answer: 5

2. Parity of 27×13 ?

Odd $\times$ Odd = Odd

Answer: Odd

3. Next Virahanka-Fibonacci number after 21?

Answer: 34

4. What is V_6 ?

Sequence: 1,2,3,5,8,13

Answer: 13

5. What does $A + A = B$ (B two-digit) give for A?

$$2A \geq 10$$

Smallest possibility:

$$A = 5, B = 10$$

Answer: $A \geq 5$ (least value 5)

F. Short Answer Type Questions

1. Why is the sum of two consecutive numbers always odd?

Let the numbers be n and $n + 1$.

$$n + (n + 1) = 2n + 1$$

Since $2n + 1$ is always odd, the sum is always odd.

2. How many 7-beat rhythms exist using 1s and 2s?

Virahanka-Fibonacci sequence:

$$1, 2, 3, 5, 8, 13, 21$$

Thus,

$$V_7 = 21$$

Answer: 21 rhythms.

3. What must be true of $a \times b$ if $a \times b$ is odd?

A product is odd only when both factors are odd.

Answer: b must be odd.

4. Identify which terms in 2, 5, 8, 11, 14, ... are odd.

Sequence alternates:

2(*E*), 5(*O*), 8(*E*), 11(*O*), 14(*E*), ...

Answer: 5, 11, 17, 23, ... (every second term).

5. What is the parity of $n(n + 1)$?

Two consecutive numbers contain one even number.

Therefore,

$$n(n + 1)$$

is always divisible by 2.

Answer: Always even.

G. Long Answer Type Questions

1. Construct a 3×3 magic square using 1–9 and verify its magic sum.

8	1	6
3	5	7
4	9	2

Verification:

Rows:

$$8 + 1 + 6 = 15$$

$$3 + 5 + 7 = 15$$

$$4 + 9 + 2 = 15$$

Columns:

$$8 + 3 + 4 = 15$$

$$1 + 5 + 9 = 15$$

$$6 + 7 + 2 = 15$$

Diagonals:

$$8 + 5 + 2 = 15$$

$$6 + 5 + 4 = 15$$

Magic Sum = 15

2. Explain why the centre of a 3×3 magic square cannot be 1 or 9.

In a 3×3 magic square using 1–9:

- Total sum = 45
- Magic sum = 15
- Centre must balance all rows, columns and diagonals.

The middle value among 1–9 is 5.

If 1 or 9 is placed at the centre, equal sums of 15 in every row, column and diagonal cannot be obtained.

Therefore, the centre must be 5 and cannot be 1 or 9.

Additional Questions (Above Competency Section)

3. A child sequence is 3, 2, 3, 1, 1, 0. What does it tell about height arrangement?

Each number shows how many taller children are ahead.

- Last child says 0 $\rightarrow$ tallest child.
- Equal numbers can occur when children have different positions but the same count of taller children ahead.

Answer: The sequence represents a valid height arrangement with the tallest child at the end.

4. Asha mixes even number of ₹2 coins, odd number of ₹5 coins and odd number of ₹10 coins. Total = ₹137. Explain the error.

Parity:

- Even $\times$ ₹2 = Even
- Odd $\times$ ₹5 = Odd
- Odd $\times$ ₹10 = Even

Total:

$$\text{Even} + \text{Odd} + \text{Even} = \text{Odd}$$

137 is odd.

Answer: No error. The total can indeed be ₹137.

5. Show that doubling every entry in a magic square doubles its magic sum.

Suppose magic sum = M .

If every number is doubled:

Each row sum becomes

$$2M$$

Similarly every column and diagonal sum becomes

$$2M$$

Therefore, doubling every entry doubles the magic sum.

Competency-Based Questions

A. Assertion–Reason

1.

Assertion: Sum of an even number of odd numbers is always even.

Reason: Pairing odd numbers always produces even sums.

Both statements are true and Reason explains Assertion.

Answer: (a)

2.

Assertion: The 8-beat rhythms in Virahanka sequence total 34.

Sequence:

1,2,3,5,8,13,21,34

Assertion is true.

Reason: Each term equals sum of previous two terms.

Also true and explains the sequence.

Answer: (a)

B. Case-Based Question

Sequence:

3,2,3,1,1,0

(1) How many children are in the line?

There are 6 entries.

Answer: 6 children.

(2) Who must be at the back of the line?

The tallest child.

Answer: Tallest child.

(3) If the second child says “2”, what does it tell?

There are exactly 2 taller children ahead of that child.

(4) Can two different children say the same number?

Yes.

Example: sequence contains two 3's and two 1's.

Answer: Yes.

C. Math Booster

1.

Sequence:

2,0,3,1,1,0

(a) How many children are taller than child in position 3?

Position 3 says 3.

Answer: 3 taller children.

(b) Total number of children?

There are 6 entries.

Answer: 6 children.

2.

Group A = 4 (even)

Group B = 7 (odd)

Exactly two groups must be odd.

Thus Group C must be odd.

(a) Parity of n

Answer: Odd

(b) Any two values of n

Examples:

$n = 1, 3$

or

$$n = 5, 7$$

Chapter- 7:A Tale of Three Intersecting Lines

NCERT CORNER

In-Text Questions

1. What happens when the three vertices lie on a straight line?

Solution:

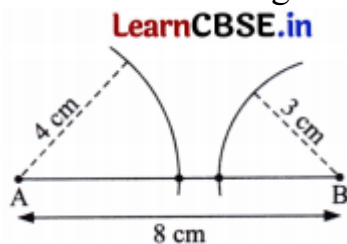
When the three vertices lie on a straight line, they become collinear. This means they no longer form a triangle because the three points do not enclose any area; they simply align along the same straight path.

2. Construct a triangle with sidelengths 3 cm, 4 cm, and 8 cm.

What is happening? Are you able to construct the triangle?

Solution:

Since the arcs from the points A and B do not meet. So, we are not able to construct the triangle with sidelengths 3 cm, 4 cm, and 8 cm.

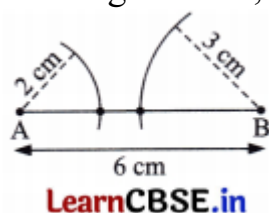


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3. Here is another set of lengths: 2 cm, 3 cm, and 6 cm. Check if a triangle is possible for these side lengths.

Solution:

The arcs from points A and B do not meet. So, a triangle is not possible for sidelengths 2 cm, 3 cm, and 6 cm.



4. Construct triangles having the following sidelengths (all the units are in cm):

- (a) 4, 4, 6
- (b) 3, 4, 5
- (c) 1, 5, 5
- (d) 4, 6, 8
- (e) 3.5, 3.5, 3.5

Solution:

(a) Steps of Construction:

Step 1: Construct the base AB with one of the side lengths.

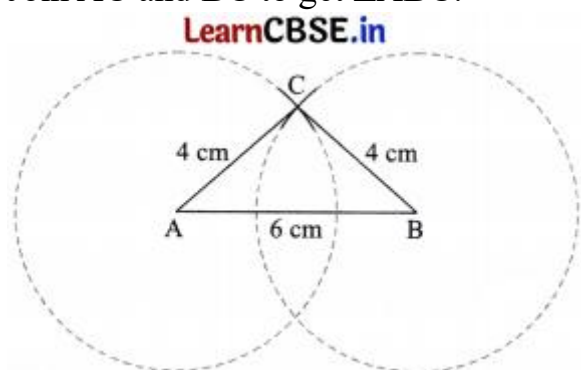
Let us choose $AB = 6$ cm.

Step 2: From A, construct a long arc of radius 4 cm.

Step 3: From B, construct an arc of radius 4 cm such that it intersects the first arc.

Step 4: The point where both the arcs meet is the required third vertex C.

Join AC and BC to get $\triangle ABC$.



Note: All the figures drawn in this chapter are proportionally reduced.

(b) Steps of Construction:

Step 1: Construct the base AB with one of the side lengths.

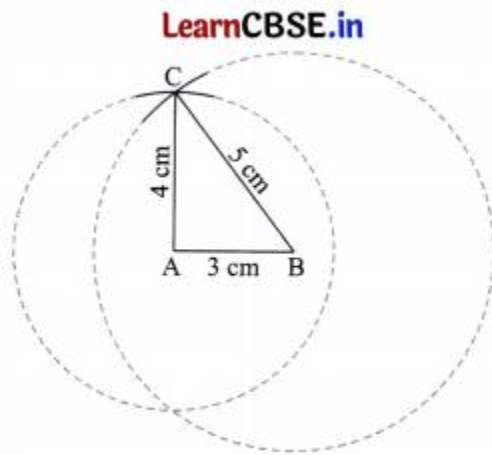
Let us choose $AB = 3$ cm.

Step 2: From A, construct a sufficiently long arc of radius 4 cm.

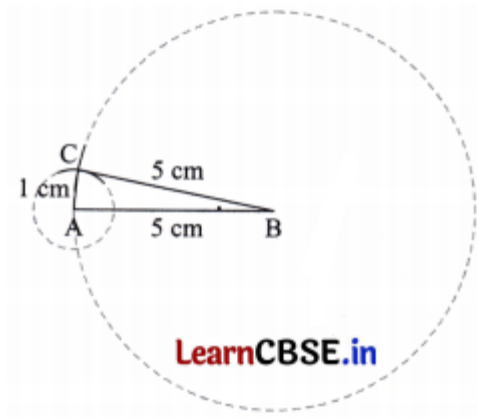
Step 3: From B, construct an arc of radius 5 cm such that it intersects the first arc.

Step 4: The point where both the arcs meet is the required third vertex C.

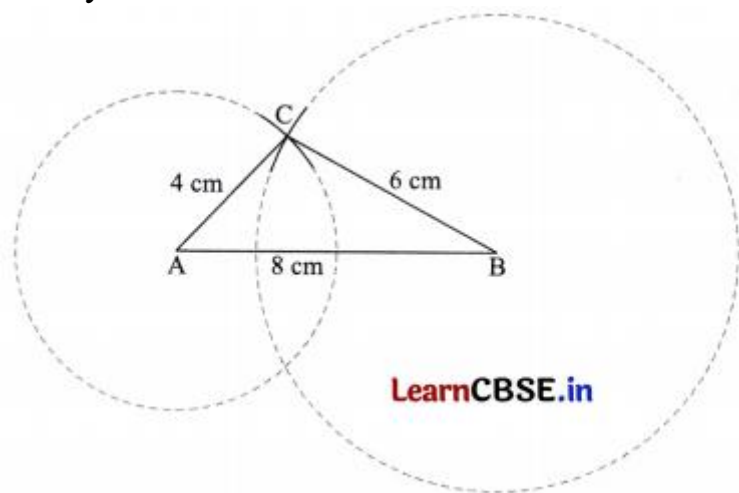
Join AC and BC to get $\triangle ABC$.



(c) Steps of Construction.
Do it yourself.



(d) Steps of Construction.
Do it yourself.



(e) Steps of Construction:

Step 1: Construct the base AB with a side length of 3.5 cm.

Step 2: From A, construct a long arc of radius 3.5 cm.

Step 3: Construct another arc of radius 3.5 cm from B.

Step 4: The point where both the arcs meet is the required third vertex C.

Join AC and BC to get $\triangle ABC$.

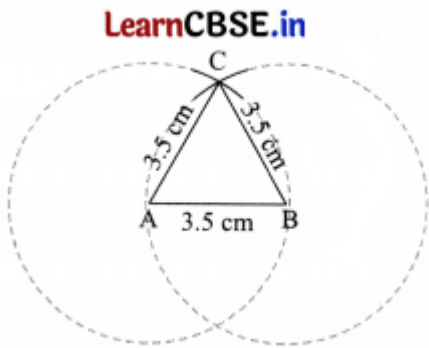


Figure it Out

Question 1.

Use the points on the circle and/or the centre to form isosceles triangles.



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Solution:

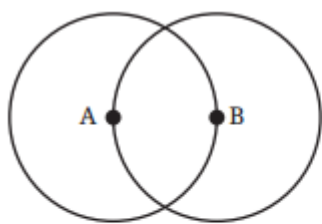
Select any two points on the circle and connect them to the centre of the circle. Also, join these points to each other. This will form an isosceles triangle as the two radii are equal in length.



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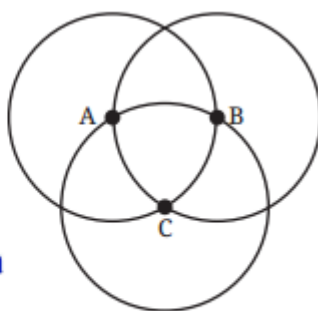
Question 2.

Use the points on the circles and/or their centres to form isosceles and equilateral triangles. The circles are of the same size.



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A and B are the centres of circles of the same size

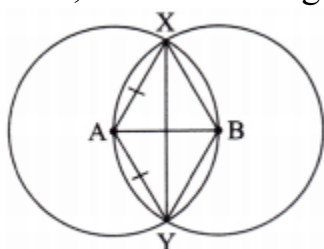


A, B, and C are the centres of circles of the same size

Solution:

An isosceles triangle can be formed by connecting the intersecting points of two circles and the centres of either circle.

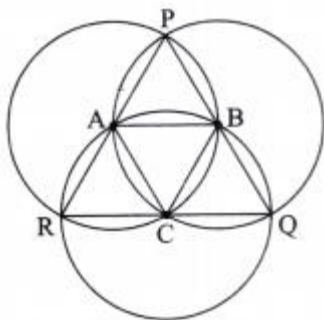
Here, isosceles triangles are AXY and BXY .



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An equilateral triangle can be formed by connecting the centers of the 2 equal circles and one of their intersecting point.

Here, triangle AXB or triangle AYB is an equilateral triangle.



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An equilateral triangle can be formed by connecting the centres of the 3 equal circles.

Here, triangle ABC is an equilateral triangle.

In addition, $\triangle PAB$, $\triangle QBC$, and $\triangle RAC$ are also equilateral triangles.

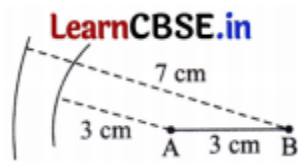
Also, the equilateral triangle is a special case of an isosceles triangle.

So, all these equilateral triangles are also isosceles.

In-Text Questions

1. Can we say anything about the existence of a triangle having sidelengths 3 cm, 3 cm, and 7 cm? Verify your answer by construction.

Solution:



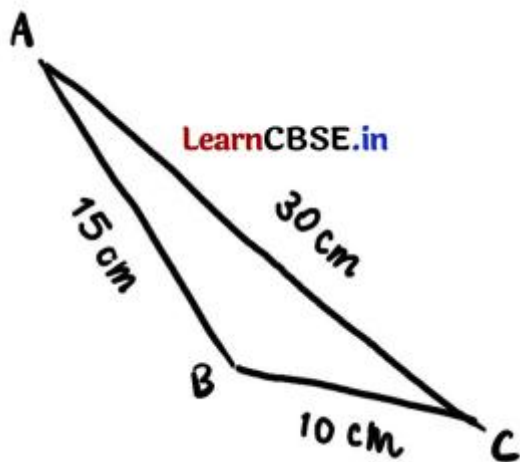
Here, let us choose the direct path length $AB = 7$ cm.

And, the round about path length $= BC + CA = 3$ cm $+ 3$ cm $= 6$ cm.

Since the direct path between two vertices is longer than the roundabout path via the third vertex. So, this triangle is not possible.

Also, by construction existence of a triangle having side lengths 3 cm, 3 cm, and 7 cm is not possible because if we draw arcs from point A and B then they do not meet.

2. “In the rough diagram given alongside, is it possible to assign lengths in a different order such that the direct paths are always coming out to be shorter than the roundabout paths? If this is possible, then a triangle might exist.”



Solution:

No

3. Is such a rearrangement of lengths possible in the triangle?

Solution:

No

4. Further, for a given set of lengths, is it possible to identify which lengths will immediately be less than the sum of the other two, without calculations?

[Hint: Consider the direct lengths in the increasing order]

Solution:

Yes, it is possible to identify which lengths will immediately be less than the sum of the other two, if we take the direct lengths in increasing order.

Figure it out

Question 1.

We checked by construction that there are no triangles having sidelengths 3 cm, 4 cm, and 8 cm; and 2 cm, 3 cm, and 6 cm. Check if you could have found this without trying to construct the triangle.

Solution:

(a) Consider $AB = 4$ cm, $BC = 3$ cm and $AC = 8$ cm.

Now, direct path length = $BC = 3$ cm

And, roundabout path length = $BA + AC$

$$= 4 \text{ cm} + 8 \text{ cm}$$

$$= 12 \text{ cm}$$

The direct path length is shorter than the roundabout path length.

Also, direct path length = $AB = 4$ cm

Roundabout path length = $AC + BC$

$$= 8 \text{ cm} + 3 \text{ cm}$$

$$= 11 \text{ cm}$$

The direct path length is shorter than the roundabout path length.

Again, direct path length = $AC = 8$ cm

Then, roundabout path length = $AB + BC$

$$= 4 \text{ cm} + 3 \text{ cm}$$

$$= 7 \text{ cm}$$

In this case, the direct path is longer than the roundabout path.

So, a triangle cannot exist.

(b) Consider $AB = 3$ cm, $BC = 2$ cm, $AC = 6$ cm

If we take the direct path = $AC = 6$ cm.

And, roundabout path length = $AB + BC$

$$= 3 \text{ cm} + 2 \text{ cm}$$

$$= 5 \text{ cm}$$

Since the direct path is longer than the roundabout path. So, a triangle cannot exist.

Question 2.

Can we say anything about the existence of a triangle for each of the following sets of lengths?

(a) 10 km, 10 km, and 25 km

(b) 5 mm, 10 m,m and 20 mm

(c) 12 cm, 20 c,m and 40 cm

You would have realised that using a rough figure and comparing the direct path lengths with their corresponding roundabout path lengths is the same as comparing each length with the sum of the other two lengths. There are three such comparisons to be made.

Solution:

(a) When we take the direct path = 25 km.

Then the roundabout path = $10 \text{ km} + 10 \text{ km} = 20 \text{ km}$.

Since the direct path is longer than the roundabout path.

So, the existence of a triangle is not possible.

(b) When we take the direct path = 20 mm.

Then the roundabout path = $10 \text{ mm} + 5 \text{ mm} = 15 \text{ mm}$.

Since the direct path is longer than the roundabout path.

So, the existence of a triangle is not possible.

(c) When we take the direct path = 40 cm.

Then the roundabout path = $12 \text{ cm} + 20 \text{ cm} = 32 \text{ cm}$.

Since the direct path is longer than the roundabout path.

So, the existence of a triangle is not possible.

Question 3.

For each set of lengths seen so far, you might have noticed that in at least two of the comparisons, the direct length was less than the sum of the other two (if not, check again!).

For example, for the set of lengths 10 cm, 15 cm, and 30 cm, there are two comparisons where this happens:

$$10 < 15 + 30$$

$$15 < 10 + 30$$

But this doesn't happen for the third length: $30 > 10 + 15$.

Solution:

Do it yourself.

Will this always happen? That is, for any set of lengths, will there be at least two comparisons where the direct length is less than the sum of the other two?

Explore different sets of lengths.

Solution:

(i) 5 mm, 10 mm, 20 mm.

There are two comparisons where this happens:

$$10 < 5 + 20 \text{ and } 5 < 10 + 20 \text{ But } 20 > 10 + 5$$

(ii) 12 cm, 20 cm and 40 cm.

There are two comparisons where this happens:

$$12 < 20 + 40 \text{ and } 20 < 12 + 40 \text{ But } 40 > 12 + 20$$

Figure it Out

Question 1.

Which of the following lengths can be the sidelengths of a triangle? Explain

your answers. Note that for each set, the three lengths have the same unit of measure.

(a) 2, 2, 5

(b) 3, 4, 6

(c) 2, 4, 8

(d) 5, 5, 8

(e) 10, 20, 25

(f) 10, 20, 35

(g) 24, 26, 28

We observe from the previous problems that whenever there is a set of lengths satisfying the triangle inequality (each length $<$ sum of the other two lengths), there is a triangle with those three lengths as sidelengths.

Solution:

A set of lengths can be the sidelengths of a triangle if each length $<$ the sum of the other two lengths.

(a) $2 < 5 + 2$ but $5 > 2 + 2$

So, 2, 2, 5 cannot be the sidelengths of a triangle.

(b) $3 < 4 + 6$, $4 < 3 + 6$, $6 < 4 + 3$

So, 3, 4, 6 can be the sidelengths of a triangle.

(c) $2 < 4 + 8$, $4 < 2 + 8$, but $8 > 4 + 2$

So, 2, 4, 8 cannot be the sidelengths of a triangle.

(d) $5 < 5 + 8$, $8 < 5 + 5$

So, 5, 5, 8 can be the sidelengths of a triangle.

(e) $10 < 20 + 25$, $20 < 25 + 10$, $25 < 10 + 20$

So, 10, 20, 25 can be the sidelengths of a triangle.

(f) $10 < 20 + 35$, $20 < 10 + 35$, but $35 > 10 + 20$

So, 10, 20, 35 cannot be the sidelengths of a triangle.

(g) $24 < 26 + 28$, $26 < 24 + 28$, $28 < 24 + 26$

So, 24, 26, 28 can be the sidelengths of a triangle.

In-Text Questions

1. How will the two circles turn out for a set of lengths that do not satisfy the triangle inequality? Find 3 examples of sets of lengths for which the circles:

(a) touch each other at a point,

(b) Do not intersect.

Solution:

When a set of three segment lengths does not satisfy the triangle inequality, it

means those segments cannot form a triangle.

However, two circles with these lengths as distances between their centres and points on their circumference can behave differently.

(a) (i) 3, 4, 7 (ii) 5, 2, 3 (iii) 6, 2, 4

(b) (i) 3, 4, 8 (ii) 6, 2, 3 (iii) 5, 1, 2

Figure it Out

Question 1.

Check if a triangle exists for each of the following set of lengths:

(a) 1, 100, 100

(b) 3, 6, 9

(c) 1, 1, 5

(d) 5, 10, 12

Solution:

We know that when each length is smaller than the sum of the other two, we say that the lengths satisfy the triangle inequality, and when a set of lengths satisfies the triangle inequality, then a triangle exists.

(a) Here $1 < 100 + 100$, $100 < 100 + 1$

So, for sidelengths 1, 100, 100, a triangle exists.

(b) $3 < 6 + 9$, $6 < 3 + 9$, but $9 = 6 + 3$

So, for sidelengths 3, 6, 9, a triangle does not exist.

(c) $1 < 1 + 5$, but $5 > 1 + 1$

So, for sidelengths 1, 1, 5, a triangle does not exist.

(d) $5 < 10 + 12$, $10 < 5 + 12$, $12 < 10 + 5$

So, for sidelengths 5, 10, and 12, a triangle exists.

Question 2.

Does there exist an equilateral triangle with sides 50, 50, 50? In general, does there exist an equilateral triangle of any sidelength? Justify your answer.

Solution:

Yes, an equilateral triangle with sides 50, 50, 50 exists because the sum of two sides is greater than the third side.

In an equilateral triangle, all sides are equal, so this condition is satisfied.

Yes, an equilateral triangle always exists for any positive sidelength.

For any positive number, say $x > 0$, an equilateral triangle with all sidelengths x exists.

Question 3.

For each of the following, give at least 5 possible values for the third length so there exists a triangle having these as sidelengths (decimal values could also be chosen):

(a) 1, 100

(b) 5, 5

(c) 3, 7

Solution:

(a) 5 possible values for the third length would be 99.5, 99.8, 100, 100.5, 100.9

Since, $100 < 1 + 99.5$, $100 < 1 + 99.8$, $100 < 1 + 100$, $100 < 1 + 100.5$, and $100 < 1 + 100.9$

(b) 5 possible values for the third length would be 1, 3.5, 5, 7.5, 8.9

Since, $5 < 1 + 5$, $5 < 5 + 3.5$, $5 < 5 + 5$, $5 < 5 + 7.5$, and $5 < 5 + 8.9$

(c) 5 possible values for the third length would be 4.5, 5, 6.9, 8, 9.8

Since, $7 < 3 + 4.5$, $7 < 5 + 3$, $7 < 3 + 6.9$, $7 < 3 + 8$, $7 < 3 + 9.8$

Question 4.

Construct triangles for the following measurements, where the angle is included between the sides:

(a) 3 cm, 75° , 7 cm

(b) 6 cm, 25° , 3 cm

(c) 3 cm, 120° , 8 cm

Solution:

(a) Step 1: Construct a side AB of length 7 cm.

Step 2: Construct $\angle A = 75^\circ$ by drawing the other arm of the angle.

Step 3: Mark the point C on the other arm such that AC = 3 cm.

Step 4: Join BC to get the required triangle.

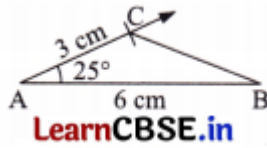


(b) Step 1: Construct a side AB of length 6 cm.

Step 2: Construct $\angle A = 25^\circ$ by drawing the other arm of the angle.

Step 3: Mark the point C on the other arm such that AC = 3 cm.

Step 4: Join BC to get the required triangle.

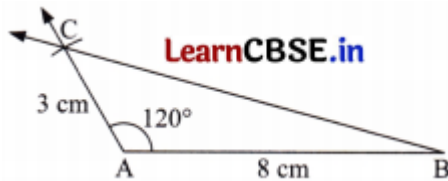


(c) Step 1: Construct a side AB of length 8 cm.

Step 2: Construct $\angle A = 120^\circ$ by drawing the other arm of the angle.

Step 3: Mark the point C on the other arm such that $AC = 3$ cm.

Step 4: Join BC to get the required triangle.



Question 5.

Construct triangles for the following measurements:

(a) 75° , 5 cm, 75°

(b) 25° , 3 cm, 60°

(c) 120° , 6 cm, 30°

Solution:

(a) Step 1: Draw the base AB of length 5 cm.

Step 2: Draw $\angle A$ and $\angle B$ of measure 75° each.

Step 3: The point of intersection of the two new arms of $\angle A$ and $\angle B$ is the third vertex, C.

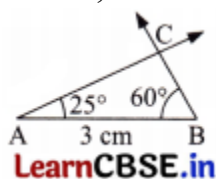


(b) Step 1: Draw the base AB of length 3 cm.

Step 2: Draw $\angle A$ and $\angle B$ of measure 25° , and 60° respectively.

Step 3: The point of intersection of the two new arms of $\angle A$ and $\angle B$ is the third

vertex, C.

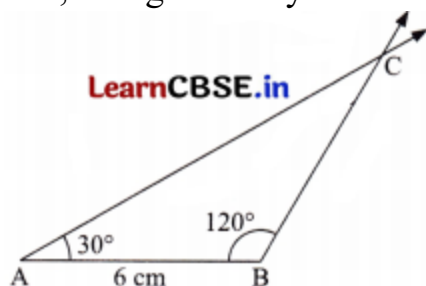


(c) Step 1: Draw the base AB of length 6 cm.

Step 2: Draw $\angle A$ and $\angle B$ of measure 30° , and 120° respectively.

Step 3: The point of intersection of the two new arms of $\angle A$ and $\angle B$ is the third vertex, C.

Yes, triangles always exist.



Question 6.

For each of the following angles, find another angle for which a triangle is (a) possible, (b) not possible. Find at least two different angles for each category:

(a) 30°

(b) 70°

(c) 54°

(d) 144°

Solution:

(a) Another angle for which a triangle is possible will be any angle less than 150° .

Two different angles are 60° , 90° .

Another angle for which a triangle is not possible will be any angle greater than or equal to 150° .

Two different angles are 170° , 160° .

(b) Another angle for which a triangle is possible will be any angle less than 110° .

Two different angles are 70° , 40° .

Another angle for which a triangle is not possible will be any angle greater than or equal to 110° .

Two different angles are 120° , 150° .

(c) Another angle for which a triangle is possible will be any angle less than 126° .

Two different angles are 72° , 54° .

Another angle for which a triangle is not possible will be any angle greater than or equal to 126° .

Two different angles are 140° , 130° .

(d) Another angle for which a triangle is possible will be any angle less than 36° .

Two different angles are 10° , 26° .

Another angle for which a triangle is not possible will be any angle greater than or equal to 36° .

Atleast two different angles are 40° , 50° .

Question 7.

Determine which of the following pairs can be the angles of a triangle and which cannot:

(a) 35° , 150°

(b) 70° , 30°

(c) 90° , 85°

(d) 50° , 150°

Solution:

(a) The sum of the given angles = $35^\circ + 150^\circ = 185^\circ$.

This is not possible because the total exceeds 180° .

(b) The sum of the given angles = $70^\circ + 30^\circ = 100^\circ$.

Possible third angle = $180^\circ - 100^\circ = 80^\circ$.

The pairs can be the angles of a triangle.

(c) The sum of the given angles = $90^\circ + 85^\circ = 175^\circ$.

Possible third angle = $180^\circ - 175^\circ = 5^\circ$.

The pairs can be the angles of a triangle.

(d) The sum of the given angles = $50^\circ + 150^\circ = 200^\circ$.

This is not possible because the total exceeds 180° .

Figure it Out

Question 1.

Find the third angle of a triangle (using a parallel line) when two of the angles are:

(a) 36° , 72°

(b) 150° , 15°

(c) 90° , 30°

(d) $75^\circ, 45^\circ$

Solution:

(a) Here $\angle B = 36^\circ$ and $\angle C = 72^\circ$.

Since the line BC is parallel to XY.

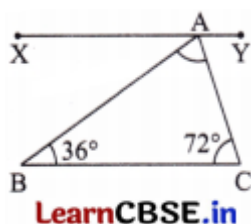
So, $\angle XAB = \angle B = 36^\circ$ [Alternate angles] (i)

and $\angle YAC = \angle C = 72^\circ$ [Alternate angles] (ii)

Also, $\angle XAB + \angle BAC + \angle YAC = 180^\circ$ [$\because \angle XAY$ is a straight angle]

$\Rightarrow 36^\circ + \angle BAC + 72^\circ = 180^\circ$ [Using (i) and (ii)]

$\Rightarrow \angle BAC = 180^\circ - 108^\circ = 72^\circ$.



(b) Here $\angle B = 150^\circ$ and $\angle C = 15^\circ$.

Since the line BC is parallel to XY.

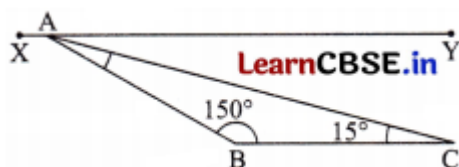
So, $\angle XAB = \angle B = 150^\circ$ [Alternate angles] (i)

and $\angle YAC = \angle C = 15^\circ$ [Alternate angles] (ii)

Also, $\angle XAB + \angle BAC + \angle YAC = 180^\circ$ [$\angle XAY$ is a straight angle]

$\Rightarrow 150^\circ + \angle BAC + 15^\circ = 180^\circ$ [Using (i) and (ii)]

$\Rightarrow \angle BAC = 180^\circ - 165^\circ = 15^\circ$



(c) Here $\angle B = 90^\circ$ and $\angle C = 30^\circ$.

Since the line BC is parallel to XY.

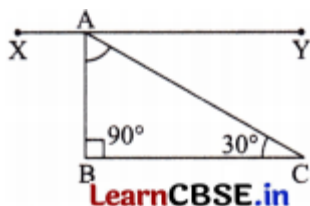
So, $\angle XAB = \angle B = 90^\circ$ [Alternate angles] (i)

and $\angle YAC = \angle C = 30^\circ$ [Alternate angles] (ii)

Also, $\angle XAB + \angle BAC + \angle YAC = 180^\circ$ [$\angle XAY$ is a straight angle]

$\Rightarrow 90^\circ + \angle BAC + 30^\circ = 180^\circ$ [Using (i) and (ii)]

$\Rightarrow \angle BAC = 180^\circ - 120^\circ = 60^\circ$



(d) Here $\angle B = 75^\circ$ and $\angle C = 45^\circ$.

Since the line BC is parallel to XY.

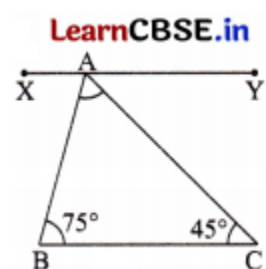
So, $\angle XAB = \angle B = 75^\circ$ [Alternate angles] (i)

and $\angle YAC = \angle C = 45^\circ$ [Alternate angles] (ii)

Also, $\angle XAB + \angle BAC + \angle YAC = 180^\circ$ [$\angle XAY$ is a straight angle]

$\Rightarrow 75^\circ + \angle BAC + 45^\circ = 180^\circ$ [Using (i) and (ii)]

$\Rightarrow \angle BAC = 180^\circ - 120^\circ = 60^\circ$

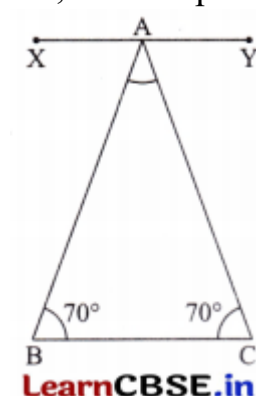


Question 2.

Can you construct a triangle all of whose angles are equal to 70° ? If two of the angles are 70° , what would the third angle be? If all the angles in a triangle have to be equal, then what must its measure be? Explore and find out.

Solution:

No, it is not possible to construct a triangle with all angles equal to 70° .



If we take two base angles as 70° that is, $\angle B$ and $\angle C = 70^\circ$, then we have to find $\angle BAC$.

Since XY is parallel to BC.

So, $\angle XAB = \angle B = 70^\circ$ (i)

and $\angle YAC = \angle C = 70^\circ$ (ii)

Also, $\angle XAB + \angle BAC + \angle YAC = 180^\circ$

$\Rightarrow 70^\circ + \angle BAC + 70^\circ = 180^\circ$ [Using (i) and (ii)]

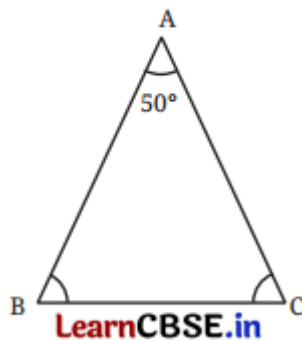
$\Rightarrow \angle BAC = 180^\circ - 140^\circ = 40^\circ$.

So, the third angle would be 40° .

If all the angles in a triangle have to be equal, then each angle must measure 60° . This type of triangle is called an equilateral triangle.

Question 3.

Here is a triangle in which we know $\angle B = \angle C$ and $\angle A = 50^\circ$. Can you find $\angle B$ and $\angle C$?

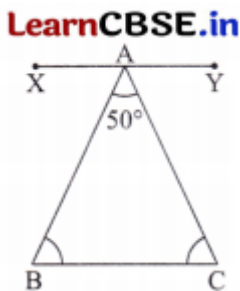


Solution:

Given $\angle A = 50^\circ$ and $\angle B = \angle C$.

Draw a line XY that is parallel to BC.

Now, $\angle XAB = \angle B$ and $\angle YAC = \angle C$ [Alternate angles] (i)



Also, $\angle XAB + \angle BAC + \angle YAC = 180^\circ$

$\Rightarrow \angle B + 50^\circ + \angle C = 180^\circ$ [Using (i)]

$\angle B + \angle C = 180^\circ - 50^\circ = 130^\circ$

$\Rightarrow 2\angle B = 130^\circ$

$\Rightarrow \angle B = 65^\circ = \angle C$

Question 4.

Construct a triangle ABC with $BC = 5$ cm, $AB = 6$ cm, $CA = 5$ cm. Construct an altitude from A to BC.

Solution:

Steps of Construction:

Step 1: Draw the base $AB = 6$ cm.

Step 2: Using a compass, construct a sufficiently long arc of radius 5 cm from A.

Step 3: Construct another arc of radius 5 cm from B such that it intersects the first arc.

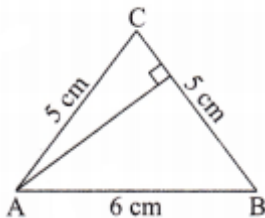


Step 4: The point where both the arcs meet is the required third vertex C. Join AC and BC to get $\triangle ABC$.

Step 5: Keep the ruler aligned to BC. Place the set square on the ruler such that one of the edges of the right angle touches the ruler.

Step 6: Slide the set square along the ruler till the perpendicular edge of the set square touches the vertex A.

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Step 7: Draw the altitude through A to BC using the perpendicular edge of the set square.

Question 5.

Construct a triangle TRY with $RY = 4$ cm, $TR = 7$ cm, $\angle R = 140^\circ$. Construct an altitude from T to RY.

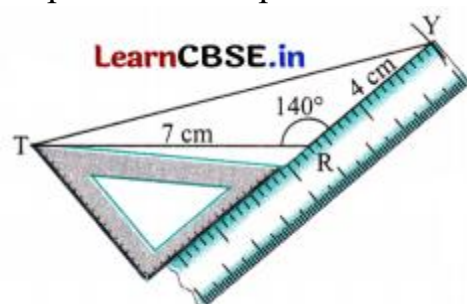
Solution:

Steps of Construction:

Step 1: Construct a side TR of length 7 cm.

Step 2: Construct $\angle R = 140^\circ$ by drawing the other arm of the angle.

Step 3: Mark the point Y on the other arm such that $RY = 4$ cm.



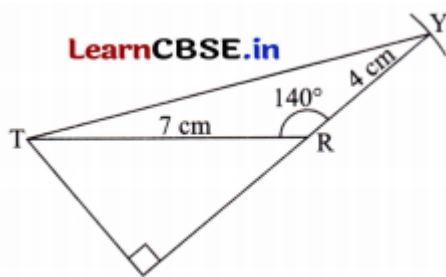
Step 4: Join TY to get the required triangle.

Step 5: Keep the ruler aligned to RY. Place the set square on the ruler such that one of the edges of the right angle touches the ruler.

Step 6: Slide the set square along the ruler till the perpendicular edge of the set

square touches the vertex T.

Step 7: Extend the line YR and then draw the altitude through T on YR using the perpendicular edge of the set square.



Question 6.

Construct a right-angled triangle $\triangle ABC$ with $\angle B = 90^\circ$, $AC = 5$ cm. How many different triangles exist with these measurements?

[Hint: Note that the other measurements can take any values. Take AC as the base. What values can $\angle A$ and $\angle C$ take so that the other angle is 90° ?]

Solution:

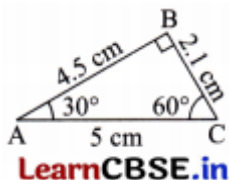
Given, $\angle B = 90^\circ$, and $AC = 5$ cm (hypotenuse)

Since $\angle B = 90^\circ$, $\angle A$ and $\angle C$ add upto 90° .

If we fixed $AC = 5$ cm and $\angle A$ and $\angle C$ vary, then there are infinitely many triangles possible.

Because the shape of the triangle can change with the different values of angles A and C.

One such example is given here:



Question 7.

Through construction, explore if it is possible to construct an equilateral triangle that is (i) right-angled, (ii) obtuse-angled. Also construct an isosceles triangle that is (i) right-angled, (ii) obtuse-angled.

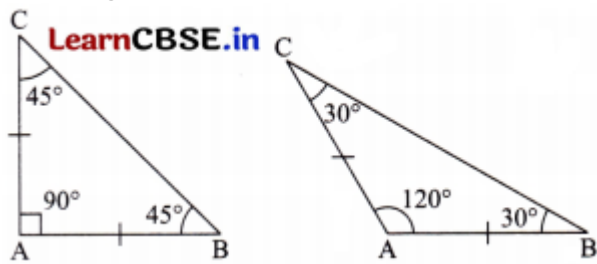
Solution:

An equilateral triangle that is right-angled and obtuse-angled is not possible because each angle of an equilateral triangle is always 60° .

An isosceles right-angled triangle has one angle of 90° and the other two angles of 45° each.

An isosceles obtuse-angled triangle can have one angle as 120° and the other

two angles of 30° each.



Practice Time 7.1

1. How many sides does a triangle have?

Answer: 3 sides

2. What are the corner points of a triangle called?

Answer: Vertices

3. What is the name of the triangle with vertices A, B and C?

Answer: $\triangle ABC$ (Triangle ABC)

4. Can three collinear points form a triangle?

Answer: No.

5. How many angles are there in a triangle?

Answer: 3 angles

6. In $\triangle PQR$, what is the angle at vertex Q called?

Answer: $\angle PQR$ or $\angle Q$

7. Write three different ways of naming the triangle with vertices X, Y and Z.

Answer: $\triangle XYZ$, $\triangle YZX$, $\triangle ZXY$

8. What is the simplest closed figure in geometry?

Answer: Triangle

Practice Time 7.2

1. Measure of each interior angle in an equilateral triangle

Answer: 60°

2. One side is 6 cm. Length of other two sides?

Answer: 6 cm and 6 cm

3. Lines of symmetry in an equilateral triangle

Answer: 3

4. Why can't we construct an equilateral triangle accurately using only a ruler?

Answer: Because equal lengths cannot be marked accurately without a compass.

5. Which geometric tool is mainly used?

Answer: Compass

6. Why are arcs drawn from A and B?

Answer: To locate the third vertex at equal distance from A and B.

7. If $AB = 5$ cm, find AC and BC.

Answer: $AC = 5$ cm, $BC = 5$ cm

8. Longest side in an equilateral triangle

Answer: No longest side; all sides are equal.

9. Do medians, altitudes and angle bisectors coincide?

Answer: Yes.

10. Why is a triangle with all sides equal always equiangular?

Answer: Equal sides subtend equal angles, so all angles are 60° .

Practice Time 7.3

1. Define triangle inequality property.

Answer: Sum of any two sides of a triangle is greater than the third side.

2. Why important before construction?

Answer: To check whether a triangle can be formed.

3. Properties of an equilateral triangle.

Answer:

- Three equal sides

- Three equal angles (60° each)
- Three lines of symmetry
- Medians, altitudes and angle bisectors coincide

4. Difference between isosceles and scalene triangle.

Answer:

- Isosceles: Two equal sides
- Scalene: All sides unequal

5. If two circles touch at exactly one point during construction?

Answer: Only one triangle is possible.

Practice Time 7.4

1. Construct $\triangle PQR$ with $PQ = 5$ cm, $PR = 4$ cm, $\angle P = 60^\circ$

Steps:

1. Draw $PQ = 5$ cm.
2. At P draw $\angle QPR = 60^\circ$.
3. Mark $PR = 4$ cm on the ray.
4. Join RQ.
5. $\triangle PQR$ obtained.

2. Construct $\triangle XYZ$ with $XY = 7$ cm, $XZ = 5$ cm, $\angle X = 45^\circ$

Steps:

1. Draw $XY = 7$ cm.
2. At X draw 45° angle.
3. Mark $XZ = 5$ cm.
4. Join YZ.
5. Verify by measuring.

3. Construct triangle with $AB = 6\text{ cm}$, $AC = 5\text{ cm}$, $\angle A = 75^\circ$

Steps:

1. Draw $AB = 6\text{ cm}$.
 2. At A construct 75° .
 3. Mark $AC = 5\text{ cm}$.
 4. Join BC.
 5. Required triangle formed.
-

4. Construct $\triangle LMN$ with $LM = 4\text{ cm}$, $LN = 3.5\text{ cm}$, $\angle L = 90^\circ$

Type: Right-angled triangle

5. Construct $\triangle DEF$ with $DE = 5\text{ cm}$, $\angle D = 45^\circ$, $\angle E = 75^\circ$

Steps:

1. Draw $DE = 5\text{ cm}$.
 2. At D construct 45° .
 3. At E construct 75° .
 4. Rays meet at F.
 5. Join DF and EF.
-

Practice Time 7.5

1. Define altitude.

Answer: A perpendicular drawn from a vertex to the opposite side.

2. How many altitudes?

Answer: 3

3. Why can one side act as altitude in a right triangle?

Answer: Two sides are already perpendicular.

4. Which triangle has all altitudes inside?

Answer: Acute-angled triangle

Which triangle has one altitude outside?

Answer: Obtuse-angled triangle

5. Draw altitude from A to BC in triangle ABC.

Answer: Draw $AD \perp BC$. AD is the altitude.

Exam Time

(MCQs)

1.

Equilateral triangle angle =

Answer: (c) 60°

2.

Longest side in a right triangle =

Answer: (d) Hypotenuse

3.

Triangle that does not exist =

Answer: (c) Equilateral Right-Angled

4.

In a scalene triangle =

Answer: (b) All sides are different

5.

Altitude from obtuse angle falls =

Answer: (a) Inside the triangle

Fill in the Blanks

1. Isosceles
2. Three
3. Hypotenuse
4. Acute-angled

5. Outside

True / False

1. True
 2. False
 3. False
 4. True
 5. True
-

Match the Columns

Column A

Column B

Equilateral triangle	All sides equal
Scalene triangle	No sides equal
Isosceles triangle	Two sides equal
Right-angled triangle	One angle = 90°
Obtuse-angled triangle	One angle $> 90^\circ$

Answers:

1-a, 2-e, 3-c, 4-d, 5-b

Very Short Answers

1.

3

2.

180°

3.

Equilateral triangle

4.

Scalene triangle

5.

Obtuse triangle

Short Answers

1. Define a scalene triangle.

A triangle having all sides unequal.

2. Triangle inequality rule.

Sum of any two sides is greater than the third side.

3. Why is a compass used?

To draw arcs and mark equal distances accurately.

4. What is an altitude?

A perpendicular from a vertex to the opposite side.

5. If $\angle A = 60^\circ$ and $\angle B = 80^\circ$, find $\angle C$.

$$\angle C = 180^\circ - (60^\circ + 80^\circ)$$

$$\angle C = 40^\circ$$

Answer: 40°

Long Answers

1. Construction of a triangle when all sides are given (SSS)

1. Draw the longest side AB.
 2. With centre A and radius AC draw an arc.
 3. With centre B and radius BC draw another arc.
 4. Let arcs intersect at C.
 5. Join AC and BC.
 6. $\triangle ABC$ is obtained.
-

2. Angle Sum Property

The sum of the three interior angles of a triangle is always:

$$\angle A + \angle B + \angle C = 180^\circ$$

$$60.0^\circ + 60.0^\circ + 60.0^\circ$$

3. Properties

Equilateral Triangle

- Three equal sides
- Three equal angles (60°)

Isosceles Triangle

- Two equal sides
- Base angles equal

Scalene Triangle

- All sides unequal
 - All angles unequal
-

4. Drawing an Altitude using Set-Square

1. Place set-square along opposite side.
 2. Slide it till vertex is reached.
 3. Draw perpendicular line.
 4. Mark foot of perpendicular.
 5. This line is the altitude.
-

5. Can sides 4 cm, 7 cm, 12 cm form a triangle?

Check triangle inequality:

$$\begin{aligned} 4 + 7 &= 11 \\ 11 &< 12 \end{aligned}$$

Condition fails.

Answer: No, a triangle cannot be formed.

Competency-Based Questions

A. Assertion–Reason

1.

Assertion: An equilateral obtuse triangle is not possible.

Reason: In an equilateral triangle each angle is 60° .

Answer: (a) Both A and R are true and R explains A.

2.

Assertion: A right-angled triangle can never be equilateral.

Reason: Right angle forces other two angles to be 45° each.

Answer: (a) Both A and R are true and R explains A.

B. Case-Based Questions

1. Type of $\triangle PQR$ (all sides 5 cm)

Answer: Equilateral triangle

2. Type of $\triangle LMN$ (6 cm, 6 cm, 8 cm)

Answer: Isosceles triangle

3. Type of $\triangle XYZ$ (one angle 120°)

Answer: Obtuse-angled triangle

4. Altitude from X in $\triangle XYZ$ falls

Answer: Outside the triangle

C. Math Booster

1. Name the hypotenuse.

Answer: AC

2. Which two sides act as altitudes?

Answer: AB and BC

Chapter 8: Working with Fractions

NCERT CORNER

Figure it Out

Question 1

Tenzin drinks $\frac{1}{2}$ glass of milk every day.

How many glasses of milk does he drink in a week?

How many glasses of milk did he drink in the month of January?

Solution

Number of glasses of milk drunk in a day

$$= \frac{1}{2}$$

There are 7 days in a week.

Number of glasses of milk drunk in 1 week

$$= 7 \times \frac{1}{2}$$

$$= \frac{7}{2}$$

$$= 3\frac{1}{2}$$

Therefore, Tenzin drinks **3½ glasses** of milk in a week.

There are 31 days in January.

Number of glasses of milk drunk in January

$$= 31 \times \frac{1}{2}$$

$$= \frac{31}{2}$$

$$= 15\frac{1}{2}$$

Therefore, Tenzin drinks **$15\frac{1}{2}$ glasses** of milk in January.

Question 2

A team of workers can make 1 km of a water canal in 8 days.

So, in one day, the team can make _____ km of the water canal.

If they work 5 days a week, they can make _____ km of the water canal in a week.

Solution

Water canal made in 8 days = 1 km

Water canal made in 1 day

$$= \frac{1}{8}\text{km}$$

Water canal made in 5 days

$$= 5 \times \frac{1}{8}$$

$$= \frac{5}{8}\text{km}$$

Hence, the team can make **$\frac{5}{8}$ km** of the water canal in one week.

Question 3

Manju and two of her neighbours buy 5 litres of oil every week and share it equally among the 3 families.

How much oil does each family get in a week?

How much oil will one family get in 4 weeks?

Solution

Oil received by each family in a week

$$= \frac{5}{3}\text{litres}$$

Oil received by one family in 4 weeks

$$= 4 \times \frac{5}{3}$$

$$= \frac{20}{3}$$

$$= 6\frac{2}{3}\text{litres}$$

Question 4

Safia saw the Moon setting on Monday at 10 pm.

Her mother, who is a scientist, told her that every day the Moon sets $\frac{5}{6}$ hours later than the previous day.

How many hours after 10 pm will the Moon set on Thursday?

Solution

Monday to Thursday = 3 days

Delay in moonset

$$= 3 \times \frac{5}{6}$$

$$= \frac{15}{6}$$

$$= \frac{5}{2}\text{hours}$$

1 hour = 60 minutes

$$\frac{5}{2} \times 60$$

$$= \frac{300}{2}$$

$$= 150 \text{ minutes}$$

150 minutes

$$= 120 \text{ minutes} + 30 \text{ minutes}$$

$$= 2 \text{ hours } 30 \text{ minutes}$$

Hence, on Thursday the Moon will set **2 hours 30 minutes after 10 pm.**

Question 5

Multiply and then convert into a mixed fraction:

(a) $7 \times \frac{3}{5}$

(b) $4 \times \frac{4}{3}$

(c) $\frac{9}{7} \times 6$

(d) $\frac{13}{11} \times 6$

Solution

(a)

$$7 \times \frac{3}{5} = \frac{21}{5} = 4\frac{1}{5}$$

(b)

$$4 \times \frac{4}{3} = \frac{16}{3} = 5\frac{1}{3}$$

(c)

$$\frac{9}{7} \times 6 = \frac{54}{7} = 7\frac{5}{7}$$

(d)

$$\frac{13}{11} \times 6 = \frac{78}{11} = 7\frac{1}{11}$$

Question 6

Find the following products. Use a unit square as a whole for representing the fractions:

(a) $\frac{1}{3} \times \frac{1}{5}$

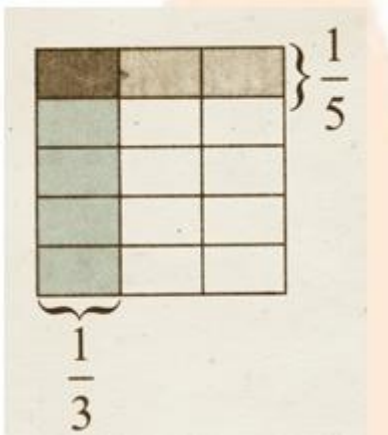
(b) $\frac{1}{4} \times \frac{1}{3}$

(c) $\frac{1}{5} \times \frac{1}{2}$

(d) $\frac{1}{6} \times \frac{1}{5}$

Solution

(a) $\frac{1}{3} \times \frac{1}{5}$

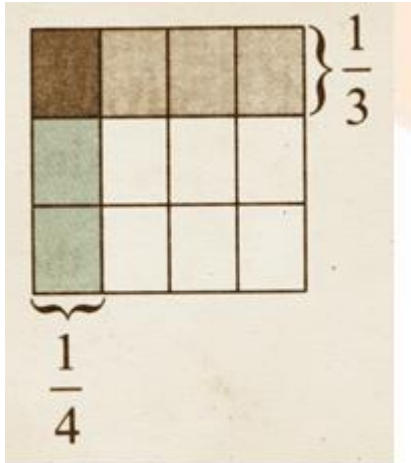


- Each row represents $\frac{1}{5}$
- Each column represents $\frac{1}{3}$
- Whole square divided into $5 \times 3 = 15$ equal parts
- 1 part is double shaded

Therefore,

$$\frac{1}{3} \times \frac{1}{5} = \frac{1}{15}$$

(b) $\frac{1}{4} \times \frac{1}{3}$



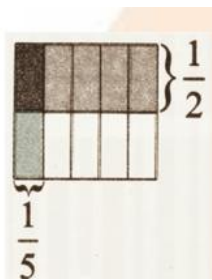
- Whole divided into 3 rows and 4 columns
- Total parts = 12
- Double shaded parts = 1

Therefore,

$$\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$$

(c) $\frac{1}{5} \times \frac{1}{2}$

•

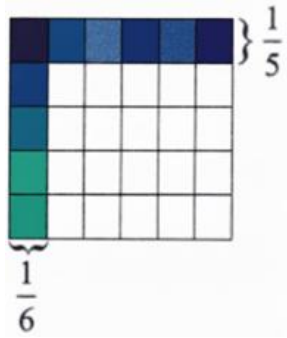


-
- Whole divided into 2 rows and 5 columns
- Total parts = 10
- Double shaded parts = 1

Therefore,

$$\frac{1}{5} \times \frac{1}{2} = \frac{1}{10}$$

(d) $\frac{1}{6} \times \frac{1}{5}$



- $\frac{1}{6}$ Whole divided into 5 rows and 6 columns
- Total parts = 30
- Double shaded parts = 1

Therefore,

$$\frac{1}{6} \times \frac{1}{5} = \frac{1}{30}$$

Question 7

Find the following products. Use a unit square as a whole for representing the fractions and carrying out the operations.

(a)

$$\frac{2}{3} \times \frac{4}{5}$$

(b)

$$\frac{1}{4} \times \frac{2}{3}$$

(c)

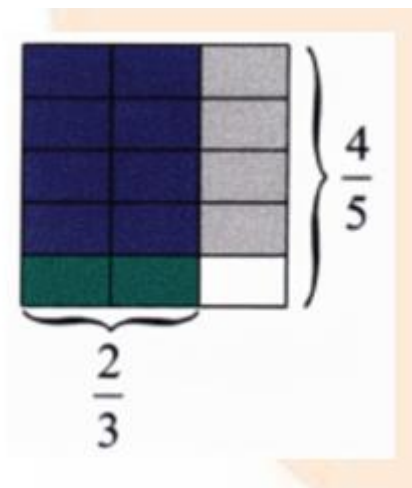
$$\frac{3}{5} \times \frac{1}{2}$$

(d)

$$\frac{4}{6} \times \frac{3}{5}$$

Solution

(a)



B Rows represent $\frac{4}{5}$

- Columns represent $\frac{2}{3}$

Total parts

$$5 \times 3 = 15$$

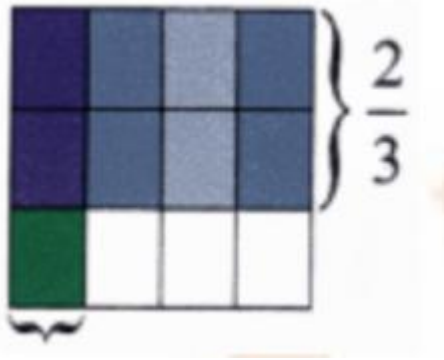
Double shaded parts

$$2 \times 4 = 8$$

Therefore,

$$\frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$$

(b)



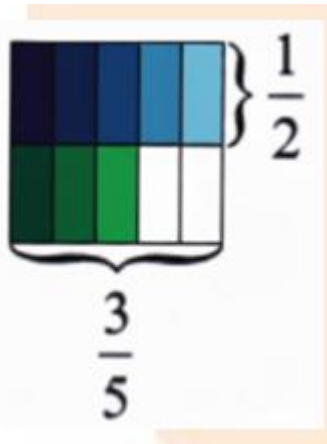
Total parts = 12

Double shaded = 2

Therefore,

$$\frac{1}{4} \times \frac{2}{3} = \frac{2}{12} = \frac{1}{6}$$

(c)



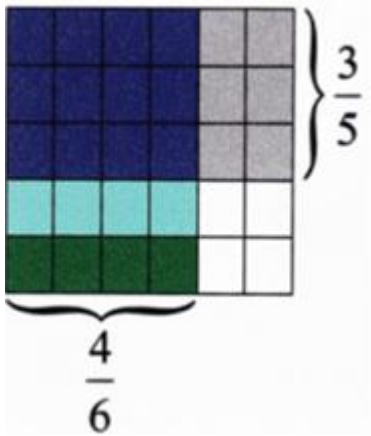
Total parts = 10

Double shaded = 3

Therefore,

$$\frac{3}{5} \times \frac{1}{2} = \frac{3}{10}$$

(d)



Total parts

$$6 \times 5 = 30$$

Double shaded

$$4 \times 3 = 12$$

Therefore,

$$\frac{4}{6} \times \frac{3}{5} = \frac{12}{30} = \frac{2}{5}$$

Question 8

A water tank is filled from a tap.

If the tap is open for **1 hour**, $\frac{7}{10}$ of the tank gets filled.

How much of the tank is filled if the tap is open for:

(a) $\frac{1}{2}$ hour

(b) $\frac{3}{4}$ hour

(c) $\frac{2}{7}$ hour

(d) $\frac{5}{14}$ hour

(e) For the tank to be full, how long should the tap be running?

Solution**Given**

In 1 hour,

$$\frac{7}{10}$$

of the tank is filled.

(a) In $\frac{1}{2}$ hour

$$\frac{1}{2} \times \frac{7}{10} = \frac{7}{20}$$

Therefore,

$$\boxed{\frac{7}{20}}$$

of the tank gets filled.

(b) In $\frac{3}{4}$ hour

$$\frac{3}{4} \times \frac{7}{10} = \frac{21}{40}$$

Therefore,

$$\boxed{\frac{21}{40}}$$

of the tank gets filled.

(c) In $\frac{2}{7}$ hour

$$\frac{2}{7} \times \frac{7}{10} = \frac{2}{10} = \frac{1}{5}$$

Therefore,

$$\boxed{\frac{1}{5}}$$

of the tank gets filled.

(d) In $\frac{5}{14}$ hour

$$\frac{5}{14} \times \frac{7}{10} = \frac{35}{140} = \frac{1}{4}$$

Therefore,

$$\boxed{\frac{1}{4}}$$

of the tank gets filled.

(e) Time needed to fill the whole tank

In 1 hour,

$$\frac{7}{10}$$

of the tank is filled.

Time required for full tank

$$1 \div \frac{7}{10} = 1 \times \frac{10}{7} = \frac{10}{7}$$

hours

$$= 1\frac{3}{7}$$

hours

Therefore,

$1\frac{3}{7}$ hours

Question 9

The government has taken $\frac{1}{3}$ of Somu's land to build a road.

What part of the land remains with Somu now?

She gives:

- Half of the remaining land to Krishna.
- $\frac{1}{4}$ of the remaining land to Bora.

After giving them their shares, she keeps the remaining land.

Find:

- (a) What part of the original land did Krishna get?
- (b) What part of the original land did Bora get?
- (c) What part of the original land did Somu keep?

Solution

Step 1: Land remaining after government acquisition

Government takes

$$\frac{1}{3}$$

Remaining land

$$1 - \frac{1}{3} = \frac{2}{3}$$

(a) Krishna's Share

Krishna receives half of remaining land.

Remaining land

$$\frac{2}{3}$$

Half of remaining land

$$\frac{1}{2} \times \frac{2}{3} = \frac{1}{3}$$

Therefore,

$$\boxed{\frac{1}{3}}$$

of the original land went to Krishna.

(b) Bora's Share

Bora receives

$$\frac{1}{4}$$

of the remaining land.

$$\frac{1}{4} \times \frac{2}{3} = \frac{1}{6}$$

Therefore,

$$\boxed{\frac{1}{6}}$$

of the original land went to Bora.

(c) Somu's Share

Total distributed:

Government

$$\frac{1}{3}$$

Krishna

$$\frac{1}{3}$$

Bora

$$\frac{1}{6}$$

Total

$$\frac{1}{3} + \frac{1}{3} + \frac{1}{6} = \frac{2}{6} + \frac{2}{6} + \frac{1}{6} = \frac{5}{6}$$

Land left

$$1 - \frac{5}{6} = \frac{1}{6}$$

Therefore,

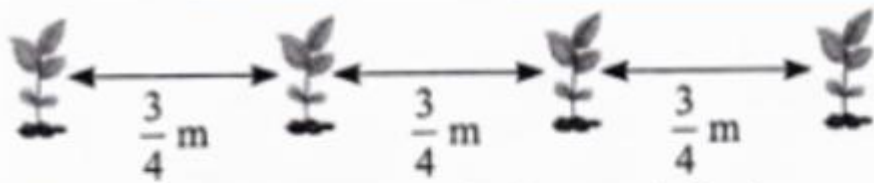
$$\boxed{\frac{1}{6}}$$

of the original land remained with Somu.

Question 10

$$\begin{aligned} 3\frac{3}{4} &= \frac{15}{4}, \quad 9\frac{3}{5} = \frac{48}{5} \\ \text{Area of the rectangle} &= 3\frac{3}{4} \text{ ft} \times 9\frac{3}{5} \text{ ft} = \frac{15}{4} \text{ ft} \times \frac{48}{5} \text{ ft} \\ &= \frac{\cancel{15}^3 \times \cancel{48}^{12}}{\cancel{4}_1 \times \cancel{5}_1} \text{ sq ft} \\ &= \frac{3 \times 12}{1 \times 1} = 36 \text{ sq ft} \end{aligned}$$

Question 11



The distance between the first and the last sapling

$$\begin{aligned} &= \frac{3}{4} \text{ m} + \frac{3}{4} \text{ m} + \frac{3}{4} \text{ m} = 3 \times \frac{3}{4} \text{ m} = \frac{3 \times 3}{4} \text{ m} \\ &= \frac{9}{4} \text{ m} = 2\frac{1}{4} \text{ m} \end{aligned}$$

Question 12

Which is heavier?

(a)

$$\frac{3}{5} \text{ of } 500 \text{ g}$$

or

(b)

$$\frac{1}{4} \text{ of } 4 \text{ kg}$$

Solution

$$\begin{aligned} \frac{12}{15} \text{ of } 500 \text{ g} &= \frac{12}{15} \times 500 \text{ g} = \frac{\cancel{12}^4 \times \cancel{500}^{100}}{\cancel{15}_3} = 400 \text{ g} \\ \text{And } \frac{3}{20} \times 4000 \text{ g} &= \frac{3 \times \cancel{4000}^{200}}{\cancel{20}} \text{ g} \\ &= 600 \text{ g} \quad (\because 1 \text{ kg} = 1000 \text{ g}) \\ \therefore 600 \text{ g is heavier than } 400 \text{ g} \\ \therefore \frac{3}{20} \text{ of } 4 \text{ kg is heavier than } \frac{12}{15} \text{ of } 500 \text{ grams.} \end{aligned}$$

Question 13

Evaluate the following.

$$\begin{aligned}
3 + \frac{7}{9} &= 3 \times \frac{9}{9} = \frac{3 \times 9}{9} = \frac{27}{9} = 3\frac{6}{9} \\
\frac{14}{4} + 2 &= \frac{14}{4} \times \frac{2}{2} = \frac{14 \times 2}{4 \times 2} = \frac{28}{8} = 3\frac{4}{8} \\
\frac{2}{3} + \frac{2}{3} &= \frac{2}{3} \times \frac{3}{3} = \frac{2 \times 3}{3 \times 3} = \frac{6}{9} = \frac{2}{3} \\
\frac{14}{6} + \frac{7}{3} &= \frac{14}{6} \times \frac{3}{3} = \frac{14 \times 3}{6 \times 3} = \frac{42}{18} = 2\frac{14}{18} \\
\frac{4}{3} + \frac{3}{4} &= \frac{4}{3} \times \frac{4}{4} = \frac{16}{12} = 1\frac{4}{12} \\
\frac{7}{4} + \frac{1}{7} &= \frac{7}{4} \times \frac{7}{7} = \frac{49}{28} = 1\frac{21}{28} \\
\frac{8}{2} + \frac{4}{15} &= \frac{8}{2} \times \frac{15}{15} = \frac{8 \times 15}{2 \times 15} = \frac{120}{30} = 4 \\
\frac{1}{5} + \frac{1}{9} &= \frac{1}{5} \times \frac{9}{9} = \frac{9}{45} = \frac{1}{5} \\
\frac{1}{6} + \frac{11}{12} &= \frac{1}{6} \times \frac{12}{12} = \frac{1 \times 12}{6 \times 12} = \frac{12}{72} = \frac{1}{6} \\
3\frac{2}{3} + 1\frac{3}{8} &= \frac{11}{3} + \frac{11}{8} = \frac{11}{3} \times \frac{8}{8} = \frac{88}{24} = 3\frac{22}{24}
\end{aligned}$$

Question 2

For each question, choose the correct expression and simplify.

(a)

Maria bought 8 m of lace.

She used

$$\frac{1}{4} \text{ m}$$

for each bag.

How many bags did she decorate?

Correct Expression

$$8 \div \frac{1}{4}$$

Solution

$$8 \times 4 = 32$$

Answer

$$\boxed{32}$$

bags

(b)

$$\frac{3}{4}$$

metre ribbon is used to make 8 badges.

Find ribbon used for one badge.

Correct Expression

$$\frac{3}{4} \div 8$$

Solution

$$\frac{3}{4} \times \frac{1}{8} = \frac{3}{32}$$

Answer

$$\boxed{\frac{3}{32} \text{ m}}$$

(c)

A baker needs

$$\frac{1}{6}$$

kg flour for one loaf.

He has 5 kg flour.

How many loaves can be made?

Correct Expression

$$5 \div \frac{1}{6}$$

Solution

$$5 \times 6 = 30$$

Answer

30

loaves

Question 15

If

$$\frac{3}{4}$$

kg flour is used to make 12 rotis,

how much flour is needed for 6 rotis?

Solution

6 rotis is half of 12 rotis.

Therefore flour needed is half of

$$\frac{3}{4}$$

kg.

$$\frac{1}{2} \times \frac{3}{4} = \frac{3}{8}$$

Answer

$$\boxed{\frac{3}{8} \text{ kg}}$$

Question 4

Patiganita, written by Sridharacharya in the 9th century CE, asks:

What sum is obtained by adding together

$$\frac{1}{2}, \frac{1}{3}, \frac{1}{4},$$

and

$$1 \div \frac{1}{5}$$

Solution

First,

$$1 \div \frac{1}{5} = 5$$

Now,

$$\frac{1}{2} + \frac{1}{3} + \frac{1}{4} + 5$$

$$\text{LCM} = 12$$

$$\begin{aligned}
 &= \frac{6}{12} + \frac{4}{12} + \frac{3}{12} + 5 \\
 &= \frac{13}{12} + 5 \\
 &= \frac{73}{12} \\
 &= 6\frac{1}{12}
 \end{aligned}$$

Answer

$$6\frac{1}{12}$$

Question 17

Mira is reading a 400-page novel.

Yesterday she read

$$\frac{1}{5}$$

of the pages.

Today she read

$$\frac{3}{10}$$

of the pages.

How many pages remain unread?

Solution

Yesterday:

$$\frac{1}{5} \times 400 = 80$$

Today:

$$\frac{3}{10} \times 400 = 120$$

Total read:

$$80 + 120 = 200$$

Remaining:

$$400 - 200 = 200$$

Answer

200 pages

Question 18

A car runs 16 km using 1 litre of petrol.

How far will it go using

$$2\frac{1}{2}$$

litres?

Solution

$$2\frac{1}{2} = \frac{5}{2}$$

Distance

$$16 \times \frac{5}{2} = 40$$

Answer

$$\boxed{40 \text{ km}}$$

Question 19

Amritpal decides on a destination for his vacation.

- By train $\rightarrow$ 5 hours
- By plane $\rightarrow \frac{3}{4}$ hour

How many hours does the plane save?

Solution

Time by train

5 hours

Time by plane

$\frac{3}{4}$ hour

Difference

$$5 - \frac{3}{4}$$

Convert 5 into fourths:

$$5 = \frac{20}{4}$$

Therefore,

$$\frac{20}{4} - \frac{3}{4} = \frac{17}{4} = 4\frac{1}{4}$$

Answer

$$4\frac{1}{4} \text{ hours}$$

The plane saves **4¼ hours**.

Question 20

Mariam's grandmother baked a cake.

Mariam and her cousins finished

$$\frac{2}{3}$$

of the cake.

The remaining cake was shared equally by Mariam's three friends.

How much cake did each friend get?

Solution

The remaining cake is

$$1 - \frac{4}{5} = \frac{5 - 4}{5} = \frac{1}{5}$$

NCERT Solutions Class 7 Maths

So, $\frac{1}{5}$ of the cake is shared equally by Mariam's three friends.

$$\therefore \text{Each of the friend got } \frac{1}{5} \div 3 = \frac{1}{5} \times \frac{1}{3} = \frac{1}{15}$$

$$\therefore \text{Thus, each friend got } \frac{1}{15} \text{ of the cake.}$$

Question 9

Choose the option(s) describing the product of

$$\frac{5}{4} \times \frac{7}{6}$$

Options:

(a) $> \frac{5}{4}$

(b) $< \frac{5}{4}$

(c) $> \frac{7}{6}$

(d) $< \frac{7}{6}$

(e) > 1

(f) < 1

Solution

$$\begin{aligned}\frac{5}{4} \times \frac{7}{6} &= \frac{35}{24} \\ &= 1 \frac{11}{24}\end{aligned}$$

Since

$$\frac{35}{24} > \frac{5}{4}$$

Option (a) ✓

Since

$$\frac{35}{24} > \frac{7}{6}$$

Option (c) ✓

Since

$$\frac{35}{24} > 1$$

Option (e) ✓

Correct Options

(a), (c), (e)

Question 22

What fraction of the whole square is shaded?

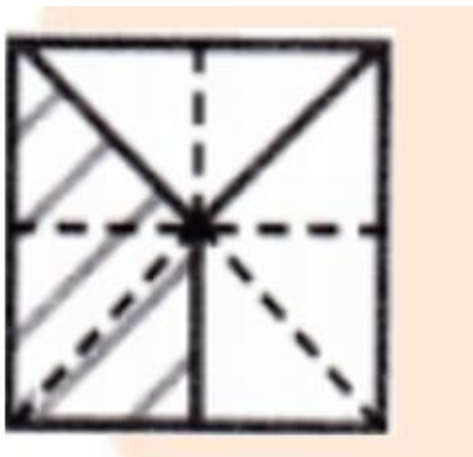
Diagram from the book (simplified)

The large square is divided into 4 equal smaller squares.

One small square is further divided into 8 equal triangles.

Out of those 8 triangles, 3 are shaded.

Solution



One small square occupies

$$\frac{1}{4}$$

of the large square.

Within that square,

$$\frac{3}{8}$$

is shaded.

Therefore,

$$\frac{1}{4} \times \frac{3}{8} = \frac{3}{32}$$

Answer

$$\boxed{\frac{3}{32}}$$

of the whole square is shaded.

Question 23

A colony of ants searches for food.

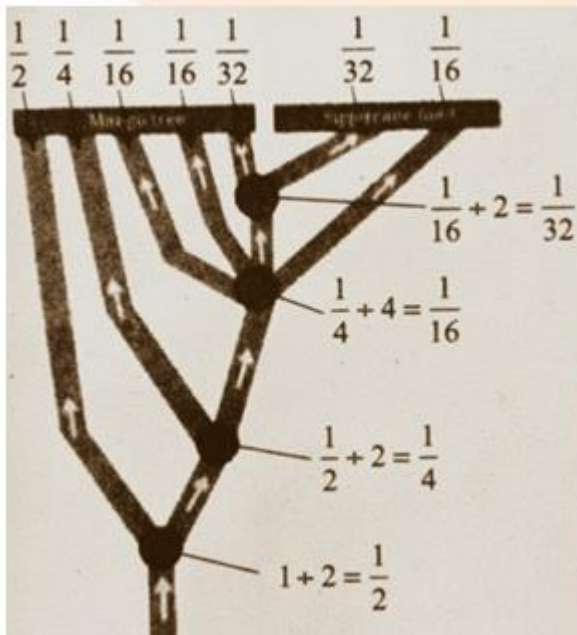
At each branching point, the ants split equally.

Two food sources are reached:

- Mango tree
- Sugarcane field

Find the fraction of the original group reaching each food source.

Solution



First split

$$1 \div 2 = \frac{1}{2}$$

goes each way.

Second split

$$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

Third split

Into four equal branches:

$$\frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$$

Fourth split

Into two equal branches:

$$\frac{1}{16} \times \frac{1}{2} = \frac{1}{32}$$

Following the route shown in the textbook,

Mango tree

$$\boxed{\frac{1}{2}}$$

of the ants reach the mango tree.

Sugarcane field

$$\boxed{\frac{1}{32}}$$

of the ants reach the sugarcane field.

(These values follow the branching pattern shown in the figure.)

Question 24

Find

$$1 - \frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \times \cdots \times \frac{99}{100}$$

Make a general statement and explain.

Solution

Observe the pattern:

$$\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \times \cdots \times \frac{99}{100}$$

Every denominator cancels the next numerator.

$$1/2 \times 2/3 \times 3/4 \times 4/5 \times \dots \times 99/100$$

$\uparrow \quad \uparrow \quad \uparrow \quad \uparrow$
 cancel cancel cancel cancel

Only the first numerator and the last denominator remain.

$$= \frac{1}{100}$$

Therefore,

$$1 - \frac{1}{100} = \frac{99}{100}$$

Answer

$$\boxed{\frac{99}{100}}$$

General Statement

For

$$\frac{1}{2} \times \frac{2}{3} \times \frac{3}{4} \times \dots \times \frac{n-1}{n}$$

all middle terms cancel.

Result:

$$\boxed{\frac{1}{n}}$$

This is called a **telescoping product**.

Practice Time 8.1

1.

$$\frac{2}{5} \times 25 = \frac{2 \times 25}{5} = 10$$

Answer: 10

2.

$$18 \times \frac{2}{9} = \frac{18}{9} \times 2 = 2 \times 2 = 4$$

Answer: 4

3.

$$\frac{7}{8} \times \frac{12}{21} = \frac{1}{2}$$

Answer: $\frac{1}{2}$

4.

$$\frac{5}{6} \times \frac{9}{10} = \frac{45}{60} = \frac{3}{4}$$

Answer: $\frac{3}{4}$

5.

$$2\frac{1}{3} \times \frac{3}{14} = \frac{7}{3} \times \frac{3}{14} = \frac{7}{14} = \frac{1}{2}$$

Answer: $\frac{1}{2}$

6.

$$\frac{4}{7} \times \frac{21}{16} = \frac{3}{4}$$

Answer: $\frac{3}{4}$

7.

$$\begin{aligned} & \left(\frac{5}{12} \times \frac{18}{20}\right) \times \frac{10}{3} \\ &= \frac{3}{8} \times \frac{10}{3} = \frac{30}{24} = \frac{5}{4} \end{aligned}$$

Answer: $\frac{5}{4}$

Practice Time 8.2

1.

$$\frac{3}{4} \div \frac{5}{6} = \frac{3}{4} \times \frac{6}{5} = \frac{9}{10}$$

Answer: $\frac{9}{10}$

2.

$$\frac{2}{7} \div \frac{14}{27} = \frac{2}{7} \times \frac{27}{14} = \frac{27}{49}$$

Answer: $\frac{27}{49}$

3.

$$5 \div \frac{2}{3} = 5 \times \frac{3}{2} = \frac{15}{2}$$

Answer: $7\frac{1}{2}$

4.

$$\frac{3}{5} \div 6 = \frac{3}{5} \times \frac{1}{6} = \frac{1}{10}$$

Answer: $\frac{1}{10}$

5.

$$2\frac{1}{2} \div \frac{5}{8} = \frac{5}{2} \times \frac{8}{5} = 4$$

Answer: 4

6.

Compare:

$$\frac{2}{3} \div \frac{3}{4} = \frac{8}{9}$$

$$\frac{2}{3} \div \frac{2}{3} = 1$$

Since

$$1 > \frac{8}{9}$$

Answer: $\frac{2}{3} \div \frac{2}{3}$ is larger.

Practice Time 8.3

1.

Milk per cup

$$\frac{5}{6} \div 10 = \frac{5}{60} = \frac{1}{12} \text{ L}$$

Answer: $\frac{1}{12}$ L

2.

Area of one tile

$$\frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$$

Number of tiles

$$\frac{7}{4} \div \frac{1}{9} = \frac{7}{4} \times 9 = \frac{63}{4} = 15\frac{3}{4}$$

Answer: $15\frac{3}{4}$ tiles

3.

Tap A fills in 1 day.

Rate = 1 tank/day

Tap B fills in $\frac{1}{4}$ day.

Rate = 4 tanks/day

Together:

$$1 + 4 = 5$$

Time

$$\frac{1}{5} \text{ day}$$

Answer: $\frac{1}{5}$ day

4.

One small square

$$= \frac{1}{4}$$

Half of one small square

$$= \frac{1}{2} \times \frac{1}{4} = \frac{1}{8}$$

Answer: $\frac{1}{8}$

5.

Center square area

$$= \frac{1}{9}$$

Shaded part

$$\frac{2}{3} \times \frac{1}{9} = \frac{2}{27}$$

Answer: $\frac{2}{27}$

6.

$$\frac{2}{3} \times \frac{3}{5} \times \frac{1}{4} = \frac{6}{60} = \frac{1}{10}$$

Answer: $\frac{1}{10}$ of the coin

Exam Time MCQs

1.

$$\frac{2}{5} \times 3 = \frac{6}{5}$$

Answer: (d) $\frac{6}{5}$

2.

$$\frac{3}{4} \times \frac{2}{5} = \frac{6}{20} = \frac{3}{10}$$

Answer: (b) $\frac{3}{10}$

3.

$$3 \div \frac{1}{4} = 12$$

Answer: (b) 12

4.

$$\frac{2}{3} \div \frac{3}{5} = \frac{2}{3} \times \frac{5}{3} = \frac{10}{9}$$

Answer: (a) $\frac{10}{9}$

5.

If $0 < p < 1$ and $0 < q < 1$,
their product is less than both.

Answer: (b) Less than both

Fill in the Blanks

1. $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$
2. reciprocal
3. $\frac{3}{5}$ of 60 = 36
4. $\frac{2}{3} \div 2 = \frac{1}{3}$
5. factors

True / False

1. True
2. True
3. True
4. True
5. False

Match the Columns

Column A

Column B

1. Multiply by reciprocal c
 2. Fraction $\times$ Fraction d
 3. Whole $\times$ Fraction b
 4. Unit square model a
 5. Product size prediction e
-

Very Short Answer Questions

1.

Reciprocal of $\frac{7}{9}$

$$\frac{9}{7}$$

2.

For $\frac{3}{5} \times \frac{4}{7}$

Equal parts:

$$5 \times 7 = 35$$

Answer: 35

3.

Dividing by a fraction less than 1 makes the number larger.

4.

Multiply numerators and multiply denominators.

5.

$$1 = \frac{1}{1}$$

Short Answer Questions

1.

$$\frac{3}{4} \times 20 = 15$$

Since $15 < 20$, $\frac{3}{4} \times 20$ is less than 20.

2.

$$\frac{6}{14} \times \frac{7}{9} = \frac{3}{7} \times \frac{7}{9} = \frac{1}{3}$$

3.

Because a whole number can be written as a fraction with denominator 1, then multiply normally.

4.

Compare the fraction with 1:

- Fraction $< 1 \Rightarrow$ product becomes smaller.
- Fraction $> 1 \Rightarrow$ product becomes larger.

5.

Area model:

$$\frac{2}{3} \times \frac{1}{4} = \frac{2}{12} = \frac{1}{6}$$

Long Answer Questions

1.

$$\frac{3}{5} \times \frac{4}{7} = \frac{12}{35}$$

2.

Example:

$$6 \div \frac{1}{4} = 24$$

Meaning: 24 quarter-units fit into 6 wholes.

3.

$$\frac{5}{6} \times \frac{18}{25} \times \frac{10}{3}$$

Cancel:

$$\frac{5}{6} \times \frac{18}{25} \times \frac{10}{3} = \frac{1 \times 3 \times 2}{1 \times 5 \times 1} = \frac{6}{5}$$

4.

Cyclist speed = 42 km/h

(a)

$$42 \times \frac{2}{3} = 28 \text{ km}$$

(b)

$$42 \times \frac{5}{7} = 30 \text{ km}$$

(c)

$$42 \times \frac{3}{2} = 63 \text{ km}$$

5.

$$\frac{3}{4} \times \frac{2}{5} = \frac{6}{20} = \frac{3}{10}$$

Answer: $\frac{3}{10}$

Competency-Based Questions

Assertion–Reason

1.

Assertion:

$$a \div \frac{1}{b} = ab$$

True.

Reason: Division by a fraction equals multiplication by its reciprocal.

True.

Reason correctly explains assertion.

Answer: (a)

2.

If $0 < p < 1$ and $q > 1$,

$pq > q$ is False.

Reason statement is True.

Answer: (d)

Case-Based Question

Machine A prints 360 pages/hour.

(a)

$$360 \times \frac{3}{4} = 270$$

Answer: 270 pages

(b) 108 pages

(d) 360

Grade 7 Maths - Part 2

Chapter 1 Geometric Twins

NCERT CORNER

INTEXT QUESTION

Question 1.

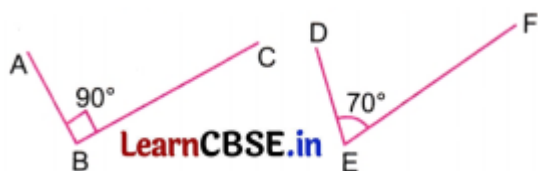
Check if the two figures are congruent.



Solution:

Let's measure the angles above with a protractor.

We found as follows:



Here, $\angle ABC$ does not coincide with $\angle DEF$.

Hence, the given figures are not congruent.

Figure it out

Question 1.

Circle the pairs that appear congruent.



Solution:

(a) and (d) are congruent. As they can be superimposed exactly.

Question 3.

What measurements would you take to create a figure congruent to a given:

(a) Circle

(b) Rectangle

Using this, state how you would check if two

(a) Are circles congruent?

(b) Rectangles are congruent?

Solution:

(a) I will measure the radius or diameter of the given circle.

(b) I will measure the length and breadth of the given rectangle.

(a) I will place one circle over another circle.

If they exactly superimpose, they are congruent.

In this case, both will have the same radius.

(b) I will place one rectangle over another rectangle.

If they exactly superimpose, they are congruent.

In such a case, both will have the same length and breadth.

Question 4.

How would we check if two figures like the one below are congruent?



Use this to identify whether each of the following pairs is congruent.



Solution:

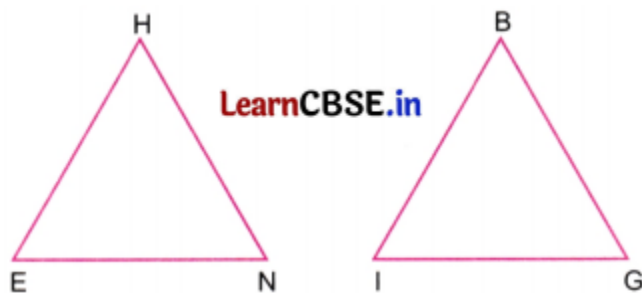
To check if the two figures are congruent, one would need to measure the lengths of the corresponding line segments and the angle between them. Yes, each of the given figures is congruent. Length of line segments in each figure is 3.3 cm (Horizontal line) and 2.3 cm (Vertical line), and the angle between them is 82° .

Question 5.

Suppose $\triangle HEN$ is congruent to $\triangle BIG$. List all the other correct ways of expressing this congruence.

Solution:

Given



$\triangle HEN = \triangle BIG$ means that the vertices H, E, and N correspond to B, I, and G, respectively.

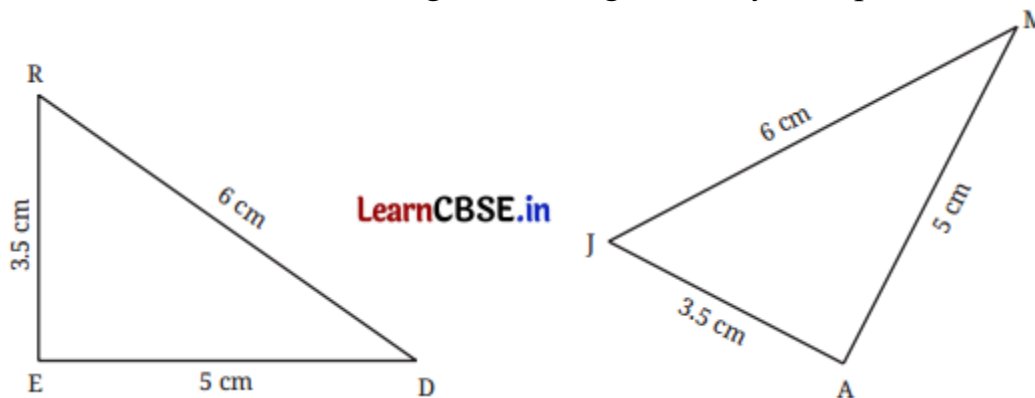
There are six ways to write a congruence statement for two congruent triangles.

The other five ways are

- (i) $\triangle HNE \cong \triangle BGI$
- (ii) $\triangle EHN \cong \triangle IBG$
- (iii) $\triangle ENH \cong \triangle IGB$
- (iv) $\triangle NHE \cong \triangle GBI$
- (v) $\triangle NEH \cong \triangle GIB$

Question 6.

Determine whether the triangles are congruent. If yes, express the congruence.



Solution:

Given the side lengths of the two triangles

$RE = 3.5$ cm, $ED = 5$ cm, $RD = 6$ cm

and $JA = 3.5$ cm, $AM = 5$ cm, $JM = 6$ cm

Clearly $RE = JA = 3.5$ cm

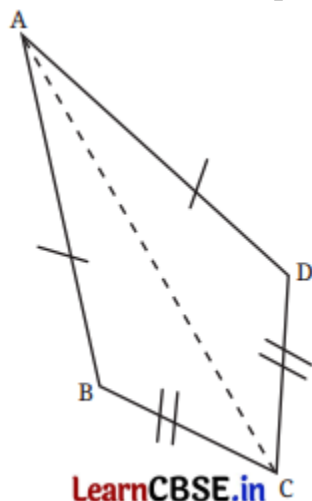
$ED = AM = 5$ cm

$RD = JM = 6$ cm

Hence $\triangle RED \cong \triangle JAM$.

Question 7.

In the figure below, $AB = AD$, $CB = CD$. Can you identify any pair of congruent triangles? If yes, explain why they are congruent. Does AC divide $\angle BAD$ and $\angle BCD$ into two equal parts? Give reasons.



Solution:

Given $AD = AB$

$CB = CD$

$AC = AC$ (Common side)

Since all three sides of $\triangle ABC$ are equal to the corresponding three sides $\triangle ADC$, the triangles are congruent by the side-side-side (SSS) congruence criterion.

Hence $\triangle ABC \cong \triangle ADC$

Yes, AC divides $\angle BAD$ and $\angle BCD$ into equal parts.

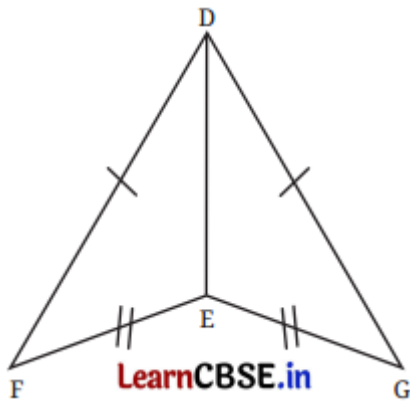
Since $\triangle ABC \cong \triangle ADC$

Then, $\angle BAC = \angle DAC$ and $\angle BCA = \angle DCA$

This means that AC bisects both $\angle BAD$ and $\angle BCD$.

Question 8.

In the figure below, are $\triangle DFE$ and $\triangle GED$ congruent to each other? It is given that $DF = DG$ and $FE = GE$.



Solution:

Given $DF = DG$ and $FE = GE$

The side DE is common to both triangles $\triangle DFE$ and $\triangle DGE$

Hence, by the SSS congruence criterion

$\triangle DFE \cong \triangle DGE$

The order of the vertices matters in congruence statements.

The vertices must correspond correctly.

In $\triangle DFE$ and $\triangle DGE$

DF corresponds to DG

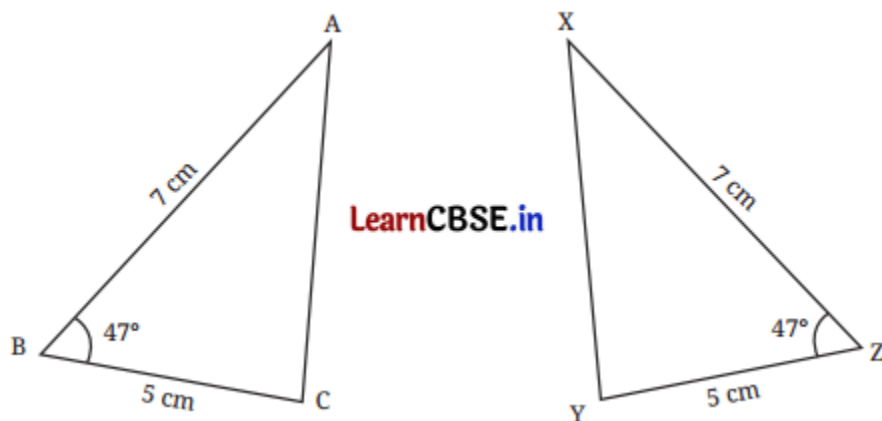
FE corresponds to EG

ED is common.

Given statements $DF = DG$ and $FE = GE$ do not support the congruence of $\triangle DFE$ and $\triangle GED$ because the corresponding sides are not equal.

Question 9.

Identify whether the triangles below are congruent. What conditions did you use to establish their congruence? Express the congruence.



Solution:

Here, $BC = ZY = 5 \text{ cm}$

$BA = ZX = 7 \text{ cm}$

$\angle ABC = \angle XZY = 47^\circ$

$\triangle ABC \cong \triangle XZY$

Since the two sides and the included angle of triangle ABC are equal to the two sides and the included angle of triangle XZY.

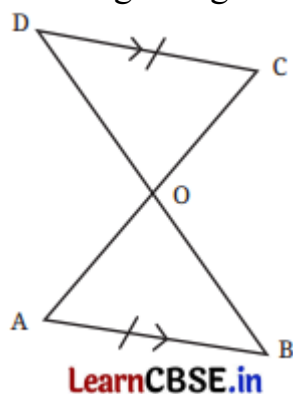
The triangles are congruent by the side-angle-side condition.

It can be expressed as $\triangle ABC \cong \triangle XZY$.

Question 10.

Given that CD and AB are parallel, and $AB = CD$, what are the other equal parts in this figure?

(Hint: When the lines are parallel, the alternate angles are equal. Are the two resulting triangles congruent? If so, express the congruence.)



Solution:

Given that $DC \parallel AB$; $AB = CD$

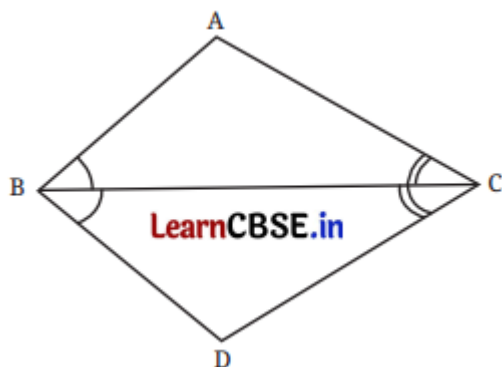
$\angle OCD = \angle OAB$; $\angle OBA = \angle ODC$ ($\because$ Alternate Angles)

$\angle DOC = \angle BOA$

$OA = OC$; $OB = OD$

Question 11.

Given that $\angle ABC = \angle DBC$ and $\angle ACB = \angle DCB$, show that $\angle BAC = \angle BDC$.
Are the two triangles congruent?



Solution:

Let $\angle ABC = a = \angle DBC$

and let $\angle ACB = b = \angle DCB$

BC is a common side of the two triangles, then $\triangle ABC \cong \triangle DCB$

Angle Side Angle Congruence:

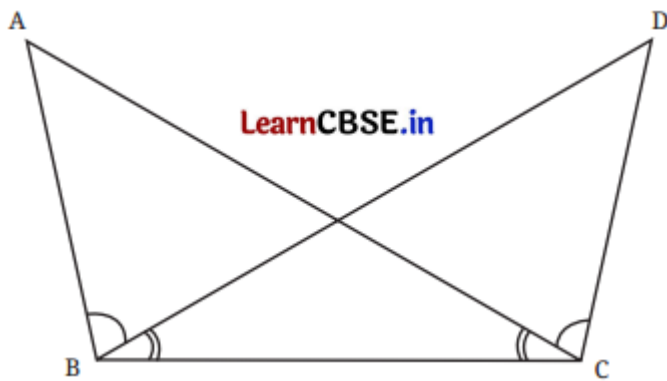
When two triangles are congruent, their corresponding parts are equal [CPCT]

Since $\triangle ABC \cong \triangle DCB$, their corresponding angles are equal.

Hence $\angle BAC = \angle BDC$

Question 12.

Identify the equal parts in the following figure, given that $\angle ABD = \angle DCA$ and $\angle ACB = \angle DBC$.



Solution:

Given $\angle ABD = \angle DCA$; $\angle ACB = \angle DBC$

$\angle AOB = \angle DOC$ ($\because$ They are vertically opposite angles)

$AO = DO$; $CO = BO$

$\triangle COD \cong \triangle BOA$

Practice Time 1.1

Q1. Name the angle congruent to:

Given:

$$\angle AOB = \angle BOC = \angle COD$$

(a) $\angle AOB$

Answer: $\angle BOC$ and $\angle COD$

(b) $\angle BOD$

$$\angle BOD = \angle BOC + \angle COD$$

Since $\angle BOC = \angle COD$,

$$\angle BOD = 2 \text{ equal parts}$$

Similarly,

$$\angle AOC = \angle AOB + \angle BOC$$

$$\angle AOC = 2 \text{ equal parts}$$

Answer: $\angle AOC$

Q2.

Given:

$$\angle POQ \cong \angle ROS$$

Since

$$\angle POR = \angle POQ + \angle QOR$$

and

$$\angle QOS = \angle QOR + \angle ROS$$

$$\text{Given } \angle POQ = \angle ROS$$

Therefore

$$\angle POR = \angle QOS$$

Answer: Yes, $\angle POR \cong \angle QOS$.

Q3.

Given:

$$a = b = c$$

$$\angle AOC = a + b + c$$

$$\angle AOB = a + b$$

$$\angle BOC = b + c$$

Since $a = b = c$,

$$\angle AOB = 2a$$

$$\angle BOC = 2a$$

Therefore

$$\angle AOB \cong \angle BOC$$

Q4.

Given:

$$PQ \cong RS$$

Need to check if $PR \cong QS$.

On line AB:

$$PR = PQ + QR$$

$$QS = QR + RS$$

$$\text{Given } PQ = RS$$

Therefore

$$PR = QS$$

Answer: Yes, $PR \cong QS$.

Q5.

Given:

$$\triangle ABC \cong \triangle FED$$

Correspondence:

$$A \leftrightarrow F$$

$$B \leftrightarrow E$$

$$C \leftrightarrow D$$

Therefore

Corresponding sides

$$AB = FE$$

$$BC = ED$$

$$AC = FD$$

Corresponding angles

$$\angle A = \angle F$$

$$\angle B = \angle E$$

$$\angle C = \angle D$$

Q6.

Rectangle ABCD $\cong$ Rectangle PQRS

$$AB = 6 \text{ cm}$$

$$QR = 4 \text{ cm}$$

In congruent rectangles

$$AB = PQ$$

$$BC = QR$$

Therefore

$$\mathbf{PQ = 6 \text{ cm}}$$

$$\mathbf{BC = 4 \text{ cm}}$$

Practice Time 1.2

Q1(a)

$\triangle COD$ and $\triangle AOB$

$$CD = AB = 5 \text{ cm}$$

$$\angle C = 40^\circ = \angle B$$

$$\angle D = 60^\circ = \angle A$$

Two angles and included side equal

Property:

ASA

Congruence:

$$\triangle COD \cong \triangle BOA$$

Q1(b)

$$PQ = PR$$

$$LM = MN$$

$$\angle P = \angle M = 70^\circ$$

Included sides equal

Property:

SAS

Congruence:

$$\triangle PQR \cong \triangle MLN$$

Q1(c)

Right triangles

$$YX = NP = 6 \text{ cm}$$

$$ZX = MP = 8 \text{ cm}$$

$$\angle Y = \angle N = 90^\circ$$

Property:

RHS

Congruence:

$$\triangle YXZ \cong \triangle NPM$$

Q1(d)

Opposite sides marked equal

$$PQ = SR$$

$$PS = QR$$

QS common

Property:

SSS

Congruence:

$$\triangle PQS \cong \triangle SRQ$$

Q1(e)

$$BC = DE = 6 \text{ cm}$$

$$\angle B = 60^\circ$$

$$\angle C = 40^\circ$$

$$\angle E = 60^\circ$$

$$\angle D = 40^\circ$$

Property:

ASA

Congruence:

$$\triangle ABC \cong \triangle FED$$

Q1(f)

$$AB = QR = 6 \text{ cm}$$

$$AC = PR = 5 \text{ cm}$$

$$BC = PQ = 3 \text{ cm}$$

Property:

SSS

Congruence:

$$\triangle ABC \cong \triangle RQP$$

Q2

Given:

$$PL \perp OB$$

$$PM \perp OA$$

$$PL = PM$$

In $\triangle PLO$ and $\triangle PMO$

$$\angle PLO = 90^\circ$$

$$\angle PMO = 90^\circ$$

OP common

$$PL = PM$$

Therefore by RHS

Answer:

$$\triangle PLO \cong \triangle PMO$$

Q3

Given

$$AB = DE$$

$$AC = DF$$

$$BF = CF$$

$$BC = BF + FC$$

$$BC = CF + FE$$

Since $BF = CF$

$$BC = FE$$

Now

$$AB = DE$$

$$AC = DF$$

$$BC = FE$$

Therefore by SSS

Answer:

Yes, triangles are congruent.

$$\triangle ABC \cong \triangle DEF$$

Q4

Given

AD bisects $\angle A$

$$AD \perp BC$$

In $\triangle ADB$ and $\triangle ADC$

$$\angle ADB = \angle ADC = 90^\circ$$

AD common

$$\angle BAD = \angle DAC$$

Therefore

(a)

$$\triangle ADB \cong \triangle ADC$$

(b)

ASA

Q5

AB and CD bisect each other at O

$$AO = OB$$

$$CO = OD$$

$$\angle AOC = \angle BOD \text{ (vertically opposite)}$$

Therefore by SAS

(a)

$$\triangle AOC \cong \triangle BOD$$

(b)

$$AC \parallel BD$$

(c)

$$AC = BD$$

Practice Time 1.3

Q1

$$AB = AC$$

$$\Rightarrow \angle B = \angle C$$

$$\text{Sum of angles} = 180^\circ$$

$$\angle B + \angle C = 180^\circ - 40^\circ$$

$$= 140^\circ$$

$$\text{Each angle} = 70^\circ$$

Answer:

$$\angle B = 70^\circ, \angle C = 70^\circ$$

Q2

$$PQ = PR$$

$$\Rightarrow \angle Q = \angle R$$

$$\angle Q = 55^\circ$$

$$\angle R = 55^\circ$$

$$\angle P = 180^\circ - 55^\circ - 55^\circ$$

$$= 70^\circ$$

Answer:

$$\angle R = 55^\circ, \angle P = 70^\circ$$

Q3

$$XY = XZ$$

$$\Rightarrow \angle Y = \angle Z$$

$$\angle Z = 48^\circ$$

$$\angle Y = 48^\circ$$

$$\begin{aligned}\angle X &= 180^\circ - 48^\circ - 48^\circ \\ &= 84^\circ\end{aligned}$$

Answer:

$$\angle Y = 48^\circ, \angle X = 84^\circ$$

Q4

$$LM = LN$$

$$\Rightarrow \angle M = \angle N$$

$$\angle M = 62^\circ$$

$$\angle N = 62^\circ$$

$$\begin{aligned}\angle L &= 180^\circ - 62^\circ - 62^\circ \\ &= 56^\circ\end{aligned}$$

Answer:

$$\angle N = 62^\circ, \angle L = 56^\circ$$

Q5

$$DE = DF$$

$$\Rightarrow \angle E = \angle F$$

$$\angle D = 110^\circ$$

$$\angle E + \angle F = 70^\circ$$

$$\text{Each} = 35^\circ$$

Answer:

$$\angle E = 35^\circ, \angle F = 35^\circ$$

Exam Time

MCQs

1.

$$AB = AC$$

Angles opposite equal sides are equal

Answer:

(b) $\angle B = \angle C$

2.

$$AB = AC \text{ and } \angle A = 50^\circ$$

$$\text{Remaining angles} = 130^\circ$$

$$\text{Each} = 65^\circ$$

Answer:

(b) 65°

3.

Equilateral triangle

$$\text{Each angle} = 60^\circ$$

Answer:

(c) 60°

4.

$60^\circ, 60^\circ, 60^\circ$

All sides equal

Answer:

(c) Equilateral

5.

$PQ = PR$

Angles opposite equal sides equal

Answer:

(b) $\angle Q$ and $\angle R$

– Fill in the Blanks

1. If two sides of a triangle are equal, then the angles opposite them are **equal**.
 2. In an equilateral triangle, $AB = BC = CA$ and $\angle A = \angle B = \angle C = \mathbf{60^\circ}$.
 3. Sum of angles of any triangle is **180°** .
 4. In $\triangle ABC$, if $AB = AC$, then $\angle B = \angle C$.
 5. In RHS congruence, "R" stands for **Right-angled** triangle.
-

C. Write True or False

1. AAA condition is enough to make two triangles congruent.
False
2. In an equilateral triangle, all sides and all angles are equal.
True
3. If $AB = AC$, then $\angle A = \angle B$.
False
4. If two triangles are congruent, their corresponding angles are equal.
True
5. The base angles of an isosceles triangle are always equal.
True

D. Match the Columns

Column A

1. Isosceles triangle
2. Equilateral triangle
3. Congruent triangles
4. Similar triangles
5. Base angles (isosceles)

Column B

- (b) Two sides equal
- (a) All sides equal
- (d) Same shape and same size
- (c) Same shape, different sizes
- (e) Equal angles at the base

Answers:

- 1 → b
2 → a
3 → d
4 → c
5 → e
-

E. Very Short Answer Type Questions

1. Define an isosceles triangle.

A triangle having **two equal sides** is called an isosceles triangle.

2. Define an equilateral triangle.

A triangle having **all three sides equal** is called an equilateral triangle.

3. What is the sum of angles of a triangle?

The sum of the three angles of a triangle is **180°**.

4. If $AB = AC$ in $\triangle ABC$, which angles are equal?

Since equal sides subtend equal angles,

$$\angle B = \angle C$$

5. Write the measure of each angle of an equilateral triangle.

Each angle =

$$180^\circ \div 3 = \mathbf{60^\circ}$$

F. Short Answer Type Questions

1. In $\triangle ABC$, $AB = AC$ and $\angle A = 36^\circ$. Find $\angle B$ and $\angle C$.

Given:

$$AB = AC$$

$$\Rightarrow \angle B = \angle C$$

Let

$$\angle B = \angle C = x$$

Using angle sum property,

$$x + x + 36^\circ = 180^\circ$$

$$2x = 144^\circ$$

$$x = 72^\circ$$

Answer:

$$\angle B = 72^\circ$$

$$\angle C = 72^\circ$$

2. In $\triangle PQR$, $PQ = PR$ and $\angle Q = 58^\circ$. Find $\angle R$ and $\angle P$.

Given:

$$PQ = PR$$

$$\Rightarrow \angle Q = \angle R$$

$$\angle R = 58^\circ$$

Using angle sum property,

$$\angle P + 58^\circ + 58^\circ = 180^\circ$$

$$\angle P = 180^\circ - 116^\circ$$

$$\angle P = 64^\circ$$

Answer:

$$\angle R = 58^\circ$$

$$\angle P = 64^\circ$$

G. Long Answer Type Questions

1. In $\triangle ABC$, $AB = AC$ and $\angle A = 80^\circ$. Draw altitude $AD \perp BC$. Prove $\angle B = \angle C$ using RHS congruence.

Proof

Given:

$$AB = AC$$

$$AD \perp BC$$

Consider $\triangle ADB$ and $\triangle ADC$

$$AD = AD \text{ (common)}$$

$$AB = AC \text{ (given)}$$

$$\angle ADB = \angle ADC = 90^\circ$$

Therefore,

$$\triangle ADB \cong \triangle ADC \text{ (RHS)}$$

By CPCT,

$$\angle ABD = \angle ACD$$

Since D lies on BC,

$$\angle ABD = \angle B$$

and

$$\angle ACD = \angle C$$

Therefore,

$$\angle B = \angle C$$

Hence proved.

2. Prove that each angle of an equilateral triangle is 60° .**Proof**

Let $\triangle ABC$ be an equilateral triangle.

$$AB = BC = CA$$

Therefore,

$$\angle A = \angle B = \angle C$$

Let each angle = x

Using angle sum property,

$$x + x + x = 180^\circ$$

$$3x = 180^\circ$$

$$x = 60^\circ$$

Therefore,

$$\angle A = \angle B = \angle C = 60^\circ$$

Hence proved.

3. In $\triangle ABC$, $AB = AC$ and $\angle B = 2x + 10^\circ$, $\angle C = 3x - 5^\circ$. Find x and all angles.

$$AB = AC$$

$$\Rightarrow \angle B = \angle C$$

$$2x + 10 = 3x - 5$$

$$x = 15$$

$$\angle B = 2(15) + 10$$

$$= 40^\circ$$

$$\angle C = 3(15) - 5$$

$$= 40^\circ$$

$$\angle A = 180^\circ - 40^\circ - 40^\circ$$

$$= 100^\circ$$

Answer:

$$x = 15$$

$$\angle A = 100^\circ$$

$$\angle B = 40^\circ$$

$$\angle C = 40^\circ$$

4. In $\triangle PQR$, $PQ = PR$. The vertex angle $\angle P = (5y + 20)^\circ$ and each base angle $= (2y + 10)^\circ$. Find y and all angles.

Using angle sum property,

$$(5y + 20) + (2y + 10) + (2y + 10) = 180$$

$$9y + 40 = 180$$

$$9y = 140$$

$$y = 140/9$$

$$\approx 15.56$$

Angles:

$$\angle P = 5(140/9) + 20$$

$$= 880/9^\circ$$

$$\approx 97.78^\circ$$

$$\angle Q = \angle R$$

$$= 2(140/9) + 10$$

$$= 370/9^\circ$$

$$\approx 41.11^\circ$$

Answer:

$$y = 140/9$$

$$\angle P \approx 97.78^\circ$$

$$\angle Q = \angle R \approx 41.11^\circ$$

5. Congruent Triangles in Real Life

Congruent triangles are triangles having the same shape and size. They are used in many structures because they provide strength and stability.

Examples:

1. Bridges

- Triangular frames are used in bridge construction.
- Congruent triangles distribute weight evenly.

2. Roof Trusses

- Roofs of houses contain congruent triangular frames.
- They make the roof strong and stable.

3. Electric Towers

- Metal towers are made using congruent triangles.
- This prevents bending and increases strength.

4. Cranes

- Congruent triangular sections help cranes carry heavy loads safely.

Competency-Based Questions

A. Assertion–Reason

1.

Assertion:

If $AB = AC$ in $\triangle ABC$, then $\angle B = \angle C$.

Reason:

Triangles can be proved congruent using RHS after drawing altitude from A to BC.

Both statements are true and Reason correctly explains Assertion.

Answer:

(a)

2.

Assertion:

Every equilateral triangle has angles 60° , 60° , 60° .

Reason:

Sum of angles of a triangle is 180° and all angles in an equilateral triangle are equal.

Both statements are true and Reason correctly explains Assertion.

Answer:

(a)

B. Case Based Study

Given:

$$AB = AC$$

$$\angle A = 70^\circ$$

$$AD \perp BC$$

1. Which triangles are used to apply RHS congruence?

Answer: (b) $\triangle ADB$ and $\triangle ADC$

2. What is $\angle B$ equal to?

$$AB = AC$$

$\Rightarrow$ Base angles are equal

Answer: (b) $\angle C$

3. Value of each base angle

$$\angle B + \angle C = 180^\circ - 70^\circ$$

$$= 110^\circ$$

$$\text{Each angle} = 55^\circ$$

Answer: (b) 55°

C. Maths Booster

1. Angle Riddle

Triangle has two equal angles.

Third angle = 96°

Remaining angles:

$$180^\circ - 96^\circ = 84^\circ$$

Each equal angle:

$$84^\circ \div 2 = 42^\circ$$

Answer:

42° and 42°

2. Find the Mystery x

Base angles = $(3x + 5)^\circ$ each

Vertex angle = $(2x + 10)^\circ$

Using angle sum property:

$$(3x + 5) + (3x + 5) + (2x + 10) = 180$$

$$8x + 20 = 180$$

$$8x = 160$$

$$x = 20$$

Answer:

$$**x = 20**$$

Chapter 2 Operations with Integers

NCERT CORNER

NCERT Corner – Figure It Out (Detailed Solutions)

1(a) Sum = 27, Difference = 9

Let the numbers be x and y .

Given:

$$x + y = 27$$

$$x - y = 9$$

Adding:

$$2x = 36$$

$$x = 18$$

Then,

$$y = 27 - 18 = 9$$

Answer: 18 and 9

1(b) Sum = 4, Difference = 12

$$x + y = 4$$

$$x - y = 12$$

Adding:

$$2x = 16$$

$$x = 8$$

$$y = 4 - 8 = -4$$

Answer: 8 and -4

1(c) Sum = 0, Difference = 10

$$x + y = 0$$

$$x - y = 10$$

Adding:

$$2x = 10$$

$$x = 5$$

$$y = -5$$

Answer: 5 and -5

1(d) Sum = 0, Difference = -10

$$x + y = 0$$

$$x - y = -10$$

Adding:

$$2x = -10$$

$$x = -5$$

$$y = 5$$

Answer: -5 and 5

1(e) Sum = -7 , Difference = -1

$$x + y = -7$$

$$x - y = -1$$

Adding:

$$2x = -8$$

$$x = -4$$

$$y = -3$$

Answer: -4 and -3

1(f) Sum = -7 , Difference = -13

$$x + y = -7$$

$$x - y = -13$$

Adding:

$$2x = -20$$

$$x = -10$$

$$y = 3$$

Answer: -10 and 3

Intext Questions

1. Conclusion from figures

Figure 1

$$a = +4, b = +2$$

$$a > b$$

Both are positive.

Figure 2

$$a = +3, b = +1$$

$$a > b$$

Both are positive.

Figure 3

$$a = -4, b = -2$$

$$|a| > |b|$$

Both are negative.

Conclusion

The magnitude of a is greater than b in all figures.

Directions may be same (both positive) or opposite (both negative).

2. Final integer in each figure

Each figure represents:

$$-2$$

The answer is same because all represent the integer -2 .

3(a)

$$7 - 18$$

$$= 7 + (-18)$$

$$= -11$$

Statement is correct.

3(b)

$$4 - (-12)$$

$$= 4 + 12$$

$$= 16$$

Statement is correct.

4. Fill the blanks

Row 1

$$-30 \times 12 = -360$$

$$12 \times (-30) = -360$$

Row 2

$$15 \times (-8) = -120$$

$$-8 \times 15 = -120$$

Row 3

$$15 \times (-5) = -75$$

$$-5 \times 15 = -75$$

5. Observation

When multiplier and multiplicand are interchanged, the product remains unchanged.

This is the **Commutative Property of Multiplication**.

6. Sign of product after swapping?

No.

The sign remains the same.

Example:

$$4 \times (-5) = -20$$

$$(-5) \times 4 = -20$$

Figure It Out

1(a)

$$4 \times (-3)$$

$$= -12$$

Answer: -12

1(b)

$$(-6) \times (-3)$$

$$= +18$$

Answer: 18

1(c)

$$(-5) \times (-1)$$

$$= +5$$

Answer: 5

1(d)

$$(-8) \times 4$$

$$= -32$$

Answer: -32

1(e)

$$(-9) \times 10$$

$$= -90$$

Answer: -90

1(f)

$$10 \times (-17)$$

$$= -170$$

Answer: -170

2. Speciality of the Grid

Every row and column follows multiplication patterns.

The arrangement of numbers creates balanced relationships.

The magic lies in **both the numbers and their arrangement.**

3(a)

$$14 \times (-15)$$

$$= -210$$

Answer: -210

3(b)

$$-16 \times (-5)$$

$$= 80$$

Answer: 80

3(c)

$$36 \div (-18)$$

$$= -2$$

Answer: -2

3(d)

$$(-46) \div (-23)$$

$$= 2$$

Answer: 2

4. Freezing Process

Initial temperature = 32°C

Decrease per hour = 5°C

After 10 hours:

Temperature decrease

$$= 10 \times (-5)$$

$$= -50^{\circ}\text{C}$$

Final temperature

$$= 32 + (-50)$$

$$= -18^{\circ}\text{C}$$

Answer: -18°C

5(a) Profit or Loss

Profit per white bag = ₹8

White bags = 3000

Profit

$$= 3000 \times 8$$

$$= ₹24,000$$

Loss per grey bag = ₹5

Grey bags = 5000

Loss

$$= 5000 \times (-5)$$

$$= -₹25,000$$

Net profit/loss

$$= 24000 - 25000$$

$$= -₹1000$$

Answer: ₹1000 Loss

5(b)

Grey cement loss:

$$6400 \times (-5)$$

$$= -₹32,000$$

For no profit and no loss:

White cement profit = ₹32,000

Number of white bags

$$= 32000 \div 8$$

$$= 4000$$

Answer: 4000 bags

6. Fill the blanks

(a)

$$(-3) \times \square = 27$$

$$\square = -9$$

Answer: -9

(b)

$$5 \times \square = -35$$

$$\square = -7$$

Answer: -7

(c)

$$\square \times (-8) = -56$$

$$\square = 7$$

Answer: 7

(d)

$$\square \times (-12) = 132$$

$$\square = -11$$

Answer: -11

(e)

$$\square \div (-8) = 7$$

$$\square = -56$$

Answer: -56

(f)

$$\square + 12 = -11$$

$$\square = -23$$

Answer: -23

Practice Time 2.1

1. $4 + 3$

Solution:

Starting from 4, move 3 steps to the right on the number line.

$$4 + 3 = 7$$

Answer: 7

2. $6 + 2$

Solution:

$$6 + 2$$

$$= 8$$

Answer: 8

3. $5 + 9$

Solution:

$$5 + 9$$

$$= 14$$

Answer: 14

4. $5 + (-7)$

Solution:

Adding a negative number means subtraction.

$$5 + (-7)$$

$$= 5 - 7$$

$$= -2$$

Answer: -2

5. $8 + (-3)$

Solution:

$$8 + (-3)$$

$$= 8 - 3$$

$$= 5$$

Answer: 5

6. $(-6) + 2$

Solution:

Start at -6 and move 2 steps right.

$$-6 + 2$$

$$= -4$$

Answer: -4

7. $4 + (-6) + 2 + 3$

Solution:

$$= 4 - 6 + 2 + 3$$

$$= -2 + 2 + 3$$

$$= 0 + 3$$

$$= 3$$

Answer: 3

8. $(-3) + (-5) + 4$

Solution:

$$= -3 - 5 + 4$$

$$= -8 + 4$$

$$= -4$$

Answer: -4

9. $7 - 18$

Solution:

$$= 7 + (-18)$$

$$= -11$$

Answer: -11

10. $5 - 12$

Solution:

$$= 5 + (-12)$$

$$= -7$$

Answer: -7

Practice Time 2.2 (Detailed Solutions)

1. Find 5×3 , 4×3 , 3×3 , 2×3 , 1×3 , 0×3

Solution

$$5 \times 3 = 15$$

$$4 \times 3 = 12$$

$$3 \times 3 = 9$$

$$2 \times 3 = 6$$

$$1 \times 3 = 3$$

$$0 \times 3 = 0$$

Pattern

15, 12, 9, 6, 3, 0

Each product decreases by 3.

2. Continue the pattern

$$0 \times 4 = 0$$

Observe:

Each time the first factor decreases by 1.

Products decrease by 4.

$$(-1) \times 4 = -4$$

$$(-2) \times 4 = -8$$

$$(-3) \times 4 = -12$$

$$(-4) \times 4 = -16$$

Answer

0, -4, -8, -12, -16

3. Find

$$6 \times (-2)$$

$$5 \times (-2)$$

$$4 \times (-2)$$

$$3 \times (-2)$$

$$2 \times (-2)$$

$$1 \times (-2)$$

$$0 \times (-2)$$

Solution

$$6 \times (-2) = -12$$

$$5 \times (-2) = -10$$

$$4 \times (-2) = -8$$

$$3 \times (-2) = -6$$

$$2 \times (-2) = -4$$

$$1 \times (-2) = -2$$

$$0 \times (-2) = 0$$

Pattern

-12, -10, -8, -6, -4, -2, 0

Each product increases by 2.

4. Continue the pattern

$$0 \times (-5) = 0$$

Products increase by 5.

$$(-1) \times (-5) = 5$$

$$(-2) \times (-5) = 10$$

$$(-3) \times (-5) = 15$$

$$(-4) \times (-5) = 20$$

Answer

5, 10, 15, 20

5. Fill in the blanks

$$3 \times (-6) = \underline{\hspace{2cm}}$$

$$2 \times (-6) = \underline{\hspace{2cm}}$$

$$1 \times (-6) = \underline{\hspace{2cm}}$$

$$0 \times (-6) = 0$$

$$(-1) \times (-6) = \underline{\hspace{2cm}}$$

$$(-2) \times (-6) = \underline{\hspace{2cm}}$$

Solution

$$3 \times (-6)$$

$$= -18$$

$$2 \times (-6)$$

$$= -12$$

$$1 \times (-6)$$

$$= -6$$

$$0 \times (-6)$$

$$= 0$$

$$(-1) \times (-6)$$

$$= 6$$

$$(-2) \times (-6)$$

$$= 12$$

Answers

-18, -12, -6, 6, 12

Practice Time 2.3

1. Find the sign and value of $(+8) \times (+7)$

Solution

Positive $\times$ Positive = Positive

$$8 \times 7 = 56$$

Therefore,

$$(+8) \times (+7)$$

$$= +56$$

Answer: +56

2. Find the sign and value of $(-9) \times (-6)$

Solution

Negative $\times$ Negative = Positive

$$9 \times 6 = 54$$

Therefore,

$$(-9) \times (-6)$$

$$= +54$$

Answer: +54

3. Find the sign and value of $(+12) \times (-5)$

Solution

Positive $\times$ Negative = Negative

$$12 \times 5 = 60$$

Therefore,

$$(+12) \times (-5)$$

$$= -60$$

Answer: -60

4. Find the sign and value of $(-15) \times (+4)$

Solution

Negative $\times$ Positive = Negative

$$15 \times 4 = 60$$

Therefore,

$$(-15) \times (+4)$$

$$= -60$$

Answer: -60

5. Quiz Question

Given:

Correct answer = +3 marks

Wrong answer = -2 marks

Correct answers = 18

Wrong answers = 7

Marks for correct answers

$$18 \times 3$$

$$= 54$$

Marks lost for wrong answers

$$7 \times (-2)$$

$$= -14$$

Total marks

$$54 + (-14)$$

$$= 40$$

Answer: 40 marks

Practice Time 2.4

1. Check if

$$(6 \times -5) \times 2 = 6 \times (-5 \times 2)$$

LHS

$$(6 \times -5) \times 2$$

$$= (-30) \times 2$$

$$= -60$$

RHS

$$6 \times (-5 \times 2)$$

$$= 6 \times (-10)$$

$$= -60$$

Since LHS = RHS,

Verified.

2. Check if

$$(-4 \times 3) \times (-2) = -4 \times (3 \times -2)$$

LHS

$$(-4 \times 3) \times (-2)$$

$$= -12 \times (-2)$$

$$= 24$$

RHS

$$-4 \times (3 \times -2)$$

$$= -4 \times (-6)$$

$$= 24$$

Since LHS = RHS,

Verified.

3. Check if

$$(-8) \times 7 = 7 \times (-8)$$

LHS

$$(-8) \times 7$$

$$= -56$$

RHS

$$7 \times (-8)$$

$$= -56$$

Since LHS = RHS,

Verified (Commutative Property).

4. Check if

$$(-6) \times (-9) = (-9) \times (-6)$$

LHS

$$(-6) \times (-9)$$

$$= 54$$

RHS

$$(-9) \times (-6)$$

$$= 54$$

Since LHS = RHS,

Verified (Commutative Property).

5. Find the sign and value of

$$(-3) \times 2 \times (-5) \times 4$$

Solution

First,

$$(-3) \times 2$$

$$= -6$$

Then,

$$-6 \times (-5)$$

$$= 30$$

Then,

$$30 \times 4$$

$$= 120$$

Sign = Positive

Value = 120

Answer: +120

EXAM TIME

A. Multiple Choice Questions (MCQs)

1. The value of $(5 + (-7))$ is:

$$= 5 - 7$$

$$= -2$$

Answer: (c) -2

2. A carrom coin moves (+6) units, then (-9) units. Final position is:

$$= 6 + (-9)$$

$$= -3$$

Answer: (b) -3

3. In token model, a zero pair means:

A $+1$ token and a -1 token together make 0.

Answer: (c) $(+1 + (-1))$

4. The sign of $(-8) \times (-3)$ is:

Negative $\times$ Negative = Positive

Answer: (a) Positive

5. The value of $(-4) \times 6$ is:

$$= -24$$

Answer: (b) -24

B. Fill in the Blanks

1.

$$(-1) \times a = \underline{\hspace{2cm}}$$

Using multiplication rule:

$$(-1) \times a = -a$$

Answer: $-a$

2.

$$(-6) \times (-9)$$

$$= 54$$

Answer: 54

3.

$$0 \times (-5)$$

$$= 0$$

Answer: 0

4.

$$(-100) \div 25$$

$$= -4$$

Answer: -4

5.

Movements = +4, -6, +2, +3

Final position

$$= 4 - 6 + 2 + 3$$

$$= -2 + 2 + 3$$

$$= 3$$

Answer: 3

C. Write True or False

1.

A zero pair changes the value of an integer.

False

(Zero pair equals 0, so value does not change.)

2.

If the number of negative factors is even, the product is positive.

True

3.

$(-3) + (+7)$ is positive.

$= 4$

True

4.

$a \times (b + c) = a \times b + a \times c$

True

(Distributive property)

5.

Multiplication of integers is commutative.

True

$(a \times b = b \times a)$

D. Match the Columns

Column A

1. $a \times (b + c)$

2. $(a \times b) \times c$

3. $a \times b = b \times a$

4. $1 \times a$

5. Even number of negatives (e) Product is Positive

Column B

(b) Distributive Property

(d) Associative Property

(a) Commutative Property

(c) Identity Element

Answers

1 $\rightarrow$ (b)

2 $\rightarrow$ (d)

3 $\rightarrow$ (a)

4 → (c)

5 → (e)

E. Very Short Answer Questions

1. Write the additive inverse of (-9) .

Additive inverse of -9 is $+9$.

Answer: 9

2. What is $0 \times (-17)$?

$0 \times \text{any number} = 0$

Answer: 0

3. What is the sign of $(+) \times (-)$?

Positive $\times$ Negative = Negative

Answer: Negative

4. What is $(-1) \times 25$?

$= -25$

Answer: -25

5. If final position is left of 0, is it positive or negative?

Numbers left of 0 are negative.

Answer: Negative

F. Short Answer Questions

1. Explain why $(7 - 18)$ becomes a negative number using zero-pair idea.

$7 - 18$

$$= 7 + (-18)$$

Create 7 zero pairs and remove positive tokens.

After removing 7 positive tokens, 11 negative tokens remain.

Therefore,

$$7 - 18 = -11$$

Hence the answer is negative.

2. State the sign rule for multiplication of integers with examples.

Signs Product

$+$ $\times$ $+$ Positive

$-$ $\times$ $-$ Positive

$+$ $\times$ $-$ Negative

$-$ $\times$ $+$ Negative

Examples:

$$4 \times 5 = 20$$

$$(-4) \times (-5) = 20$$

$$4 \times (-5) = -20$$

$$(-4) \times 5 = -20$$

3. Write the missing-factor meaning of $a \div b$.

$a \div b$ means:

"What number multiplied by b gives a ?"

Example:

$$20 \div 5 = 4$$

because

$$5 \times 4 = 20$$

4. Check whether

$$5 \times (4 + (-7)) = 5 \times 4 + 5 \times (-7)$$

LHS:

$$5 \times (4 - 7)$$

$$= 5 \times (-3)$$

$$= -15$$

RHS:

$$5 \times 4 + 5 \times (-7)$$

$$= 20 - 35$$

$$= -15$$

$$\text{LHS} = \text{RHS}$$

Verified

5. What does the machine rule $(a + b - c)$ do to the third number (c)?

The machine subtracts the third number from the sum of the first two numbers.

Answer:

"It subtracts the third number."

G. Long Answer Questions

1. Using token model, explain subtraction when you don't have enough tokens.

Example: $4 - 7$

Start with 4 positive tokens.

We need to remove 7 positive tokens, but only 4 are available.

Add 3 zero pairs (+1 and -1).

Now there are 7 positive tokens and 3 negative tokens.

Remove the 7 positive tokens.

3 negative tokens remain.

Therefore,

$$4 - 7 = -3$$

2. Explain the staircase pattern of integer multiplication for 3.

Observe:

$$3 \times 4 = 12$$

$$3 \times 3 = 9$$

$$3 \times 2 = 6$$

$$3 \times 1 = 3$$

$$3 \times 0 = 0$$

$$3 \times (-1) = -3$$

$$3 \times (-2) = -6$$

$$3 \times (-3) = -9$$

Pattern:

As the multiplier decreases by 1, the product decreases by 3.

This continues below zero also.

3. Explain Brahmagupta's fortune–debt rule.

Ancient mathematician **Brahmagupta** called:

- Positive numbers = Fortune
- Negative numbers = Debt

Rules:

1. Fortune $\times$ Fortune = Fortune ($+$ $\times$ $+$ = $+$)
2. Debt $\times$ Debt = Fortune ($-$ $\times$ $-$ = $+$)
3. Fortune $\times$ Debt = Debt ($+$ $\times$ $-$ = $-$)
4. Debt $\times$ Fortune = Debt ($-$ $\times$ $+$ = $-$)

Example 1

$$(-5) \times (-3)$$

$$= +15$$

$$\text{Debt} \times \text{Debt} = \text{Fortune}$$

Example 2

$$6 \times (-4)$$

$$= -24$$

$$\text{Fortune} \times \text{Debt} = \text{Debt}$$

Competency-Based Questions

A. Assertion–Reason

1.

Assertion:

$$(-6) \times (-4) = +24 \quad \text{True}$$

Reason:

Product of two negatives is positive True

Reason correctly explains assertion.

Answer: (a)

2.

Assertion:

$$a \times (b + c) = a \times b + a \times c \quad \text{True}$$

Reason:

Multiplication can be spread over addition . True

Reason correctly explains assertion.

Answer: (a)

B. Case Based Study

Questions attempted = 25

Correct = 18

Wrong = $25 - 18 = 7$

1. Wrong answers

Answer: (b) 7

2. Marks for correct answers

18×3

$= 54$

Answer: (a) 54

3. Total score

Correct marks = 54

Wrong marks = $7 \times (-2)$

$= -14$

Total

$= 54 - 14$

$= 40$

Answer: (a) 40

C. Maths Booster

1. Machine Puzzle

Rule:

$a + b - c = 10$

Given:

$a = 5$

$$b = 8$$

$$5 + 8 - c = 10$$

$$13 - c = 10$$

$$c = 3$$

Answer: $c = 3$

2. Staircase Puzzle

$$3 \times (-3) = -9$$

$$2 \times (-3) = -6$$

$$1 \times (-3) = -3$$

$$0 \times (-3) = 0$$

$$(-1) \times (-3) = 3$$

Answers:

- $2 \times (-3) = -6$
- $3 \times (-3) = -9$
- $1 \times (-3) = -3$
- $(-1) \times (-3) = 3$

Chapter 3 Finding Common Ground

NCERT CORNER

INTEXT QUESTION

1. Is $2 \times 2 \times 7 = 28$ a factor of 840?

$$840 \div 28 = 30$$

Since 30 is a whole number, **28 is a factor of 840.**

Answer: Yes.

2. Find the factors of 225 using prime factorisation.

$$225 = 3^2 \times 5^2$$

Factors:

1, 3, 5, 9, 15, 25, 45, 75, 225

Answer: 1, 3, 5, 9, 15, 25, 45, 75, 225

3. Check that all factors of 225 occur in this list.

(a) Sum = 27, Difference = 9

$$\text{Numbers} = \frac{27+9}{2} = 18, \frac{27-9}{2} = 9$$

Factors: 1, 2, 3, 6, 9, 18

(b) Sum = 4, Difference = 12

Numbers = 8, -4

Factors: 1, 2, 4, 8

(c) Sum = 0, Difference = 10

Numbers = 5, -5

Factors: 1, 5

(d) Sum = 0, Difference = -10

Numbers = -5, 5

Factors: 1, 5

(e) Sum = -7, Difference = -1

Numbers = -4, -3

Factors: 1

(f) Sum = -7, Difference = -13

Numbers = 3, -10

Factors: 1

The factors obtained include:

1, 3, 5, 9, 15, 25, 45, 75, 225

Hence verified.

Figure It Out

Question 1.

List all the factors of the following numbers:

(a) 90

(b) 105

(c) 132

(d) 360 (this number has 24 factors)

(e) 840 (this number has 32 factors)

Solution:

(a) 90

Here

2	90
3	45
3	15
5	5
	1

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$$\therefore 90 = 2 \times 3 \times 3 \times 5$$

Hence, factors of 90 are 1, 2, 3, 5, 6, 9, 10, 15, 18, 30, 45, and 90.

Total factors = 12

(b) 105

Here

3	105
5	35
7	7
	1

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$$\therefore 105 = 3 \times 5 \times 7$$

Hence, factors of 105 are 1, 3, 5, 7, 15, 21, 35, and 105.

Total factors = 8

(c) 132

Here

2	132
2	66
3	33
11	11
	1

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$$\therefore 132 = 2 \times 2 \times 3 \times 11$$

Hence, factors of 132 are 1, 2, 3, 4, 6, 11, 12, 22, 33, 44, 66, 132.

Total factors = 12

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(d) 360

Here

2	360
2	180
2	90
3	45
3	15
5	5
	1

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$$\therefore 360 = 2 \times 2 \times 2 \times 3 \times 3 \times 5$$

Hence, factors of 360 are 1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30, 36, 40, 45, 60, 72, 90, 120, 180, 360.

Total factors = 24

(e) 840

Here

$$\begin{array}{r|l}
 2 & 840 \\
 \hline
 2 & 420 \\
 \hline
 2 & 210 \\
 \hline
 3 & 105 \\
 \hline
 5 & 35 \\
 \hline
 7 & 7 \\
 \hline
 & 1
 \end{array}$$

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$$\therefore 840 = 2 \times 2 \times 2 \times 3 \times 5 \times 7$$

Hence, factors of 840 are 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 14, 15, 20, 21, 24, 28, 30, 35, 40, 42, 56, 60, 70, 84, 105, 120, 140, 168, 210, 280, 420, 840.

Total factors = 32

Question 2.

Find the common factors and the HCF of the following numbers:

(a) 50, 60

(b) 140, 275

(c) 77, 725

(d) 370, 592

(e) 81, 243

How do we directly find the HCF without listing all the factors?

Solution:

(a) Here, 50

$$\begin{array}{r|l}
 2 & 50 \\
 \hline
 5 & 25 \\
 \hline
 & 5
 \end{array}$$

$$\therefore 50 = \boxed{2} \times 5 \times \boxed{5}$$

and 60

$$\begin{array}{r|l}
 2 & 60 \\
 \hline
 2 & 30 \\
 \hline
 3 & 15 \\
 \hline
 5 & 5 \\
 \hline
 & 1
 \end{array}$$

$$\therefore 60 = \boxed{2} \times 2 \times 3 \times \boxed{5}$$

$\therefore$ Common factors of 50 and 60 are 2, 5, and $\text{HCF}(50, 60) = 2 \times 5 = 10$.

(b) Here 140 and 275

2		140		5		275
2		70		5		55
5		35		11		11
7		7				1
		1				

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$$\therefore 140 = 2 \times 2 \times 5 \times 7 \text{ and } 275 = 5 \times 5 \times 11$$

$\therefore$ Common factor of 140 and 275 = 5, and HCF of 140 and 275 = 5.

(c) Here, 77 and 725

7		77	and	5		725
11		11		5		145
		1		29		29
						1

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$$\therefore 77 = 7 \times 11 \text{ and } 725 = 5 \times 5 \times 29$$

$\therefore$ Common factor = 1 and HCF (77, 725) = 1 (as there are no common prime factors)

(d) Here, 370 and 592

2		370	and	2		592
5		185		2		296
37		37		2		148
		1		2		74
				37		37
						1

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$$\therefore 370 = 2 \times 5 \times 37 \text{ and } 592 = 2 \times 2 \times 2 \times 2 \times 37$$

$\therefore$ Common factors = 1, 2, 37, and HCF (370, 592) = $2 \times 37 = 74$

(e) Here 81 and 243

3		81	and	3		243
3		27		3		81
3		9		3		27
3		3		3		9
		1		3		3
						1

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$$\therefore 81 = 3 \times 3 \times 3 \times 3 \text{ and } 243 = 3 \times 3 \times 3 \times 3 \times 3$$

$\therefore$ Common factors = $3 \times 3 \times 3 \times 3$ and HCF (81, 243) = $3 \times 3 \times 3 \times 3 = 81$.

Question 3.

Find the HCF of the following numbers:

(a) 24, 180

(b) 42, 75, 24

(c) 240, 378

(d) 400, 2500

(e) 300, 800

Solution:

(a) Given 24, 180

$$\begin{aligned}\text{Now } 24 &= 2 \times 2 \times 2 \times 3 \\ \text{and } 180 &= 2 \times 2 \times 3 \times 3 \times 5\end{aligned}$$

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Clearly, the common prime factors are 2 and 3.

$$\therefore \text{HCF}(24, 180) = 2 \times 2 \times 3 = 4 \times 3 = 12$$

(b) Given 42, 75, 24

Now

$$\begin{aligned}42 &= 2 \times 7 \times 3 \\ 75 &= 5 \times 5 \times 3 \\ 24 &= 2 \times 2 \times 3 \times 2\end{aligned}$$

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Clearly only common prime factor is 3.

$$\therefore \text{HCF}(42, 75, 24) = 3.$$

(c) Here 240 and 378

$\begin{array}{r l} 2 & 240 \\ \hline 2 & 120 \\ \hline 2 & 60 \\ \hline 2 & 30 \\ \hline 3 & 15 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$	$\begin{array}{r l} 2 & 378 \\ \hline 3 & 189 \\ \hline 3 & 63 \\ \hline 3 & 21 \\ \hline 7 & 7 \\ \hline & 1 \end{array}$
---	--

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$$\begin{aligned}\therefore 240 &= 2 \times 2 \times 2 \times 2 \times 3 \times 5 \\ \text{and } 378 &= 2 \times 3 \times 3 \times 3 \times 7\end{aligned}$$

$$\text{Hence, HCF}(240, 378) = 2 \times 3 = 6$$

(d) Here 400 and 2500

2	400	2	2500
2	200	2	1250
2	100	5	625
2	50	5	125
5	25	5	25
5	5	5	5
	1		1

$$\therefore 400 = 2 \times 2 \times 2 \times 2 \times 5 \times 5$$

$$\text{and } 2500 = 2 \times 2 \times 5 \times 5 \times 5 \times 5$$

$$\therefore \text{HCF}(400, 2500) = 2 \times 2 \times 5 \times 5 = 100.$$

(e) Here 300 and 800

2	300	and	2	800
2	150		2	400
3	75		2	200
5	25		2	100
5	5		2	50
	1		5	25
			5	5
				1

$$\therefore 300 = 2 \times 2 \times 3 \times 5 \times 5$$

$$800 = 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5$$

$$\therefore \text{HCF}(300, 800) = 2 \times 2 \times 5 \times 5 = 100.$$

Question 4.

Consider the numbers 72 and 144. Suppose they are factorised into composite numbers as: $72 = 6 \times 12$ and $144 = 8 \times 18$. Seeing this, can one say that these two numbers have no common factor other than 1? Why not?

Solution:

No, one cannot say that 72 and 144 have no common factor other than 1 because their factorisations have composite numbers.

Here $72 = 6 \times 12$

$144 = 8 \times 18$

These are not prime factorisations.

Both 6 and 12 are composite numbers, as are 8 and 18.

Prime factorisation of $72 = 2 \times 2 \times 2 \times 3 \times 3$

Prime factorisation of $144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$

$\therefore \text{HCF}(72, 144) = 2 \times 2 \times 2 \times 3 \times 3 = 8 \times 9 = 72$

Since the HCF is 72, which is greater than 1, the numbers have common factors other than 1.

INTEXT QUESTIONS

1. A sweet shop gives out free gajak on Mondays. Kabamai visits the shop once every 10 days. Today is Monday. When will she next get free gajak?

Free gajak is available every **7 days** (every Monday).

Kabamai visits every **10 days**.

We find the LCM of 7 and 10.

$$7 = 7$$

$$10 = 2 \times 5$$

$$\text{LCM} = 2 \times 5 \times 7 = 70$$

Answer: She will get free gajak again after **70 days**.

2. How do we find the LCM of two numbers using their prime factors?

Method:

1. Find the prime factorisation of each number.
2. Take each prime factor that appears in either number.
3. Take the highest power of each prime factor.
4. Multiply them together.

Answer: The product of the highest powers of all prime factors gives the LCM.

3. Is $2 \times 3 \times 5 \times 7$ also a common multiple?

$$2 \times 3 \times 5 \times 7 = 210$$

Since 210 is a multiple of both 14 and 35, it is a common multiple.

Answer: Yes, 210 is also a common multiple.

4. What is the lowest among all the common multiples of 14 and 35?

$$14 = 2 \times 7$$

$$35 = 5 \times 7$$

$$\text{LCM} = 2 \times 5 \times 7 = 70$$

Answer: 70

Figure It Out

Question 1.

Find the LCM of the following numbers:

(a) 30, 72

(b) 36, 54

(c) 105, 195, 65

(d) 222, 370

Solution:

(a) 30, 72

$$\text{Here } 30 = 2 \times 3 \times 5$$

(One occurrence of 2, one occurrence of 3, and one occurrence of 5)

$$\text{and } 72 = 2 \times 2 \times 2 \times 3 \times 3$$

(Three occurrences of 2s and two occurrences of 3s)

$$\therefore \text{LCM}(30, 72) = 2 \times 2 \times 2 \times 3 \times 3 \times 5$$

(Three occurrences of 2s and two occurrences of 3s, and one occurrence of 5)

$$= 8 \times 9 \times 5$$

$$= 360$$

(b) 36, 54

$$\text{Here } 36 = 2 \times 2 \times 3 \times 3$$

(Two occurrences of 2s and two occurrences of 3s)

$$\text{and } 54 = 2 \times 3 \times 3 \times 3$$

(One occurrence of 2, and three occurrences of 3s)

$$\therefore \text{LCM}(36, 54) = 2 \times 2 \times 3 \times 3 \times 3 = 4 \times 27 = 108$$

(One occurrence of 2, and three occurrences of 3s)

$$\therefore \text{LCM}(36, 54) = 2 \times 2 \times 3 \times 3 \times 3 = 4 \times 27 = 108$$

(c) 105, 195, 65

Here 105, 195, and 65

$$\text{Now } 105 = 3 \times 5 \times 7$$

$$195 = 3 \times 5 \times 13$$

$$65 = 5 \times 13$$

$$\therefore \text{LCM}(105, 195, 65) = 3 \times 5 \times 7 \times 13 = 1365$$

(d) 222, 370

Here 222, 370

2	222	2	370
3	111	5	185
37	37	37	37
1	1	1	1

$$222 = 2 \times 3 \times 37 \text{ and } 370 = 2 \times 5 \times 37$$

$$\therefore \text{LCM}(222, 370) = 2 \times 3 \times 5 \times 37 = 1110.$$

Intext Questions

1(a) For number pairs satisfying the property that one number is the HCF, if m is a number, what could be the other number?

The other number must be a multiple of m .

Answer: mk , where k is a natural number.

1(b) If $7k$ is a number, what could be the other number?

The other number may be 7.

Since 7 divides $7k$, the HCF can be 7.

Answer: 7

2. What happens to the HCF if both numbers are doubled?

Example:

$$\text{HCF}(12, 18) = 6$$

Doubling both numbers:

24 and 36

$$\text{HCF}(24, 36) = 12$$

$$12 = 2 \times 6$$

Another example:

$$\text{HCF}(15, 25) = 5$$

$$\text{HCF}(30, 50) = 10$$

$$10 = 2 \times 5$$

Answer: When both numbers are doubled, the HCF also doubles.

Figure It Out

(a) Two consecutive numbers

Example:

8 and 9

Factors of 8 = 1, 2, 4, 8

Factors of 9 = 1, 3, 9

Common factor = 1

General Statement: HCF of two consecutive numbers is **1**.

(b) Two consecutive odd numbers

Example:

11 and 13

Common factor = 1

General Statement: HCF of two consecutive odd numbers is **1**.

Figure It Out

Question 1.

Make a general statement about the HCF for the following pairs of numbers.

You could consider examples before coming up with general statements. Look for possible explanations of why they hold.

(a) Two consecutive even numbers

(b) Two consecutive odd numbers

(c) Two even numbers

(d) Two consecutive numbers

(e) Two co-prime numbers

Share your observations with the class.

Solution:

(a) Two Consecutive Even Numbers

Examples:

(i) (2, 4)

$$\text{HCF}(2, 4) = 2$$

(ii) (6, 8)

$$\text{HCF}(6, 8) = 2$$

(iii) (10, 12)

$$\text{HCF}(10, 12) = 2$$

General Statement: The HCF of any two consecutive even numbers is 2.

Reason: All even numbers are divisible by 2, and consecutive even numbers differ by 2.

They will not have any other common factor except 2.

(b) Two Consecutive Odd Numbers

Examples:

(i) (3, 5)

$$\text{HCF}(3, 5) = 1$$

(ii) (7, 9)

$$\text{HCF}(7, 9) = 1$$

(iii) (11, 13)

$$\text{HCF}(11, 13) = 1$$

General Statement: The HCF of any two consecutive odd numbers is 1.

Reason: Consecutive odd numbers are not divisible by any common even or odd factor other than 1, so they are always co-prime.

(c) Two Even Numbers

Examples:

(i) (4, 10)

$$\text{HCF}(4, 10) = 2$$

(ii) (8, 12)

$$\text{HCF}(8, 12) = 4$$

(iii) (14, 20)

$$\text{HCF}(14, 20) = 2$$

General Statement: The HCF of two even numbers is always an even number.

Reason: Since all even numbers are divisible by 2, their HCF will include 2 as a factor.

If both have more factors in common, the HCF will be a multiple of 2.

(d) Two Consecutive Numbers

Examples:

(i) (7, 8)

$$\text{HCF}(7, 8) = 1$$

(ii) (14, 15)

$$\text{HCF}(14, 15) = 1$$

(iii) (20, 21)

$$\text{HCF}(20, 21) = 1$$

General Statement: The HCF of any two consecutive numbers is 1.

Reason: Consecutive numbers can never share any common factor other than 1, because every next number is exactly 1 more than the previous number.

(e) Two Co-prime Numbers

Examples:

(i) (4, 9)

$$\text{HCF}(4, 9) = 1$$

(ii) (5, 8)

$$\text{HCF}(5, 8) = 1$$

(iii) (7, 10)

$$\text{HCF}(7, 10) = 1$$

General Statement: The HCF of two co-prime numbers is always 1.

Reason: Co-prime numbers are defined as numbers that have no common factor other than 1.

Question 2.

The LCM of 3 and 24 is 24 (it is one of the two given numbers).

(a) Find more such number pairs where the LCM is one of the two numbers.

(b) Make a general statement about such numbers. Describe such number pairs using algebra.

Solution:

(a) Here are more number pairs where the LCM of the two numbers is one of the given numbers:

(i) LCM of 2 and 4: The LCM is 4.

Prime factorization of 2: 2

Prime factorization of 4: 2×2

$$\text{LCM}(2, 4) = 2 \times 2 = 4$$

(ii) LCM of 5 and 10: The LCM is 10.

Prime factorization of 5: 5

Prime factorization of 10: 2×5

$$\text{LCM}(5, 10) = 2 \times 5 = 10$$

(iii) LCM of 6 and 12: The LCM is 12.

Prime factorization of 6: 2×3

Prime factorization of 12: $2 \times 2 \times 3$

$\text{LCM}(6, 12) = 2 \times 2 \times 3 = 12$

(iv) LCM of 7 and 49: The LCM is 49.

Prime factorization of 7: 7

Prime factorization of 49: 7×7

$\text{LCM}(7, 49) = 49$

(v) LCM of 10 and 100: The LCM is 100.

Prime factorization of 10: 2×5

Prime factorization of 100: $2 \times 2 \times 5 \times 5$

$\text{LCM}(10, 100) = 2 \times 2 \times 5 \times 5 = 100$

(b) General Statement: For any two positive integers, let's call them a and b , the Least Common Multiple (LCM) will be equal to one of the numbers (specifically, the larger number) if and only if the smaller number is a factor (or a divisor) of the larger number.

In the original example, the LCM of 3 and 24 is 24 because 3 is a factor of 24 ($24 \div 3 = 8$)

Algebraic Description: Let the two positive integers be a and b , where $a < b$.

The LCM of a and b will be b if and only if b is a multiple of a .

This can be expressed using algebra as: $\text{LCM}(a, b) = b$ if and only if $b = k \times a$, where k is a positive integer.

Question 3.

Make a general statement about the LCM for the following pairs of numbers.

You could consider examples before coming up with these general statements.

Look for possible explanations of why they hold.

(a) Two multiples of 3

(b) Two consecutive even numbers

(c) Two consecutive numbers

(d) Two co-prime numbers

Solution:

(a) Two Multiples of 3

Examples:

(i) (6, 9)

$\text{LCM}(6, 9) = 18$

(ii) (9, 12)

$\text{LCM}(9, 12) = 36$

(iii) (12, 18)

$\text{LCM}(12, 18) = 36$

Observation: The LCM of two multiples of 3 is also a multiple of 3.

Reason: Since both numbers are divisible by 3, their common multiples will also be divisible by 3.

Hence, the LCM must include 3 as a factor.

General Statement: The LCM of two multiples of 3 is always a multiple of 3.

(b) Two Consecutive Even Numbers

Examples:

(i) (2, 4)

$$\text{LCM}(2, 4) = 4$$

(ii) (6, 8)

$$\text{LCM}(6, 8) = 24$$

(iii) (10, 12)

$$\text{LCM}(10, 12) = 60$$

Observation: The LCM of two consecutive even numbers is half of their product.

Reason: Consecutive even numbers always share a common factor of 2, but not more.

Therefore, when finding the LCM, one factor of 2 overlaps, so the LCM becomes smaller than their product.

General Statement: The LCM of two consecutive even numbers $2n$ and $2n + 2$ is always equal to half of their product.

$$\text{or } \text{LCM}(2n, 2n + 2) =$$

$$+ 2n$$

(c) Two Consecutive Numbers

Examples:

(i) (7, 8)

$$\text{LCM}(7, 8) = 56$$

(ii) (9, 10)

$$\text{LCM}(9, 10) = 90$$

(iii) (10, 11)

$$\text{LCM}(10, 11) = 110$$

Observation: The LCM of two consecutive numbers is equal to their product.

Reason: Consecutive numbers have no common factors other than 1, so their product is the smallest number divisible by both.

General Statement: The LCM of two consecutive numbers is their product.

(d) Two Co-prime Numbers

Examples:

(i) (4, 9)

$$\text{LCM}(4, 9) = 36$$

(ii) $(5, 8)$

$$\text{LCM}(5, 8) = 40$$

(iii) $(7, 10)$

$$\text{LCM}(7, 10) = 70$$

Observation: The LCM of two co-prime numbers is equal to their product.

Reason: Co-prime numbers do not share any common factors except 1, so the smallest number that contains both is simply their product.

General Statement: The LCM of two co-prime numbers is equal to their product.

Note: Co-prime numbers are any two natural numbers that have no common factor other than 1.

INTEXT QUESTIONS

1. Here are some more numbers where both numbers are multiples of the same number. Find their HCF.

(a) $18 \times 10, 18 \times 15$

$$\text{HCF} = 18 \times \text{HCF}(10, 15)$$

$$= 18 \times 5$$

$$= \mathbf{90}$$

(b) $10 \times 38, 10 \times 21$

$$\text{HCF} = 10 \times \text{HCF}(38, 21)$$

$$= 10 \times 1$$

$$= \mathbf{10}$$

(c) $5 \times 13, 5 \times 20$

$$\text{HCF} = 5 \times \text{HCF}(13, 20)$$

$$= 5 \times 1$$

$$= \mathbf{5}$$

(d) $12 \times 16, 12 \times 20$

$$\text{HCF} = 12 \times \text{HCF}(16,20)$$

$$= 12 \times 4$$

$$= 48$$

2. In which cases is the HCF the same as the common multiplier?

The HCF is the same as the common multiplier when the remaining factors are co-prime.

From above:

- (a) $\text{HCF} = 90 \neq 18$ ✗
- (b) $\text{HCF} = 10 = 10$ ✓
- (c) $\text{HCF} = 5 = 5$ ✓
- (d) $\text{HCF} = 48 \neq 12$ ✗

Answer: Cases (b) and (c).

3. How do we use this to find the HCF of 84 and 180?

$$84 = 12 \times 7$$

$$180 = 12 \times 15$$

So,

$$\text{HCF} = 12 \times \text{HCF}(7,15)$$

$$= 12 \times 1$$

$$= 12$$

Answer: $\text{HCF}(84,180) = 12$

4. Which is greater – the LCM of two numbers or their product?

Since

$$\text{HCF} \times \text{LCM} = \text{Product of the numbers}$$

$$\text{LCM} = \frac{\text{Product}}{\text{HCF}}$$

As $\text{HCF} \geq 1$,

LCM can never be greater than the product.

Answer: The product is greater than or equal to the LCM.

5. Check whether the LCM is a factor of the product.

(a) 45, 105

$$45 = 3^2 \times 5$$

$$105 = 3 \times 5 \times 7$$

$$\text{LCM} = 3^2 \times 5 \times 7 = 315$$

$$\text{Product} = 45 \times 105 = 4725$$

$$4725 \div 315 = 15$$

So LCM is a factor.

Multiplier = 15

(b) 275, 352

$$275 = 5^2 \times 11$$

$$352 = 2^5 \times 11$$

$$\text{LCM} = 2^5 \times 5^2 \times 11 = 8800$$

$$\text{Product} = 275 \times 352 = 96800$$

$$96800 \div 8800 = 11$$

Multiplier = 11

(c) 222, 370

$$222 = 2 \times 3 \times 37$$

$$370 = 2 \times 5 \times 37$$

$$\text{LCM} = 1110$$

$$\text{Product} = 222 \times 370 = 82140$$

$$82140 \div 1110 = 74$$

$$\text{Multiplier} = 74$$

Pattern

The number obtained each time is the **HCF**.

Thus,

$$\boxed{\text{Product} = \text{HCF} \times \text{LCM}}$$

6. Why does this happen?

For any two numbers:

$$\boxed{\text{HCF} \times \text{LCM} = \text{Product of the numbers}}$$

The common factors are counted once in the LCM and once in the HCF, giving exactly the product.

7. Does this property hold for 3 numbers?

Not always.

For two numbers:

$$\text{HCF} \times \text{LCM} = \text{Product}$$

This relation is generally **not true for three numbers**.

Example:

Numbers = 2, 4, 8

$$\text{HCF} = 2$$

$$\text{LCM} = 8$$

$$2 \times 8 = 16$$

But

$$2 \times 4 \times 8 = 64$$

Since $16 \neq 64$,

the property does **not** hold for three numbers.

Figure It Out

Question 1.

In the two rows below, colours repeat as shown. When will the black stars meet next?



Solution:

The positions of the black star in the first row are 4 and 10.

The difference in position = $10 - 4 = 6$.

So, the next positions of the black star in the first row are: 4, 10, 16, 22, 28, ...

The positions of the black star in the second row are 4 and 8.

The difference in position = $8 - 4 = 4$.

So, the next positions of the black star in the second row are: 4, 8, 12, 16, 20, ...

The 16th position is common in both rows.

Hence, the black stars meet again at the 16th position.

Question 2.

(a) Is $5 \times 7 \times 11 \times 11$ a multiple of $5 \times 7 \times 7 \times 11 \times 2$?

(b) Is $5 \times 7 \times 11 \times 11$ a factor of $5 \times 7 \times 7 \times 11 \times 2$?

Solution:

(a) Here let $a = 5 \times 7 \times 11 \times 11$ and $b = 5 \times 7 \times 7 \times 11 \times 2$

For a number a to be a multiple of number b , all prime factors of b must be present in a with at least the same power.

Number a does not have the prime factor 2.

Number a has 71, while number b has 7.

Hence, a is not a multiple of b.

(b) Let $a = 5 \times 7 \times 11 \times 11$

$b = 5 \times 7 \times 7 \times 11 \times 2$

For a to be a factor of b, b must contain all the prime factors of a, in equal or higher powers.

But here b has only one 11 (a has two 11s), so b does not include all factors of a.

Hence, $5 \times 7 \times 11 \times 11$ is not a factor of $5 \times 7 \times 7 \times 11 \times 2$.

Question 3.

Find the HCF and LCM of the following (state your answers in the form of prime factorisations):

(a) $3 \times 3 \times 5 \times 7 \times 7$ and $12 \times 7 \times 11$

(b) 45 and 36

Solution:

(a) Here $3 \times 3 \times 5 \times 7 \times 7$ and $12 \times 7 \times 11 = 2 \times 2 \times 3 \times 7 \times 11$

$\therefore \text{HCF} = 3 \times 7 = 21$

$\therefore \text{LCM} = 2 \times 2 \times 3 \times 3 \times 5 \times 7 \times 7 \times 11$.

(b) Here $45 = 3 \times 3 \times 5$

$36 = 2 \times 2 \times 3 \times 3$

$\text{HCF}(45, 36) = 3 \times 3$

$\text{LCM}(45, 36) = 2 \times 2 \times 3 \times 3 \times 5$

Question 4.

Find two numbers whose HCF is 1, and LCM is 66.

Solution:

For two numbers a and b, the product of the numbers is equal to the product of their LCM and HCF.

$\therefore a \times b = \text{HCF}(a, b) \times \text{LCM}(a, b)$

Here $\text{HCF} = 1$, $\text{LCM} = 66$

$\Rightarrow a \times b = 1 \times 66 = 66$

$\therefore$ Pairs of factors of 66 are (1, 66), (2, 33), (3, 22), (6, 11)

Any of the following pairs of numbers will satisfy the conditions: (1, 66), (2, 33), (3, 22), (6, 11).

Question 5.

A cowherd took all his cows to graze in the fields. The cows can go to a crossing with 3 gates. An equal number of cows passed through each gate.

Later, at another crossing with 5 gates again an equal number of cows passed through each gate. The same happened at the third crossing with 7 gates. If the

cowherd had fewer than 200 cows, how many cows did he have? (Based on the folklore mathematics from Karnataka).

Solution:

No. of cows is divisible by 3, 5, 7.

This means the number of cows is a multiple of the LCM(3, 5, 7).

The total number of cows is also less than 200.

$$\text{LCM}(3, 5, 7) = 3 \times 5 \times 7 = 105$$

No. of cows must be a multiple of 105.

Multiples of 105 are 105, 210, 315.

The problem states that the cowherd had fewer than 200 cows.

Only multiples of 105 that are less than 200 are 105.

Hence cowherd had 105 cows.

Question 6.

The length, width, and height of a box are 12 cm, 18 cm, and 36 cm, respectively. Which of the following-sized cubes can be packed in this box without leaving gaps?

(a) 9 cm

(b) 6 cm

(c) 4 cm

(d) 3 cm

(e) 2 cm

Solution:

Here, dimensions of box: Length = 12 cm, Width = 18 cm, Height = 36 cm

The size of the largest cube that can exactly fit (without gaps)

That means the side of the cube must exactly divide all three dimensions of the box.

So, we need to find the HCF (Highest Common Factor) of 12, 18, and 36.

Prime factorisation $12 = 2 \times 2 \times 3$, $18 = 2 \times 3 \times 3$, and $36 = 2 \times 2 \times 3 \times 3$

Common factors = $2 \times 3 = 6$

HCF = 6 cm

The cube must have a side length equal to a factor of the HCF.

From the options:

(a) 9 cm X (9 doesn't divide 12 evenly)

(b) 6 cm ✓ (divides 12, 18, and 36 exactly)

(c) 4 cm X (doesn't divide 18 evenly)

(d) 3 cm ✓ (also divides all)

(e) 2 cm ✓ (also divides all)

Hence, the largest possible cube that fits without gaps is (b) 6 cm.

Question 7.

Among the numbers below, which is the largest number that perfectly divides both 306 and 36?

- (a) 36
- (b) 612
- (c) 18
- (d) 3
- (e) 2
- (f) 360

Solution:

Longest number that perfectly divides $(306, 36) = \text{HCF}(306, 36)$

Now

2	306
3	153
3	51
17	17
	1

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$$\therefore 306 = 2 \times 3 \times 3 \times 17$$
$$36 = 2 \times 2 \times 3 \times 3$$

$$\text{HCF}(306, 36) = 2 \times 3 \times 3 = 18.$$

$\therefore$ (c) is the correct option.

Question 8.

Find the smallest number that is divisible by 3, 4, 5, and 7, but leaves a remainder of 10 when divided by 11.

Solution:

$$\text{LCM}(3, 4, 5, 7) = 3 \times 4 \times 5 \times 7 = 420$$

The number must be a multiple of 420, so the number can be written as $420k$, where k is a whole number.

$$N = 420 \times 1 = 420$$

When divided by 11 leaves a remainder of 2

$$11 \times 38 + 2 = 420$$

But we require 10 as a remainder

$$\therefore 2k = 10$$

$$\Rightarrow k = 5$$

$$\text{Hence number} = 420 \times 5 = 2100$$

Question 9.

Children are playing 'Fire in the Mountain.' When the number 6 was called out, no one got out. When the number 9 was called out, no one got out. But when the number 10 was called out, some people got out. How many children could have been playing initially?

- (a) 72
- (b) 90
- (c) 45
- (d) 3
- (e) 36
- (f) None of these

Solution:

Interpretation is that when a number k is called, the children are grouped into rows of size k , and "no one got out" means the children formed complete rows with no remainder.

So: "No one got out" when 6 was called $\Rightarrow$ the total number N is divisible by 6.

"No one got out" when 9 was called $\Rightarrow N$ is divisible by 9.

"Some people got out" when 10 was called $\Rightarrow N$ is not divisible by 10.

If N is divisible by both 6 and 9, then it must be divisible by their LCM:

$$\text{LCM}(6, 9) = 18.$$

So N is a multiple of 18, but not a multiple of 10.

Now check the options:

- (a) $72 = 18 \times 4$ – divisible by 18 and not by 10 $\rightarrow$ possible.
- (b) $90 = 18 \times 5$ – divisible by 18 but is divisible by 10 $\rightarrow$ not possible.
- (c) 45 – not divisible by 18 $\rightarrow$ not possible.
- (d) 3 – not divisible by 18 $\rightarrow$ not possible.
- (e) $36 = 18 \times 2$ – divisible by 18 and not by 10 $\rightarrow$ possible.

So the numbers that could have been playing are 36 and 72.

Question 10.

Tick the correct statement(s). The LCM of two different prime numbers (m, n) can be:

- (a) Less than both numbers
- (b) In between the two numbers
- (c) Greater than both numbers
- (d) Less than $m \times n$
- (e) Greater than $m \times n$

Solution:

LCM of two different prime numbers, m and n , is their product of $m \times n$.

Since both m and n are prime numbers, their only common factor is 1.

Hence, LCM is always greater than both individual numbers.
Hence, option (c) is correct.

11. Dog and Rabbit

Rabbit's head start = 150 feet

Dog gains per leap:

$$9 - 7 = 2 \text{ feet}$$

Number of leaps required:

$$150 \div 2 = 75$$

Answer: The dog catches the rabbit after **75 leaps**.

12. Smallest number that is a multiple of 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10

This is the LCM of 1 to 10.

$$\begin{aligned} LCM &= 2^3 \times 3^2 \times 5 \times 7 \\ &= 8 \times 9 \times 5 \times 7 \\ &= 2520 \end{aligned}$$

Answer: 2520

13. Add:

$$\frac{8}{15} + \frac{1}{20} + \frac{7}{36} + \frac{11}{63} + \frac{1}{21}$$

LCM of 15, 20, 36, 63 and 21 = **1260**

$$\begin{array}{r} \frac{8}{15} = \frac{672}{1260} \\ \frac{1}{20} = \frac{63}{1260} \\ \frac{7}{36} = \frac{245}{1260} \end{array}$$

$$\frac{11}{63} = \frac{220}{1260}$$

$$\frac{1}{21} = \frac{60}{1260}$$

Adding:

$$\frac{672 + 63 + 245 + 220 + 60}{1260} = \frac{1260}{1260} = 1$$

Answer: 1

Practice Time 3.1

1.

80 rose plants and 100 jasmine plants.

$$\text{HCF}(80,100) = 20$$

Answer: 20 plants in each row.

2.

54 apples and 81 oranges

$$\text{HCF}(54,81)=27$$

Answer: 27 fruits per basket.

3.

96 m and 120 m ropes

$$\text{HCF}(96,120)=24$$

Answer: 24 m

4.

72 boys and 90 girls

$$\text{HCF}(72,90)=18$$

Answer: 18 students per row.

5.

108 red balloons and 180 blue balloons

$$\text{HCF}(108,180)=36$$

Answer: 36 balloons per packet.

Practice Time 3.2

1.

$$36 = 2^2 \times 3^2$$

$$48 = 2^4 \times 3$$

$$\text{HCF} = 2^2 \times 3 = 12$$

Answer: 12

2.

$$54 = 2 \times 3^3$$

$$90 = 2 \times 3^2 \times 5$$

$$\text{HCF} = 2 \times 3^2 = 18$$

Answer: 18

3.

$$32 = 2^5$$

$$56 = 2^3 \times 7$$

$$\text{HCF} = 2^3 = 8$$

Common factors = 1, 2, 4, 8

4.

$$84 = 2^2 \times 3 \times 7$$

$$126 = 2 \times 3^2 \times 7$$

$$210 = 2 \times 3 \times 5 \times 7$$

$$\text{HCF} = 2 \times 3 \times 7 = 42$$

5.

$$50 = 2 \times 5^2$$

$$75 = 3 \times 5^2$$

$$\text{HCF} = 25$$

Common factors = 1, 5, 25

6.

$$96 = 2^5 \times 3$$

$$144 = 2^4 \times 3^2$$

$$\text{HCF} = 2^4 \times 3 = 48$$

Answer: 48

Practice Time 3.3

1.

LCM(4,9)

$$4 = 2^2, 9 = 3^2$$

$$\text{LCM} = 2^2 \times 3^2 = 36$$

2.

LCM(8,12)

$$8 = 2^3, 12 = 2^2 \times 3$$

$$\text{LCM} = 2^3 \times 3 = 24$$

3.

$$\text{LCM}(10,15)$$

$$10 = 2 \times 5, 15 = 3 \times 5$$

$$\text{LCM} = 2 \times 3 \times 5 = 30$$

4.

$$\text{LCM}(16,20)$$

$$16 = 2^4, 20 = 2^2 \times 5$$

$$\text{LCM} = 2^4 \times 5 = 80$$

5.

$$\text{LCM}(6,9,12)$$

$$6 = 2 \times 3$$

$$9 = 3^2$$

$$12 = 2^2 \times 3$$

$$\text{LCM} = 2^2 \times 3^2 = 36$$

Practice Time 3.4

1.

$$\text{HCF}(8,32)=8$$

Yes, HCF is one of the numbers.

2.

$$\text{HCF}(11,55)=11$$

Because $55 = 11 \times 5$.

3.

$$\text{HCF}(9,81)=9$$

Yes, 9 is a factor of 81.

4.

$$\text{HCF}(16,64)=16$$

Relation:

$$64 = 4 \times 16$$

5(a)

Other number = $7k$

5(b)

Possible pairs:

$(7,14)$

$(7,21)$

Practice Time 3.5

1. The HCF of 32 and 48 is 16. If both numbers are multiplied by 5, what is the new HCF?

New numbers:

$$32 \times 5 = 160$$

$$48 \times 5 = 240$$

$$\text{New HCF} = \text{Old HCF} \times 5$$

$$= 16 \times 5$$

$$= \mathbf{80}$$

2. Find the HCF of 21 and 35. Then find the HCF of 214×21 and 354×35 .

$$\text{HCF}(21, 35) = 7$$

$$\text{HCF}(214 \times 21, 354 \times 35)$$

$$= 7 \times \text{HCF}(214 \times 3, 354 \times 5)$$

$$= 7 \times \text{HCF}(642, 1770)$$

$$= 7 \times 6$$

$$= \mathbf{42}$$

Observation: When both numbers are multiplied, the HCF also gets multiplied by common factors.

3. The HCF of two numbers is 9. If one number is 63, find the other number when:

(a) both numbers are multiplied by 2

Original pair may be 63 and 45.

New numbers:

126 and 90

New HCF = 18

Answer: 18

(b) both numbers are multiplied by 7

New HCF

$$= 9 \times 7$$

$$= \mathbf{63}$$

4. Two numbers are mn and $8n$ where m is a natural number.

(a) What is their HCF?

$$\text{HCF} = n \times \text{HCF}(m, 8)$$

Answer: $n \times \text{HCF}(m, 8)$

(b) If $n = 11$, write the pair and their HCF.

Numbers:

$11m$ and 88

$\text{HCF} = 11 \times \text{HCF}(m, 8)$

For example, if $m = 4$:

Numbers = 44 and 88

$\text{HCF} = 44$

5. The numbers $m \times 12$ and $n \times 18$ have HCF $6n$.

Verify for $m = 4$.

Numbers:

48 and $18n$

Taking $n = 2$:

48 and 36

$\text{HCF} = 12 = 6 \times 2$

Verified.

Exam Time

A. Multiple Choice Questions

1.

$\text{HCF}(72, 120)$

$= 24$

Answer: (c) 24

2.

$\text{LCM}(8, 12)$

$= 24$

Answer: (b) 24

3.

$$\text{HCF}(36,84)$$

$$36 = 2^2 \times 3^2$$

$$84 = 2^2 \times 3 \times 7$$

$$\text{HCF} = 12$$

Answer: (b) 12

4.

$$\text{HCF}(24,40) = 8$$

$$\text{HCF}(3 \times 24, 3 \times 40)$$

$$= 3 \times 8$$

$$= 24$$

Answer: (c) 24

B. Fill in the Blanks

1. $\text{HCF}(48,60) = \mathbf{12}$
 2. $\text{LCM}(10,15) = \mathbf{30}$
 3. $\text{HCF}(25,35)=5$ and $\text{LCM}(25,35)= \mathbf{175}$
 4. In ladder method, last row has no **common** factor greater than 1.
 5. New HCF = **4d**
-

C. True or False

1. True
2. True
3. False

4. True
 5. False
-

D. Match the Columns

Column A

Column B

- | | |
|-----------------------------------|--------------------------------|
| 1. HCF(18,30) | (c) Greatest common factor |
| 2. LCM(6,15) | (b) 90 |
| 3. Co-prime numbers | (e) Numbers with HCF = 1 |
| 4. Ladder method | (a) Gives both HCF and LCM |
| 5. $\text{HCF} \times \text{LCM}$ | (d) Product of the two numbers |
-

E. Very Short Answer Questions

1.

HCF of two numbers = Greatest common factor common to both numbers.

2.

LCM of 4 and 6 = 12

3.

Numbers whose HCF is 1 are called **co-prime numbers**.

4.

Prime factorisation method.

5.

$$\boxed{\text{HCF} \times \text{LCM} = a \times b}$$

F. Short Answer Questions

1. HCF of 54 and 90

$$54 = 2 \times 3^3$$

$$90 = 2 \times 3^2 \times 5$$

$$\text{HCF} = 18$$

2. LCM of 8, 12 and 18

$$8 = 2^3$$

$$12 = 2^2 \times 3$$

$$18 = 2 \times 3^2$$

$$\text{LCM} = 2^3 \times 3^2$$

$$= 72$$

3. HCF and LCM of 72 and 120 (Ladder Method)

$$\text{HCF} = 24$$

$$\text{LCM} = 360$$

4. Show that if numbers are n and $5n$, HCF is n .

n is common to both.

$$\text{HCF}(n, 5n)$$

$$= n \times \text{HCF}(1, 5)$$

$$= n$$

Hence proved.

5. Verify $\text{HCF} \times \text{LCM} = \text{Product}$

Numbers = 28 and 42

$$\text{HCF} = 14$$

$$\text{LCM} = 84$$

$$14 \times 84 = 1176$$

$$28 \times 42 = 1176$$

Verified.

Competency-Based Questions

Assertion–Reason

1

Assertion: True

Reason: True

Reason correctly explains Assertion.

Answer: (a)

2

Assertion: True

Reason: True

Reason correctly explains Assertion.

Answer: (a)

Case Based Study

84 juniors and 126 seniors

$\text{HCF}(84, 126)$

$= 42$

1.

Members in each row

Answer: (d) 42

2.

Rows of juniors

$$84 \div 42 = 2$$

Answer: 2 rows

3.

Smallest equal group using all 210 members

$$210 = 2 \times 3 \times 5 \times 7$$

Smallest possible equal complete groups among options = **14**

Answer: (b) 14

Maths Booster

1.

$$\text{HCF} = 9$$

$$\text{LCM} = 180$$

$$\text{One number} = 45$$

Other number

$$= \frac{9 \times 180}{45}$$

$$= 36$$

Answer: 36

2.

Ladder factors: 2, 3, 5

Last row: 7 and 11

Original numbers:

$$2 \times 3 \times 5 \times 7 = 210$$

$$2 \times 3 \times 5 \times 11 = 330$$

Answer:

(a) Numbers = 210 and 330

(b) HCF = 30

LCM = 2310

CHAPTER -4: Another Peek Beyond The Point

NCERT CORNER

INTEXT QUESTION

1. Convert the fractions into decimals

Fraction	Decimal
3/10	0.3
4/100	0.04
67/1000	0.067
457/100	4.57
71/100	0.71
43/100	0.43

Fraction	Decimal
9/100	0.09

2. Write the fractions as a sum of tenths, hundredths and thousandths and as decimals

(a) 847/10000

Expanding the fraction

$$\frac{847}{10000} = \frac{800}{10000} + \frac{40}{10000} + \frac{7}{10000}$$

As decimals

$$0.08 + 0.004 + 0.0007$$

Decimal form

$$\boxed{0.0847}$$

(b) 173/100

Expanding the fraction

$$\frac{173}{100} = \frac{100}{100} + \frac{70}{100} + \frac{3}{100}$$

As decimals

$$1 + 0.7 + 0.03$$

Decimal form

$$\boxed{1.73}$$

(c) 23/1000

Expanding the fraction

$$\frac{23}{1000} = \frac{20}{1000} + \frac{3}{1000}$$

As decimals

$$0.02 + 0.003$$

Decimal form

$$\boxed{0.023}$$

3. Can the product of two decimals be a natural number?

Yes.

Example:

$$0.5 \times 2 = 1$$

1 is a natural number.

4. Can the product of a decimal and a natural number be a natural number?

Yes.

Example:

$$0.25 \times 4 = 1$$

1 is a natural number.

5.If $596 \times 248 = 147808$, find 5.96×24.8

$$5.96 = \frac{596}{100}$$
$$24.8 = \frac{248}{10}$$

$$\begin{aligned}
 5.96 \times 24.8 &= \frac{596 \times 248}{1000} \\
 &= \frac{147808}{1000} \\
 &= 147.808
 \end{aligned}$$

Answer: 147.808

FIGURE IT OUT

Question 1.

Recall that a tenth is 0.1, a hundredth is 0.01, and so on. Find the following products in tenths, hundredths, and so on:

(a) 6×4 tenths = 24 tenths

(b) 7×0.3

(c) 9×5 hundredths

Solution:

(a) Here, 6×4 tenths = 24 tenths.

(b) $7 \times 0.3 = 7 \times 3$ tenths = 21 tenths

(c) Here, 9×5 hundredths = 45 hundredths

Question 2.

Find the products:

(a) 27.34×6

(b) 4.23×3.7

(c) 0.432×0.23

Solution:

$$(a) \text{ Here, } 27.34 \times 6 = \frac{2734}{100} \times 6 = \frac{16404}{100}$$

$$\text{LearnCBSE.in} = 164.04$$

(2 decimals)

$$(b) \text{ Here } 4.23 \times 3.7 = \frac{423 \times 37}{100 \times 10}$$

(2 decimals) (1 decimal)

$$\text{LearnCBSE.in} = \frac{15651}{1000} = 15.651$$

(3 decimals)

$$(c) \text{ We have } 0.432 \times 0.23 = \frac{9936}{1000 \times 100}$$

(3 decimals) (2 decimals)

$$= 0.09936$$

(5 decimals)

Question 3.

Thejus needs 1.65 m of cloth for a shirt. How many metres of cloth are needed for 3 shirts?

Solution:

Given: Thejus needs 1.65 m of cloth for a shirt.

For 3 shirts, the total cloth needed = 1.65×3

$$= 165100 \times 3$$

$$= 495100$$

$$= 4.95$$

Question 4.

Meenu bought 4 notebooks and 3 erasers. The cost of each book was ₹ 15.50, and each eraser was ₹ 2.75. How much did she spend in all?

Solution:

Here cost of 1 notebook = ₹ 15.50

$$\therefore \text{Cost of 4 notebooks} = 4 \times 15.50$$

$$= 4 \times 15.50$$

$$= 62.00$$

$$= ₹ 62$$

$$\text{and cost of 1 eraser} = ₹ 2.75$$

$$\therefore \text{Cost of 3 erasers} = 3 \times ₹ 2.75$$

$$= 3 \times 2.75$$

$$= 8.25$$

$$= ₹ 8.25$$

$$\therefore \text{Total amount spent} = 62 + 8.25 = ₹ 70.25$$

Question 5.

The thickness of a rupee coin is 1.45 mm. What is the total height of the cylinder formed by placing 36 rupee coins one over the other? Write the answer in centimetres.

Solution:

$$\text{Thickness of 1 coin} = 1.45 \text{ mm}$$

$$\text{Total thickness of 36 coins} = 36 \times 1.45$$

$$= 36 \times 1.45$$

$$= 52.2$$

$$= 52.2 \text{ mm}$$

$$\text{Now } 10 \text{ mm} = 1 \text{ cm}$$

$$1 \text{ mm} = 0.1 \text{ cm}$$

$$\therefore 52.2 \text{ mm} = 52.2 \times 0.1 = 5.22 \text{ cm.}$$

Question 6.

The price of 1 kg of oranges is ₹ 56.50. What is the price of 2.250 kg of oranges? Can we write 56.50 as 56.5 and 2.250 as 2.25 and multiply? Will we get the same product? Why?

Solution:

Price of 1 kg of oranges = ₹ 56.50

Price of 2.250 kg of oranges = 56.50×2.250

$$= 5650 \times 2250 \div 100 \times 1000$$

$$= 12712500 \div 100000$$

$$= ₹ 127.125$$

$$\text{Now } 56.5 \times 2.25 = 127.125$$

Hence, we will get the same product.

The zeroes at the end of a decimal do not change its value.

As we saw, 56.50 is the same as 56.5, and 2.250 is the same as 2.25.

Hence, the product of the two numbers will be the same.

Question 6.

Dwarakanath purchases notebooks at a wholesale price of ₹ 23.6 per piece and sells each notebook at ₹ 30/-. How much profit does he make if he sells 50 books in a week?

Solution:

Profit per notebook = Selling price – wholesale price

$$= 30 - 23.6$$

$$= ₹ 6.4$$

Total profit = Profit per notebook $\times$ No. of notebooks

$$= 6.4 \times 50$$

$$= ₹ 320$$

Question 7.

Given that $18 \times 12 = 216$, find the products:

(a) 18×1.2

(b) 18×0.12

(c) 1.8×1.2

(d) 0.18×0.12

(e) 0.018×0.012

(f) 1.8×12

In which of the cases above is the product less than 1?

Solution:

(a) Here $18 \times 12 = 216$ (i)

Now $18 \times 1.2 = 18 \times 1210$ [Using (i)]

$= 21610$

$= 21.6$ (1 decimal place)

(b) $18 \times 0.12 = 18 \times 12100$ (Using (i))

$= 216100$

$= 2.16$ (2 decimal places)

(c) $1.8 \times 1.2 = 1810 \times 1210 = 216100$ [Using (i)]

$= 2.16$ (2 decimal places)

(d) $0.18 \times 0.12 = 18100 \times 12100 = 216100 \times 100$ [Using (i)]

$= 0.0216$ (4 decimal places)

(e) $1.8 \times 12 = 18 \times 1210 = 21610$ [Using (i)]

$= 21.6$ (1 decimal place)

When multiplying two numbers positive if both numbers are less than 1, their product will also be less than 1.

In (d) and (e) product is less than 1.

Question 9.

In which of the following multiplications is the product less than 1? Can you find the answer without actually doing the multiplications?

- (a) 7×0.6
- (b) 0.7×0.6
- (c) 0.7×6
- (d) 0.07×0.06

Solution:

Yes, we can find the answer without actual multiplication, only by using decimal place values.

Multiplying by a number greater than 1: The product is greater than the original number.

Multiplying by a number between 0 and 1: The product is less than the original number.

Multiplying two numbers between 0 and 1: The product will be less than both factors, and therefore definitely less than 1.

- (a) Greater than 1.
- (b) Less than 1.
- (c) Greater than 1.
- (d) Less than 1.

Question 10.

Multiplying the following numbers by 10, 100, and 1000 to complete the table.

Solution:

	$\times 10$	$\times 100$	$\times 1000$
5.7	57	570	5700
23.02	230.2	2302	23020
0.92	9.2	92	920
0.306	3.06	30.6	306
24.67	246.7	2467	24670

Question 11.

Find the quotient by converting the denominator into 1, 10, 100, or 1000 and verify the solution by the long division method (division by place value).

Solution:

(a) Given $\frac{18}{5}$

To convert the denominator 5 into 10, multiply both the numerator and Dr by 2.

$$\frac{18 \times 2}{5 \times 2} = \frac{36}{10} = 3.6$$

Verification

$$18 \div 5$$

Dividing 1 ten and 8 ones into 5 equal parts.

$$1 < 5$$

It means we need to regroup 1 ten as 10 ones,

$$\text{i.e., } 10 + 8 = 18 \text{ ones}$$

$$18 \text{ ones} \div 5$$

3 ones remain.

To divide 3 ones into 5 equal parts.

Regroup the 3 ones as 30 Tenths. (Place a decimal while regrouping ones into tenths).

$$30 \text{ Tenths} \div 5 = 6$$

$$\text{Then, } 18 \div 5 = 3.6$$

$$\begin{array}{r}
 \text{T O Tenths} \\
 5 \overline{) 18} \text{ } 03.6 \\
 \underline{-15} \\
 30 \\
 \underline{-30} \\
 0
 \end{array}$$

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(b)

(b) Given $\frac{415}{4}$

To convert the denominator 4 into 100, multiply both the Nr and Dr by 25.

$$\frac{415 \times 25}{4 \times 25} = \frac{10375}{100} = 103.75$$

Verification

By following the steps

$$\begin{array}{r} 4 \overline{) 415} \begin{matrix} \text{H} & \text{T} & \text{O} & \text{T}^{\text{th}} & \text{H}^{\text{th}} \\ 1 & 0 & 3 & . & 7 & 5 \end{matrix} \\ \underline{-4} & & & & & \\ 15 & & & & & \\ \underline{-12} & & & & & \\ 30 & & & & & \\ \underline{-28} & & & & & \\ 20 & & & & & \\ \underline{20} & & & & & \\ \times & & & & & \end{array}$$

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$$\therefore 414 \div 4 = 103.75$$

Hence verified.

(c)

(c) Given $\frac{1217}{2}$

To convert the denominator 2 into 10, multiply both the Nr and Dr by 5.

$$\frac{1217 \times 5}{2 \times 5} = \frac{6085}{10} = 608.5$$

Verification

By following the steps:

$$\begin{array}{r} \text{H T O T}^{\text{th}} \\ 2 \overline{) 1217} (608.5 \\ \underline{-12} \\ 017 \\ \underline{-16} \\ 10 \\ \underline{-10} \\ 0 \end{array}$$

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$$\therefore 1217 \div 2 = 608.5$$

Hence verified.

(d)

(d) Given $\frac{4827}{8}$

To convert the denominator 8 into 1000, multiply both the Nr and Dr by 125

$$\frac{4827 \times 125}{8 \times 125} = \frac{603375}{1000} = 603.375$$

Verification

By following the steps:

$$\begin{array}{r}
 \text{Th H T O T}^{\text{th}} \text{H}^{\text{th}} \text{T}^{\text{th}} \\
 8 \overline{) 4827} \left(\begin{array}{c} 0 \\ 6 \\ 0 \\ 3 \\ . \\ 3 \\ 7 \\ 5 \end{array} \right. \\
 \underline{-48} \\
 027 \\
 \underline{-24} \\
 30 \\
 \underline{-24} \\
 60 \\
 \underline{-56} \\
 40 \\
 \underline{-40} \\
 \times
 \end{array}$$

We get $4827 \div 8 = 0603.375$

Hence verified.

Question 12.

Choose the correct answer:

Solution:

(a) $\frac{1526}{4}$

By using the Long Division Method:

$$\begin{array}{r}
 \text{H T O T}^{\text{th}} \\
 4 \overline{) 1526} \left(\begin{array}{c} 3 \\ 8 \\ 1.5 \end{array} \right. \\
 \underline{-12} \\
 32 \\
 \underline{-32} \\
 06 \\
 \underline{-4} \\
 20 \\
 \underline{-20} \\
 0
 \end{array}$$

Hence, option (iii) is correct.

(b) Given $\frac{3567}{8}$

By using the Long Division Method:

$$\begin{array}{r} 8 \overline{) 3567} \begin{matrix} \text{H} & \text{T} & \text{O} & \text{T}^{\text{th}} & \text{H}^{\text{th}} & \text{Th}^{\text{th}} \\ 4 & 4 & 5 & . & 8 & 7 & 5 \end{matrix} \\ \underline{-32} & & & & & & \\ 36 & & & & & & \\ \underline{-32} & & & & & & \\ 47 & & & & & & \\ \underline{-40} & & & & & & \\ 70 & & & & & & \\ \underline{-64} & & & & & & \\ 60 & & & & & & \\ \underline{-56} & & & & & & \\ 40 & & & & & & \\ \underline{-40} & & & & & & \\ 0 & & & & & & \end{array}$$

Hence, option (iii) is correct.

Question 3.

What is the quotient?

(a) $132 \div 4 = \underline{\hspace{2cm}}$

(b) $13.2 \div 4 = \underline{\hspace{2cm}}$

(c) $1.32 \div 4 = \underline{\hspace{2cm}}$

(d) $0.132 \div 4 = \underline{\hspace{2cm}}$

Solution:

$$(a) \frac{132}{4}$$

4	132	T O 3 3
	-12	
	12	
	-12	
	0	

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∴ Quotient = 33

$$(b) \frac{13.2}{4} = \frac{132}{40}$$

40	132	O T th 3 . 3
	-120	
	120	
	-120	
	0	

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∴ Quotient = 3.3

(c) Here $\frac{1.32}{4} = \frac{132}{400}$

$$\begin{array}{r}
 \text{O} \quad \text{T}^{\text{th}} \quad \text{H}^{\text{th}} \\
 400 \overline{) 1320} \left(\begin{array}{c} 0 \\ 3 \\ 3 \end{array} \right. \\
 \underline{-1200} \\
 1200 \\
 \underline{-1200} \\
 0
 \end{array}$$

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$\therefore$ Quotient = 0.33

(d) Here $\frac{0.132}{4} = \frac{132}{4000}$

$$\begin{array}{r}
 \text{O} \quad \text{T}^{\text{th}} \quad \text{H}^{\text{th}} \quad \text{Th}^{\text{th}} \\
 4000 \overline{) 132000} \left(\begin{array}{c} 0 \\ 0 \\ 3 \\ 3 \end{array} \right. \\
 \underline{-12000} \\
 12000 \\
 \underline{-12000} \\
 0
 \end{array}$$

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$\therefore$ Quotient = 0.033

Question 4.

What is the quotient?

(a) $126 \div 8 = \underline{\hspace{2cm}}$

(b) $12.6 \div 8 = \underline{\hspace{2cm}}$

(c) $1.26 \div 8 = \underline{\hspace{2cm}}$

(d) $0.126 \div 8 = \underline{\hspace{2cm}}$

(e) $0.0126 \div 8 = \underline{\hspace{2cm}}$

Solution:

(a) $\frac{126}{8}$

$$\begin{array}{r}
 \text{T O T}^{\text{th}} \text{H}^{\text{th}} \\
 8 \overline{) 126} \left(\begin{array}{c} 15.75 \\ 15.75 \end{array} \right. \\
 \underline{-8} \\
 46 \\
 \underline{-40} \\
 60 \\
 \underline{-56} \\
 40 \\
 \underline{-40} \\
 0
 \end{array}$$

Hence quotient = 15.75

(b) $\frac{12.6}{8}$

$$\begin{array}{r}
 \text{T O T}^{\text{th}} \text{H}^{\text{th}} \\
 8 \overline{) 12.6} \left(\begin{array}{c} 1.575 \\ 1.575 \end{array} \right. \\
 \underline{-8} \\
 46 \\
 \underline{-40} \\
 60 \\
 \underline{-56} \\
 40 \\
 \underline{-40} \\
 0
 \end{array}$$

Hence quotient = 1.575

(c) Here $1.26 \div 8$

$$\begin{array}{r}
 \text{O T}^{\text{th}} \text{H}^{\text{th}} \text{T}^{\text{th}} \text{T}^{\text{th}} \\
 8 \overline{) 1.26} \left(\begin{array}{c} 0.1575 \\ 0.1575 \end{array} \right. \\
 \underline{-0} \\
 12 \\
 \underline{-8} \\
 46 \\
 \underline{-40} \\
 60 \\
 \underline{-56} \\
 40 \\
 \underline{-40} \\
 0
 \end{array}$$

Hence quotient = 0.1575

(d) Here $0.126 \div 8$

$$\begin{array}{r}
 \begin{array}{ccccccc}
 & & & \text{O} & \text{T}^{\text{th}} & \text{H}^{\text{th}} & \text{T}^{\text{th}} & \text{T}^{\text{h}}^{\text{th}} \\
 8 & \overline{) 0.126} & (& 0.01 & 5 & 7 & 5 & \\
 \underline{-0} & & & & & & & \\
 12 & & & & & & & \\
 \underline{-8} & & & & & & & \\
 46 & & & & & & & \\
 \underline{-40} & & & & & & & \\
 60 & & & & & & & \\
 \underline{-56} & & & & & & & \\
 40 & & & & & & & \\
 \underline{-40} & & & & & & & \\
 0 & & & & & & &
 \end{array}
 \end{array}$$

Hence quotient = 0.01575

(e) Here $0.0126 \div 8$

$$\begin{array}{r}
 \begin{array}{ccccccc}
 & & & & & & \\
 8 & \overline{) 0.0126} & (& 0.001 & 575 & & \\
 \underline{0} & & & & & & \\
 00 & & & & & & \\
 \underline{00} & & & & & & \\
 12 & & & & & & \\
 \underline{-8} & & & & & & \\
 46 & & & & & & \\
 \underline{-40} & & & & & & \\
 60 & & & & & & \\
 \underline{-56} & & & & & & \\
 40 & & & & & & \\
 \underline{-40} & & & & & & \\
 0 & & & & & &
 \end{array}
 \end{array}$$

Hence quotient = 0.001575

INTEXT QUESTIONS

1. To find one such number, you can find $1 \div 17$ in decimal and use the repeating block of digits.

$$1 \div 17 = 0.0588235294117647 \dots$$

The repeating block is:

0588235294117647

One such number is:

0.0588235294117647

2. Will the quotient always be greater than the dividend when the divisor is a decimal?

No.

Examples:

$$10 \div 0.5 = 20$$

(Quotient is greater.)

But

$$10 \div 1.5 = 6.67$$

(Quotient is smaller.)

Answer: No, it depends on whether the decimal divisor is less than or greater than 1.

Figure It Out

Question 1.

Express the following fractions in decimal form:

(a) $\frac{2}{5}$

Multiply both the Nr and Dr by 2.

$$\frac{2}{5} \times \frac{2}{2} = \frac{4}{10}$$

Now, put decimal $\frac{4}{10} = 0.4$

Hence $\frac{2}{5}$ in decimal form is 0.4.

(b) $\frac{13}{4}$

Multiply both the Nr and Dr by 25.

$$\frac{13}{4} \times \frac{25}{25} = \frac{325}{100}$$

Now, put a decimal

$$\frac{325}{100} = 3.25$$

Hence $\frac{13}{4}$ in decimal form is 3.25.

(c) $\frac{4}{50}$

Multiply both the Nr and Dr by 2.

$$\frac{4}{50} \times \frac{2}{2} = \frac{8}{100}$$

Now, put the decimal

$$\frac{8}{100} = 0.08$$

Hence $\frac{4}{50}$ in decimal form is 0.08.

(d) $\frac{5}{8}$

Multiply both the Nr and Dr by 125.

$$\frac{5}{8} \times \frac{125}{125} = \frac{625}{1000}$$

Now, put the decimal

$$\frac{625}{1000} = 0.625$$

Hence $\frac{5}{8}$ in decimal form is 0.625.

Question 2.

Find the quotients:

(a) $24.86 \div 1.2$

(b) $5.728 \div 1.52$

Solution:

Solution.

(a) Here $24.86 \div 1.2$

Converting division into a fraction, we get

$$\frac{24.86}{1.2} = \frac{2486 \times 10}{12 \times 100} = \frac{2486}{120}$$

Now

$$\begin{array}{r} 120 \overline{) 2486} \quad (20.7166 \\ \underline{-240} \\ 860 \\ \underline{-840} \\ 200 \\ \underline{-120} \\ 800 \\ \underline{-720} \\ 80 \end{array}$$

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$\therefore$ Quotient = 20.7166...

(b) Converting division into a fraction, we get

$$5.728 \div 1.52 = \frac{5.728}{1.52} = \frac{5728 \times 100}{152 \times 1000}$$

$$= \frac{5728}{1520}. \text{ Now } 1520 \overline{) 5728} \quad (3.76$$

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$$\begin{array}{r} \underline{-4560} \\ 11680 \\ \underline{-10640} \\ 10400 \\ \underline{-9120} \\ 1280 \end{array}$$

$\therefore$ Quotient = 3.76

Question 3.

Evaluate the following using the information $156 \times 12 = 1872$.

(a) $15.6 \times 1.2 = \underline{\hspace{2cm}}$

(b) $187.2 \div 1.2 = \underline{\hspace{2cm}}$

(c) $18.72 \div 15.6 = \underline{\hspace{2cm}}$

(d) $0.156 \times 0.12 = \underline{\hspace{2cm}}$

Solution:

Given $156 \times 12 = 1872$ (i)

$$\Rightarrow 156 = \frac{1872}{12} \text{(ii)}$$

$$\Rightarrow 12 = \frac{1872}{156} \text{(iii)}$$

(a) Now converting division into a fraction

$$15.6 \times 1.2 = \frac{156 \times 12}{10 \times 10} = \frac{1872}{100} = 18.72 \text{ [using (i)]}$$

(b) Converting division into a fraction $187.2 \div 1.2$

$$187.2 \div 1.2 = \frac{187.2}{1.2} = \frac{1872}{12} = 156 \text{ [using (ii)]}$$

(c) Converting division into a fraction $18.72 \div 15.6$, we get

$$18.72 \div 15.6 = \frac{18.72}{15.6} = \frac{1872 \times 10}{156 \times 100} = \frac{12}{10} = 1.2 \text{ [Using (iii)]}$$

(d) Here $0.156 \times 0.12 = \frac{156 \times 12}{1000 \times 100}$ [Using (i)]

$$= \frac{1872}{1000 \times 100}$$

$$= 0.01872$$

Question 4.

Evaluate the following:

(a) $25 \div \underline{\hspace{2cm}} = 0.025$

(b) $25 \div \underline{\hspace{2cm}} = 250$

(c) $25 \div \underline{\hspace{2cm}} = 2.5$

(d) $25 \div 10 = 25 \times \underline{\hspace{2cm}}$

(e) $25 \div 0.10 = 25 \times \underline{\hspace{2cm}}$

(f) $25 \div 0.01 = 25 \times \underline{\hspace{2cm}}$

Solution:

(a) Let $25 \div x = 0.025$

$$\frac{25}{0.025} = x \Rightarrow x = \frac{25 \times 1000}{25} = 1000$$

(b) $25 \div x = 250$

$$\Rightarrow x = \frac{25}{250} = \frac{1}{10} = 0.1$$

(c) $25 \div x = 2.5$ [LearnCBSE.in](https://www.learnCBSE.in)

$$\Rightarrow x = \frac{25}{2.5} = \frac{25 \times 10}{25} = 1 \times 10 = 10$$

(d) Let $25 \div 10 = 25 \times x$

$$\frac{25}{10} = 25 \times x \Rightarrow x = \frac{25}{10 \times 25} = \frac{1}{10} = 0.1$$

(e) Let $25 \div 0.10 = 25 \times x$

$$\Rightarrow \frac{25}{0.10 \times 25} = x \Rightarrow x = \frac{1}{0.10} = \frac{100}{10} = 10$$

(f) Let $25 \div 0.01 = 25 \times x$

$$x = \frac{25}{0.01 \times 25} = x \Rightarrow x = \frac{1}{0.01} = \frac{100}{1} = 100.$$

Question 5.

Find the quotients:

(a) $2.46 \div 1.5 = \underline{\hspace{2cm}}$

(b) $2.46 \div 0.15 = \underline{\hspace{2cm}}$

(c) $2.46 \div 0.015 = \underline{\hspace{2cm}}$

Is the quotient obtained in $24.6 \div 1.5$ the same as the quotient obtained in $2.46 \div 0.15$?

Solution:

Solution:

Converting $2.46 \div 1.5$ into fraction

$$\frac{2.46}{1.5} = \frac{246 \times 10}{15 \times 100} = \frac{246}{150}$$

$$\begin{array}{r} 150 \overline{) 246} \quad (1.64 \\ \underline{-150} \\ 960 \\ \underline{-900} \\ 600 \\ \underline{-600} \\ 0 \end{array}$$

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$\therefore$ Quotient = 1.64

(b)

(b) Converting $2.46 \div 0.15$ into a fraction, we get

$$\frac{2.46}{0.15} = \frac{246 \times 100}{15 \times 100} = \frac{246}{15}$$

$$\begin{array}{r} 15 \overline{) 246} \quad (16.4 \\ \underline{-15} \\ 96 \\ \underline{-90} \\ 60 \\ \underline{-60} \\ 0 \end{array}$$

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$\therefore$ Quotient = 16.4

(c)

(c) Converting $2.46 \div 0.015$ into a fraction, we get

$$\frac{2.46}{0.015} = \frac{246 \times 1000}{15 \times 100} = \frac{2460}{15}$$

$$\begin{array}{r} 15 \overline{) 2460} \quad (164 \\ -15 \\ \hline 96 \\ -90 \\ \hline 60 \\ -60 \\ \hline 0 \end{array}$$

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$\therefore$ Quotient = 164

$$\text{Now } \frac{24.6}{1.5} = \frac{246 \times 10}{15 \times 10} = \frac{246}{15}$$

$$\text{and } \frac{2.46}{0.15} = \frac{246 \times 100}{15 \times 100} = \frac{246}{15}$$

Both are the same.

Hence quotient obtained in $24.6 \div 1.5$ is the same as the quotient obtained in $2.46 \div 0.15$.

Question 6.

A 4 m long wooden block has to be cut into 5 pieces of equal length. What is the length of each piece?

Solution:

Here total length = 4 m

No. of pieces = 5

$$\text{Length of each piece} = \frac{\text{Total length}}{\text{No. of pieces}}$$

$$= \frac{4}{5}$$

$$= 0.8 \text{ m}$$

$$\begin{array}{r} \text{Now } 5 \overline{) 4} \quad (0.8 \\ -0 \\ \hline 40 \\ -40 \\ \hline 0 \end{array}$$

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Question 7.

If the perimeter of a regular polygon with 12 sides is 208.8 cm, what is the length of its side?

Solution:

Here Perimeter = 208.8 cm

No. of sides = 12

Length Of a side = $\frac{\text{Perimeter}}{\text{No. of sides}}$

$$= \frac{208.8}{12}$$

$$= 17.4 \text{ cm}$$

$$\begin{array}{r} 12 \overline{) 208.8} \quad 17.4 \\ \underline{-12} \\ 88 \\ \underline{-84} \\ 48 \\ \underline{-48} \\ 0 \end{array}$$

Question 8.

3 litres of watermelon juice is shared among 8 friends equally. How much watermelon juice will each get? Express the quantity of juice in millilitres.

Solution:

Here total quantity of juice = 3 litres

No. of friends = 8

∴ Juice per friend = $\frac{3}{8}$ litre

$$= \frac{3}{8} \times 1000 \text{ ml}$$

$$= \frac{3000}{8}$$

$$= 375 \text{ ml}$$

$$\begin{array}{r} 8 \overline{) 3000} \quad (375 \\ \underline{-24} \\ -60 \\ \underline{56} \\ 40 \\ \underline{-40} \\ 0 \end{array}$$

Question 9.

A car covers 234.45 km using 12.6 litres of petrol. What is the distance travelled per litre?

Given total distance = 234.45 km

Total petrol = 12.6 litres

$$\begin{aligned}\text{Distance per litre} &= \frac{\text{Total distance}}{\text{Total petrol}} \\ &= \frac{234.45}{12.6} \\ &= \frac{23445 \times 10}{126 \times 100} \\ &= \frac{23445}{1260} = 18.607 \text{ km}\end{aligned}$$

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$$\begin{array}{r} 1260 \overline{) 23445} \quad (18.607 \\ \underline{-1260} \\ 10845 \\ \underline{-10080} \\ 7650 \\ \underline{-7560} \\ 9000 \\ \underline{-8820} \\ 180 \end{array}$$

Hence, the total distance travelled per litre of petrol is 18.607 km.

Question 10.

13.5 kg of flour (aata) was distributed equally among 15 students. How much flour did each student receive?

Solution:

Solution:

Total quantity of flour = 13.5 kg

No. of students = 15

Flour per student = $\frac{13.5}{15} = 0.9$ kg

Now

$$\begin{array}{r} 15 \overline{) 13.5} \quad (.9 \\ \underline{-13.5} \\ 0 \end{array}$$

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Each student receives = 0.9 kg.

INTEXT QUESTIONS

1. What pattern do you observe? Why are 2 and 5 related in this way?

Because

$$2 \times 5 = 10$$

and powers of 10 create terminating decimals.

2. Which month has the extra day?

February

3. Number of days in 100 calendar years

Without leap years:

$$100 \times 365 = 36500$$

4. How many years are divisible by 4 in 100 years?

$$100 \div 4 = 25$$

25

5. Days in 100 calendar years with leap-year adjustment

$$\begin{aligned} &36500 + 25 \\ &= 36525 \end{aligned}$$

6. How did people know Earth takes 365.2422 days?

Through long-term astronomical observations and measurements of Earth's revolution around the Sun.

7. Traditional Indian calendars

Traditional Indian calendars use astronomical observations of the Sun, Moon and stars and adjust dates using extra months (Adhik Maas) to stay aligned with seasons.

Figure It Out

Question 1.

A 210-gram packet of peanut chikki costs ₹ 70.5, while a 110-gram packet of potato chips costs ₹ 33.25. Which is cheaper?

Solution:

Given cost of a peanut is ₹ 70.5 per 210 grams.

$$\therefore \text{Cost per gram} = \frac{70.5}{210} = 0.3357$$

and cost of potato chips is ₹ 33.25 for 110 grams.

$$\therefore \text{Cost per gram} = \frac{33.25}{110} = 0.3023$$

$$\because 0.3023 < 0.3357.$$

Hence, potato chips are cheaper.

Question 2.

Write the decimal number at the arrow mark:

(i) Here number line is divided into 10 equal parts.

Difference between 3.2 and 3.1 = $3.2 - 3.1 = 0.1$

Value of each mark = $\frac{0.1}{10} = 0.01$

Now the arrow is on the sixth mark after 3.1

∴ Decimal number at the arrow mark = $3.1 + 6 \times 0.01$

= $3.1 + 0.06$

= 3.16

(ii) Here number line is divided into 10 equal parts between 2.15 and 2.17.

∴ Difference between 2.17 and 2.15 = $2.17 - 2.15 = 0.02$

Value of each mark = $\frac{0.02}{10} = 0.002$

Arrow is on the sixth mark after 2.15

∴ Decimal number at the arrow mark = $2.15 + 6 \times 0.002$

= $2.150 + 0.012$

= 2.162

Question 3.

Shyamala bought 3 kg of bananas at ₹ 30/- per kg. She counted 35 bananas in all. She sells each banana for ₹ 5/-. How much profit does she make selling all the bananas?

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Chapter 4 Page 93 Q3

Solution:

Given that Shyamala bought 3 kg of bananas at ₹ 30 per kg.

Total cost = $3 \times 30 = ₹ 90$

She sold 35 bananas for ₹ 5 each.

Total revenue = $35 \times 5 = ₹ 175$

Profit = Total revenue – Total cost

= $175 - 90$

= ₹ 85

Question 4.

A teacher placed textbooks that are 2.5 cm thick on a bookshelf. The teacher wanted to place 80 textbooks on the shelf. The bookshelf is 160 cm long. How many books could be placed on the shelf? Was there any space left? If yes, how much?

Solution:

Given that, the teacher wanted to place 80 textbooks, each is 2.5 cm thick.

Total thickness required = $80 \times 2.5 = 200$ cm

The bookshelf is 160 cm long.

The thickness of one book is 2.5 cm.

Number of books that can fit = $\frac{160 \text{ cm}}{2.5 \text{ cm}} = 64$

64 books could be placed on the shelf.

The total thickness of these books = $64 \times 2.5 = 160$ cm, which is the full length of the shelf.

The teacher wanted to place 80 textbooks, but only 64 textbooks can fit.

Therefore, there is no space left after placing the maximum number of books.

Question 5.

Fill in the following blanks appropriately:

Solution:

Here, (i) 1 km = 1000 m

$\therefore 5.5 \text{ km} = 5.5 \times 1000 = 5500 \text{ m}$

(ii) 1 m = 100 cm

$\therefore 35 \text{ cm} = \frac{35}{100} = 0.35 \text{ m}$

(iii) 1 cm = 10 mm

$\therefore 14.5 \text{ cm} = 14.5 \times 10 = 145 \text{ mm}$

(iv) 1 kg = 1000 g

$\therefore 68 \text{ g} = \frac{68}{1000} = 0.068 \text{ kg}$

(v) 1 m = 1000 mm

$\therefore 9.02 \text{ m} = 9.02 \times 1000 = 9020 \text{ mm}$

(vi) 1 l = 1000 ml

$$\therefore 125.5 \text{ ml} = \frac{125.5}{1000} = 0.1255 \text{ l}$$

5.5 km = <u>5500 m</u>	35 cm = <u>0.35 m</u>	14.5 cm = <u>145 mm</u>
68 g = <u>0.068 kg</u>	9.02 m = <u>9020 mm</u>	125.5 ml = <u>0.1255 l</u>

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Question 6.

The following problem was set by Sridharacharya in his book, Patiganita. “614 is divided by 212, and 6014 is divided by 312. Tell the quotients separately.”

Can you try to solve by converting the fractions into decimals?

Solution:

$$\text{Given } 6\frac{1}{4} = 6 + \frac{1}{4} = 6 + 0.25 = 6.25$$

$$\text{and } 2\frac{1}{2} = 2 + \frac{1}{2} = 2 + 0.5 = 2.5$$

$$60\frac{1}{4} = 60 + \frac{1}{4} = 60 + 0.25 = 60.25$$

$$3\frac{1}{2} = 3 + 0.5 = 3.5$$

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Now $6\frac{1}{4}$ is divided by $2\frac{1}{2}$.

$$\Rightarrow \frac{6.25}{2.5} = \frac{625 \times 10}{25 \times 100} = \frac{625}{250}$$

$$\begin{array}{r} 250 \overline{) 625} \quad (2.5 \quad \therefore \text{Quotient} = 2.5 \\ \underline{-500} \\ 1250 \\ \underline{-1250} \\ 0 \end{array}$$

Also $60\frac{1}{4}$ is divided by $3\frac{1}{2}$.

$$\Rightarrow \frac{60.25}{3.5} = \frac{6025 \times 10}{35 \times 100} = \frac{6025}{350}$$

$$\begin{array}{r} \therefore 350 \overline{) 6025} (17.21 \\ \underline{-350} \\ 2525 \\ \underline{-2450} \text{ LearnCBSE.in} \\ 750 \\ \underline{-700} \\ 500 \\ \underline{-350} \\ 150 \end{array}$$

$\therefore$ Quotient = 17.21

Question 7.

Fill the boxes in at least 2 different ways:

Solution:

(a) Here $1.2 \times 2 = 2.4$ and $0.4 \times 6 = 2.4$

(b) Here $2.9 \times 5 = 14.5$ and $14.5 \times 1 = 14.5$

Question 8.

Find the following quotients given that $756 \div 36 = 21$:

(a) $75.6 \div 3.6$

(b) $7.56 \div 0.36$

(c) $756 \div 0.36$

(d) $75.6 \div 360$

(e) $7560 \div 3.6$

(f) $7.56 \div 0.36$

Solution:

Solution:

(a) Given $756 \div 36 = 21$... (i)

Here $\frac{75.6}{3.6} = \frac{756 \times 10}{36 \times 10} = \frac{756}{36} = 21$ [Using (i)]

(b) Here $\frac{7.56}{0.36} = \frac{756 \times 100}{36 \times 100} = \frac{756}{36} = 21$ [Using (i)]

(c) Here $\frac{756}{0.36} = \frac{756 \times 100}{36} = 21 \times 100 = 2100$ [Using (i)]

(d) Here $\frac{75.6}{360} = \frac{756}{360 \times 10} = \frac{756}{360 \times 10}$ [Using (i)]
 $= \frac{21}{100} = 0.21$ [LearnCBSE.in](https://www.learnCBSE.in)

(e) Here $\frac{7560}{3.6} = \frac{7560}{36} \times 10 = \frac{756}{36} \times 10 \times 10$ [Using (i)]
 $= 21 \times 10 \times 10 = 2100$

(f) Here $\frac{7.56}{0.36} = \frac{756 \times 100}{36 \times 100} = \frac{756}{36} = 21$ [Using (i)]

Question 9.

Find the missing cells if each cell represents $a \div b$:

Here table given here represents division, where the value in each cell is the result of dividing the number in the corresponding 'a' column by the number in the corresponding row 'b'.

Given $1517 \div 37 = 41$

$$\frac{151.7}{3.7} = 41$$

$$\frac{15.17}{0.37} = 41$$

$$\frac{1.517}{37} = 0.041$$

$b \downarrow a \rightarrow$	1517	151.7	15.17	1.517	15170
37	41	4.1	0.41	0.041	410
3.7	410	41	4.1	0.41	4100
0.37	4100	410	4.1	4.1	41000
0.037	41000	4100	410	41	410000
370	4.1	0.41	0.041	0.0041	41

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Question 10.

SOLUTION.

$$(a) \boxed{4} \boxed{2} . \boxed{0} \times \boxed{8} . \boxed{5} = 357$$

$$(b) \boxed{4} \boxed{5} . \boxed{8} \times \boxed{0} . \boxed{2} = 9.16$$

$$(c) \boxed{8} \boxed{5} . \boxed{4} \times \boxed{2} . \boxed{0} = 170.8$$

$$(d) \boxed{2} \boxed{0} . \boxed{5} \times \boxed{4} . \boxed{8} = 98.4$$

$$(e) \boxed{4} \boxed{5} . \boxed{8} \times \boxed{0} . \boxed{2} = 9.16$$

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Question 11.

Sort the following expressions in increasing order:

(a) 245.05×0.942368

(b) 245.05×7.9682

(c) $245.05 \div 7.9682$

(d) $245.05 \div 0.942368$

(e) 245.05

(f) 7.9682

Solution:

Let $A = 245.05$, $B = 0.942368$, $C = 7.9682$

We note that $B < 1$ and $C > 1$

(a) Now $A \times B = 245.05 \times 0.942368 < 245.05$

($\therefore$ Multiplying a number by a value less than 1 results in a smaller number)

(b) $A \times C = 245.05 \times 7.9682 > 245.05$

(Multiplying a number by a value greater than 1 results in a larger number)

(c) $A \div C = 245.05 \div 7.9682 < 245.05$

(Dividing a number by a value greater than 1 results in a smaller number)

(d) $A \div B = 245.05 \div 0.942368 > 245.05$

(Dividing a number by a value greater than 1 results in a larger number)

(e) Now, expression less than 245.05

$\therefore 0.942368$ is closer to 1 than 7.9682 is to 1.

0.942368 will result in a value closer to 245.05 than dividing by 7.9682 .

$\therefore (c) < (a)$

Again, 0.942368 is closer to 1 than 7.9682 is to 1.

$\therefore$ Dividing by 0.942368 will result in a value closer to 245.05 than multiplying by 7.9682 .

$\therefore (d) < (b)$

Also, (f) 7.9682 is significantly smaller than 245.05; it will be the smallest value.

(f) $\therefore 7.9682 < (e) 245.05 \div 7.9682$

Combining all, we get (f), (c), (a), (e), (d), (b).

Practice Time 4.1

1. Write each of the following as a decimal

(a)

$$\frac{47}{10} = 4.7$$

(b)

$$\frac{509}{1000} = 0.509$$

(c)

$$\frac{82}{100} = 0.82$$

2. Express the following decimals as fractions in simplest form

(a)

$$0.6 = \frac{6}{10} = \frac{3}{5}$$

(b)

$$0.48 = \frac{48}{100} = \frac{12}{25}$$

(c)

$$0.305 = \frac{305}{1000} = \frac{61}{200}$$

3. Expand the fraction $\frac{735}{1000}$

(a)

$$\frac{735}{1000} = \frac{700}{1000} + \frac{30}{1000} + \frac{5}{1000}$$

$$= \frac{7}{10} + \frac{3}{100} + \frac{5}{1000}$$

(b)

$$\frac{735}{1000} = 0.735$$

4. Write the decimal place value of the underlined digit

(a) 3.64

Digit = 4

Place value = Hundredths

$$4 \times \frac{1}{100} = 0.04$$

(b) 9.25

Digit = 5

Place value = Hundredths

$$5 \times \frac{1}{100} = 0.05$$

(c) 0.071

Digit = 1

Place value = Thousandths

$$1 \times \frac{1}{1000} = 0.001$$

5. Without long division

(a)

$$84 \div 10 = 8.4$$

(b)

$$392 \div 100 = 3.92$$

(c)

$$7 \div 1000 = 0.007$$

Practice Time 4.2

1. Find the product

(a)

$$19.5 \times 3 = 58.5$$

(b)

$$7.08 \times 6 = 42.48$$

(c)

$$0.9 \times 0.8 = 0.72$$

2. Multiply

(a)

$$4.6 \times 9 = 41.4$$

(b)

$$12.75 \times 8 = 102$$

(c)

$$24.64 \times 7 = 172.48$$

3. Find

(a)

$$0.9 \times 25 = 22.5$$

(b)

$$3.2 \times 15 = 48$$

(c)

$$9.2 \times 38 = 349.6$$

4. Evaluate

(a)

$$6.03 \times 4 = 24.12$$

(b)

$$11.4 \times 7 = 79.8$$

(c)

$$17.8 \times 8 = 142.4$$

5. Juice Problem

Juice in one packet

$$= 1.25L$$

For 9 packets

$$\begin{aligned} &1.25 \times 9 \\ &= 11.25L \end{aligned}$$

Answer = 11.25 litres

Practice Time 4.3

1. Find the value

(a)

$$46.8 \div 10 = 4.68$$

(b)

$$46.8 \div 100 = 0.468$$

(c)

$$3.75 \div 10 = 0.375$$

(d)

$$3.75 \div 1000 = 0.00375$$

2. Calculate

(a)

$$0.904 \div 10 = 0.0904$$

(b)

$$0.904 \div 100 = 0.00904$$

(c)

$$215.7 \div 1000 = 0.2157$$

(d)

$$9.03 \div 10000 = 0.000903$$

3. Wire Problem

Length of wire

$$= 12.5m$$

(a)

$$12.5 \div 10 = 1.25m$$

(b)

$$12.5 \div 100 = 0.125m$$

4. Find

(a)

$$19.6 \div 4 = 4.9$$

(b)

$$7.35 \div 5 = 1.47$$

5. Oil Problem

Total oil

$$= 2.4L$$

Number of jars

$$= 6$$

$$2.4 \div 6 = 0.4L$$

Answer = 0.4 litre in each jar

Practice Time 4.4

1. Convert divisor into a whole number

(a)

$$\begin{aligned} &84 \div 1.2 \\ &= \frac{840}{12} \\ &= 70 \end{aligned}$$

(b)

$$\begin{aligned} &56 \div 0.7 \\ &= \frac{560}{7} \\ &= 80 \end{aligned}$$

2. Divide

(a)

$$\begin{aligned} &42.5 \div 2.5 \\ &= \frac{425}{25} \\ &= 17 \end{aligned}$$

(b)

$$\begin{aligned} &18.9 \div 0.3 \\ &= \frac{189}{3} \\ &= 63 \end{aligned}$$

3. Car Problem

Petrol used

$$= 7.2L$$

Distance

$$= 0.9km$$

Distance per litre

$$\begin{aligned} &0.9 \div 7.2 \\ &= 0.125km \end{aligned}$$

Answer = 0.125 km per litre

4. Rope Problem

Rope length

$$= 96m$$

Each piece

$$\begin{aligned} &= 1.6m \\ &96 \div 1.6 \\ &= \frac{960}{16} \\ &= 60 \end{aligned}$$

Answer = 60 pieces

5. Find

(a)

$$\begin{aligned} &63 \div 0.09 \\ &= \frac{6300}{9} \end{aligned}$$

$$= 700$$

(b)

$$\begin{aligned} & 7.35 \div 0.15 \\ & \quad 735 \\ & = \frac{\quad}{15} \\ & = 49 \end{aligned}$$

Practice Time 4.5

1.

True year

$$= 365.2422 \text{ days}$$

Calendar year

$$= 365 \text{ days}$$

(a)

$$\begin{aligned} & 365.2422 - 365 \\ & = 0.2422 \end{aligned}$$

Answer = 0.2422 days

(b)

Convert into hours

$$\begin{aligned} & 0.2422 \times 24 \\ & = 5.8128 \end{aligned}$$

Answer = 5.8128 hours

2.

Error in 1 year

$$= 0.2422 \text{ day}$$

For 50 years

$$\begin{aligned} &50 \times 0.2422 \\ &= 12.11 \end{aligned}$$

Answer = 12.11 days

3. Every 4th year is a leap year

(a)

$$200 \div 4 = 50$$

Answer = 50 leap years

(b)

$$\begin{aligned} &200 \times 365 + 50 \\ &= 73000 + 50 \\ &= 73050 \end{aligned}$$

Answer = 73,050 days

4.

(a)

Actual days in 200 years

$$\begin{aligned} &200 \times 365.2422 \\ &= 73048.44 \end{aligned}$$

Answer = 73,048.44 days

(b)

Difference

$$\begin{aligned} &73050 - 73048.44 \\ &= 1.56 \end{aligned}$$

Answer = 1.56 days

(Calendar is longer by 1.56 days.)

5.

(a)

Actual days in 100 years

$$\begin{aligned} &100 \times 365.2422 \\ &= 36524.22 \end{aligned}$$

Answer = 36,524.22 days

(b)

Calendar days

$$= 36524$$

Difference

$$\begin{aligned} &36524.22 - 36524 \\ &= 0.22 \end{aligned}$$

Answer = 0.22 day

The calendar is **short by 0.22 day** after 100 years.

EXAM TIME

A. Multiple Choice Questions

1. Place value of 7 in 42.738

(d) thousandths

2. Equal to 0.504

(c) $\frac{504}{1000}$

3. Decimal form of

$$6 + \frac{3}{10} + \frac{5}{100} = 6.35$$

(a) 6.35

4.

$$4.7 \times 5 = 23.5$$

(a) 23.5

5.

$$0.6 \times 0.4 = 0.24$$

0.24 is less than both 0.6 and 0.4.

(b) less than both

B. Fill in the Blanks

1. 27.053 has **3** digits after the decimal point.

2.

$$\frac{47}{1000} = 0.047$$

3.

$$6.2 \times 10 = 62$$
$$6.2 \div 10 = 0.62$$

4.

$$3.75 \times 100 = 375$$

5.

$$48.9 \div 100 = 0.489$$

C. True or False

1. $0.507 = \frac{507}{100}$

False

2. $5.39 > 5.4$

False

3. Product of two decimals less than 1 is less than both.

True

4. $0.08 \div 4 = 0.2$

False

5. When dividing by 10, only digits change, not decimal point.

True

D. Match the Columns

Column A

0.01

3.456

Column B

Hundredth place (c)

Thousands place (d)

Column A

$9.6 \div 3$

Year divisible by 4 but not by 100 Leap year (b)

365.2422 days

Column B

3.2 (e)

True length of one solar year (a)

E. Very Short Answer Questions

1.

$$5.078 = 5 + 0.07 + 0.008$$

2. Which is greater?

$$4.9 > 4.09$$

Answer: 4.9

3. Rule for multiplying decimals

Multiply normally and place the decimal point so that total decimal places equal the sum of decimal places in both factors.

4. Divide by 10, 100, 1000

Move decimal point left by 1, 2 and 3 places respectively.

5. Why were leap years introduced?

To keep the calendar aligned with Earth's revolution around the Sun.

F. Short Answer Questions

1. Convert $\frac{735}{1000}$ into decimal

$$\frac{735}{1000} = 0.735$$

2. Cost of 6 notebooks

$$\begin{aligned} 18.75 \times 6 \\ = 112.50 \\ \boxed{\text{₹}112.50} \end{aligned}$$

3. 23.4 L milk into 8 bottles

$$\begin{aligned} 23.4 \div 8 \\ = 2.925 \\ \boxed{2.925 \text{ L}} \end{aligned}$$

4. Was 1900 a leap year?

1900 is divisible by 100 but not by 400.

Therefore,

1900 was not a leap year

5. Meaning of 365.2422 days

A year is approximately 365 days, 5 hours, 48 minutes and 46 seconds long.

G. Long Answer Type Questions

1. A shop sells sugar at ₹42.75 per kg.

(a) Find the cost of 3.5 kg sugar.

Cost = ₹42.75 × 3.5

$$42.75 \times 3.5 = 42.75 \times \frac{35}{10}$$

$$= \frac{1496.25}{10} = 149.625$$

Cost of 3.5 kg sugar = ₹149.625 ≈ ₹149.63

(b) If a customer pays ₹200, how much money does she get back?

$$200 - 149.625 = 50.375$$

Money returned = ₹50.375 ≈ ₹50.38

2. Riya walks 1.25 km to school and 1.25 km back home.

(a) Distance walked in one day

$$1.25 + 1.25 = 2.50 \text{ km}$$

Answer = 2.5 km

(b) Distance walked in 6 school days

$$2.5 \times 6 = 15$$

Answer = 15 km

3. A can has 18.9 L of juice.

(a) Volume in each bottle

$$18.9 \div 9 = 2.1$$

Answer = 2.1 L

(b) Each bottle is sold for ₹35.50.

Number of bottles = 9

$$35.50 \times 9 = 319.50$$

Total money collected = ₹319.50

4. Length of a year

(a) Using 365 days

$$100 \times 365 = 36500$$

Answer = 36,500 days

(b) Using 365.2422 days

$$100 \times 365.2422 = 36524.22$$

Answer = 36,524.22 days

(c) Difference

$$36524.22 - 36500 = 24.22$$

Difference = 24.22 days

This means the seasons would shift by about **24 days** in 100 years if leap years were ignored.

5. Gregorian Calendar

(a) Total calendar days in 400 years

303 ordinary years and 97 leap years

$$\begin{aligned} &303 \times 365 + 97 \times 366 \\ &= 110595 + 35502 \\ &= 146097 \end{aligned}$$

Answer = 146,097 days

(b) Actual number of days

$$\begin{aligned} &400 \times 365.2422 \\ &= 146096.88 \end{aligned}$$

Answer = 146,096.88 days

(c) Error

$$\begin{aligned} &146097 - 146096.88 \\ &= 0.12 \end{aligned}$$

Answer = 0.12 day

The error is very small, so the Gregorian calendar is highly accurate.

Competency-Based Questions

A. Assertion–Reason Questions

1.

Assertion (A): Product of 0.6 and 0.7 is less than 0.6.

$$0.6 \times 0.7 = 0.42$$

$$0.42 < 0.6$$

Assertion is **True**.

Reason (R): Multiplying by a decimal between 0 and 1 makes a number smaller.

Reason is **True**.

Reason correctly explains Assertion.

Answer: (a) Both A and R are true and R is the correct explanation.

2.

Assertion (A): Year 2000 was a leap year.

True.

Reason (R): Any year divisible by 400 is a leap year.

$$2000 \div 400 = 5$$

Reason is True and explains Assertion.

Answer: (a)

B. Case Based Study

A school uses a 365-day calendar.

1. If leap years are ignored completely, after 50 years the calendar will be behind the real seasons by

Error per year

$$365.2422 - 365 = 0.2422$$

In 50 years

$$50 \times 0.2422 = 12.11$$

$\approx$ 12 days

Answer: (a) About 12 days

2. If the simple "every 4th year is a leap year" rule is used, in 100 years the calendar will be

Calendar days:

$$100 \times 365 + 25 = 36525$$

Actual days:

$$36524.22$$

Difference:

$$36525 - 36524.22 = 0.78$$

Calendar is ahead by less than 1 day.

Answer: (b) Ahead of the true time by less than a day

Maths Booster

1. Leap-Year Ladder

Starting from 2000, the next 10 leap years are:

2004, 2008, 2012, 2016, 2020, 2024, 2028, 2032, 2036, 2040

Why are some century years missing?

Century years are leap years only if divisible by 400.

Examples:

- 1700 ✗
 - 1800 ✗
 - 1900 ✗
 - 2000 ✓
 - 2100 ✗
-

2. Decimal Shuffle

Number = 365.2422

(a) Rounding

Nearest whole number:

365

Nearest tenth:

365.2

Nearest hundredth:

365.24

(b) Long-term error over 50 years

Using 365:

Error per year

0.2422

50-year error

12.11 days

Using 365.2:

Error per year

0.0422

50-year error

2.11 days

Using 365.24:

Error per year

0.0022

50-year error

0.11 day

Answer: 365.24 gives the smallest long-term error over 50 years.

Chapter 5 : Connecting the dots

NCERT CORNER

Intext Question

Question 1

Statistical Questions

- (a) Price of a tennis ball in India ✓
- (b) How old are the dogs that live on this street? ✓
- (c) Fraction of students who like walking uphill ✓
- (d) Do you like reading? ✗ (single answer)
- (e) Approximately how many bricks are in this wall? ✗
- (f) Who was the best bowler yesterday? ✗
- (g) Rainfall pattern in Barmer last year ✓

Question 2

No.

A single number cannot represent an entire group because it does not show variation in data.

Example:

Shubman scores = 20, 40, 60

Yashasvi scores = 40, 40, 40

Both averages are 40, but performances are different.

Figure It Out –

Q1

Shreyas recorded the number of bounces in 8 attempts:

6, 2, 9, 5, 4, 6, 3, 5

Step 1: Find the total number of bounces

$$6 + 2 + 9 + 5 + 4 + 6 + 3 + 5 = 40$$

Step 2: Find the average (mean)

$$\begin{aligned}\text{Mean} &= \frac{\text{Total number of bounces}}{\text{Number of attempts}} \\ &= \frac{40}{8} \\ &= 5\end{aligned}$$

Answer:

The average number of bounces made by Shreyas is 5.

Interpretation:

This means that Shreyas bounced the ball about **5 times per attempt on average**.

Q4

Nikhil's times (seconds)

17, 18, 17, 16, 19, 17, 18

Sum:

122

Mean:

$$\frac{122}{7} = 17.43 \text{ seconds}$$

Sunil's times (seconds)

20, 18, 18, 17, 16, 16, 17

Sum:

122

Mean:

$$\frac{122}{7} = 17.43 \text{ seconds}$$

Answer:

Both Nikhil and Sunil have the **same average running time of 17.43 seconds**.

Therefore, **neither is faster on average**.

5. The enrolment in a school during six consecutive years was as follows: 1555, 1670, 1750, 2013, 2040, 2126. Find the mean enrolment in the school during this period."

Solution

Data:

1555, 1670, 1750, 2013, 2040, 2126

Step 1: Find the sum

$$\begin{aligned} &1555 + 1670 + 1750 + 2013 + 2040 + 2126 \\ &= 11154 \end{aligned}$$

Step 2: Number of years

$$n = 6$$

Step 3: Find the mean

$$\begin{aligned} \text{Mean} &= \frac{\text{Sum of observations}}{\text{Number of observations}} \\ &= \frac{11154}{6} \\ &= 1859 \end{aligned}$$

Answer

$$\boxed{1859}$$

The mean enrolment in the school during the six-year period is 1859 students.

Intext Questions

1. Can you think of any other ways to compare the data?

Answer: Yes. We can compare data using:

- Mean (Average)
 - Median
 - Mode
 - Range
 - Bar graphs and pictographs
-

2. What else do you wonder about? Write questions that you are curious about with your peers, teachers, or family members.

Sample Answers:

- What is the average age of students in my class?
 - How many hours do students study daily?
 - What is the average monthly expenditure of a family?
 - Which sport is most popular among students?
-

3. Which of the values would you consider an outlier?

Answer: An outlier is a value that is very different from the other values in a data set. The value far away from the rest of the data should be considered the outlier.

4. Find the mean and median in the absence of the outlier. What change do you notice?

Answer:

- Removing an outlier usually changes the **mean significantly** because the mean uses all values.

- The **median changes very little or may remain the same** because it depends on the middle value.
-

5. Consider the values:

1555, 1670, 1750, 2013, 2040, 2126

(a) Mean and median are close to each other

Answer: Yes. Since the values increase gradually and there is no extreme value, the mean and median are close.

(b) Mean < Median

Answer: This happens when a few very small values pull the mean downward.

(c) Mean > Median

Answer: This happens when a few very large values pull the mean upward.

6. Discuss the effect on mean and median when outliers are present on both sides.

Answer:

- Mean is affected by outliers on either side.
 - Median is much less affected by outliers.
 - Therefore, the median is often a better measure of central tendency when outliers are present.
-

7. What can we infer from the dot plots and the central tendency measures?

Answer:

- Dot plots show how data is distributed.
 - Mean gives the average value.
 - Median gives the middle value.
 - Comparing them helps us understand the overall pattern and spread of data.
-

8. How many students are taller than the class average height?

Answer: Count all students whose heights are greater than the calculated mean height from the given data.

9. How many boys are taller than the class average height?

Answer: Count the boys whose heights are greater than the mean height.

10. Discuss how well both the groups fared at this activity. Describe and compare the variability in data and their central tendency.

Answer:

- Compare the means and medians of the two groups.
- The group with the higher mean performed better on average.
- The group with smaller spread (range) showed more consistency.
- Variability helps us understand how much the data values differ from one another.

Figure It Out

Q1. Find the median of onion prices in Yahapur and Wahapur.

Do it yourself

Q2. Domestic Animals and Pets Data

Data:

0, 1, 0, 4, 8, 0, 0, 2, 1, 1, 5, 3, 4, 0, 0, –, 10, 25, 2, –, 2, 4

Ignoring the absent students (–):

Data in ascending order:

0, 0, 0, 0, 0, 0, 1, 1, 1, 2, 2, 2, 3, 4, 4, 4, 5, 8, 10, 25

Number of observations = 20

Mean

Sum = 72

Mean = $72 \div 20 = 3.6$

Median

20 observations $\Rightarrow$ Median = average of 10th and 11th terms

$$= (2 + 2) \div 2$$

$$= 2$$

Answer:

- Mean = **3.6**
- Median = **2**

Description: The data is right-skewed because one value (25) is much larger than the others. Hence mean is greater than median.

Q3. Date-Palm Tree Heights

Heights (in feet):

50, 45, 43, 52, 61, 63, 46, 55, 60, 55, 59, 56, 56, 49, 54, 65, 66, 51, 44, 58, 60, 54, 52, 57, 61, 62, 60, 60, 67

Number of trees = 29

Sum = 1621

Mean

Mean = $1621 \div 29$

= **55.9 ft (approx.)**

Median

Arranged data:

43, 44, 45, 46, 49, 50, 51, 52, 52, 54, 54, 55, 55, 56, **56**, 57, 58, 59, 60, 60, 60, 60, 61, 61, 62, 63, 65, 66, 67

Median = 15th term

= **56 ft**

Trees shorter than average

Average $\approx$ 55.9

Trees shorter than 55.9:

43, 44, 45, 46, 49, 50, 51, 52, 52, 54, 54, 55, 55

Total = **13 trees**

Answer:

- Mean = **55.9 ft**
 - Median = **56 ft**
 - Trees shorter than average = **13**
-

Q4. Daily Water Usage

Data:

5.6, 8, 3.09, 12.9, 6.5, 12.1, 11.3, 20.5, 7.4

(a)

No.

Mean and median must lie between the minimum and maximum values.

Minimum = 3.09

Maximum = 20.5

Therefore neither mean nor median can lie between 25 and 30.

(b)

No.

The mean and median of a data set always lie between the minimum and maximum values.

Q5. Weights of Newborn Babies

Boys

3.5, 4.1, 2.6, 3.2, 3.4, 3.8

Mean

$$= (3.5 + 4.1 + 2.6 + 3.2 + 3.4 + 3.8) \div 6$$

$$= 20.6 \div 6$$

$$= \mathbf{3.43 \text{ kg}}$$

Median

Ordered:

2.6, 3.2, 3.4, 3.5, 3.8, 4.1

Median

$$= (3.4 + 3.5) \div 2$$

$$= \mathbf{3.45 \text{ kg}}$$

Girls

4.0, 3.1, 3.4, 3.7, 2.5, 3.4

Mean

$$= 20.1 \div 6$$

$$= \mathbf{3.35 \text{ kg}}$$

Median

Ordered:

2.5, 3.1, 3.4, 3.4, 3.7, 4.0

Median

$$= (3.4 + 3.4) \div 2$$

$$= \mathbf{3.4 \text{ kg}}$$

Analysis

- Boys have slightly higher average weight.
 - Both groups have similar median weights.
 - Variation is small in both groups.
-

Q6. Height Dot Plots

Given:

Whole Class:

- Mean = 141.21 cm

- Median = 142.5 cm

Boys:

- Mean = 142.05 cm
- Median = 143 cm

Girls:

- Mean = 140.14 cm
- Median = 140 cm

Observations

1. Boys are slightly taller on average than girls.
2. Median height of boys is greater than girls.
3. Whole class values lie between boys' and girls' values.
4. Girls show slightly greater spread in heights.
5. Heights of most students lie around 140–145 cm.

Q7. Cricket Graph

(a)

No, we cannot tell who batted first.

The graph only shows runs scored per over.

(b)

Blue team in Over 12

= **6 runs**

(c)

Red team scored the least runs in

Over 1 = 2 runs

(d)

No.

The target cannot be known from the graph because batting order is not given.

Q8. Sumo Wrestlers and Ballet Dancers

Mean weight of Sumo Wrestlers

$$(292.5 + 250.7 + 234.1 + 221.0 + 200.9) \\ = 1199.2$$

$$\text{Mean} = 1199.2 \div 5$$

$$= \mathbf{239.84 \text{ kg}}$$

Mean weight of Ballet Dancers

$$(40.3 + 37.6 + 38.8 + 45.5 + 44.1 + 48.2) \\ = 254.5$$

$$\text{Mean} = 254.5 \div 6$$

$$= \mathbf{42.42 \text{ kg}}$$

Comparison

$$239.84 \div 42.42 \approx 5.65$$

Answer

A sumo wrestler is approximately **6 times heavier** than a ballet dancer.

Figure It Out

Q1. Ball Bounces

Data:

6, 2, 9, 5, 4, 6, 3, 5

Sum

$$6 + 2 + 9 + 5 + 4 + 6 + 3 + 5 = 40$$

$$\text{Average} = \frac{40}{8} = 5$$

Answer: Average bounces = 5

Q4. Running Race

Nikhil

17, 18, 17, 16, 19, 17, 18

Sum

122

Mean

$$\frac{122}{7} = 17.43$$

Sunil

20, 18, 18, 17, 16, 16, 17

Sum

122

Mean

$$\frac{122}{7} = 17.43$$

Answer: Both have the same average time.

Figure It Out

Q1. School Enrolment

Data:

1555, 1670, 1750, 2013, 2040, 2126

Sum

11154

$$\text{Mean} = \frac{11154}{6} = 1859$$

Answer: Mean enrolment = 1859 students

Q2.

Other questions:

- Which year had highest enrolment?
 - Which year had lowest enrolment?
 - How much did enrolment increase over six years?
-

Q4. Absence Data

Data:

0,1,0,4,8,0,0,2,1,1,5,3,4,0,0,10,25,2,0,2,4

Arranged:

0,0,0,0,0,0,0,1,1,1,2,2,2,3,4,4,4,5,8,10,25

Median = 11th value = 2

Total = 72

$$\text{Mean} = \frac{72}{21} = 3.43$$

Answer:

Mean = 3.43

Median = 2

The value 25 is an outlier.

Q5. Daily Water Usage

Data:

5.6, 8, 3.09, 12.9, 6.5, 12.1, 11.3, 20.5, 7.4

Mean

$$\text{Sum} = 87.39$$

$$\frac{87.39}{9} = 9.71$$

Mean = 9.71 L

Median

Arrange:

3.09, 5.6, 6.5, 7.4, 8, 11.3, 12.1, 12.9, 20.5

Middle value = 8

Median = 8

Q9. Estimate and then measure

This is an activity-based question.

Sample answers:

Object	Estimate (cm)	Measure (cm)	Positive Difference
Pen	14	15	1
Eraser	4	5	1
Palm	9	10	1
Geometry Box	20	22	2
Notebook	24	25	1

Observation: Estimation gives an approximate value. Actual measurements may differ slightly.

Q10. Sudoku Puzzle Times

Data:

410, 400, 370, 340, 360, 400, 320, 330, 310, 320, 290, 380, 280, 270, 230, 220, 240

Arranged Data

220, 230, 240, 270, 280, 290, 310, 320, 320, 330, 340, 360, 370, 380, 400, 400, 410

Mean

$$\text{Sum} = 5770$$

$$\text{Mean} = 5770 \div 17$$

$$= \mathbf{339.4 \text{ seconds}}$$

Median

17 observations

Median = 9th observation

$$= \mathbf{320 \text{ seconds}}$$

Observation

- Mean > Median
 - A few larger values pull the mean upward.
 - Most puzzle-solving times lie around 300–350 seconds.
-

Electric Vehicle Bar Graph

(b) Scale and Pattern

Scale:

Each major horizontal line represents approximately **25,000 vehicles**.

Pattern:

- Registrations generally increased from 2022 to 2024.
- Assam, Gujarat and Delhi show high registrations.
- Uttarakhand shows the lowest registrations.

(c) Change from 2022 to 2024

Every state shows an overall increase in registrations.

Therefore EV adoption is increasing steadily.

(d) Assam: increase in 2023 compared to 2022

$$2022 \approx 40,000$$

2023 $\approx$ 60,000

Increase = 20,000

Answer: Approximately 20,000 vehicles

(e) West Bengal

2022 $\approx$ 10,000

2024 $\approx$ 42,000

Increase factor

$= 42,000 \div 10,000$

$= 4.2$

Answer: About 4 times

(f)

Statement:

"There were very few new registrations in Uttarakhand in 2023 and 2024."

Not correct.

Although the increase is small compared to some states, registrations still increased.

Height Table Questions

Q2

(a)

True

The heights of boys and girls generally increased from 1989 to 2019.

(b)

13-year-old girls in 1989

$= 143.2$ cm

14-year-old girls in 2009

= 148 cm

$143.2 < 148$

False

(c)

15-year-old boys in 2019

= 159 cm

16-year-old boys in 1989

= 158.9 cm

$159 > 158.9$

True

(d)

Cannot be concluded.

Table only gives averages.

False

(e)

Boys' average height is greater at every age.

True

(f)

Data ends at age 19.

No conclusion beyond age 19.

False

Q3

Boys (2019)

Successive growth:

$$5 \rightarrow 6 = 6.0$$

$$6 \rightarrow 7 = 5.5$$

$$7 \rightarrow 8 = 4.9$$

$$8 \rightarrow 9 = 4.5$$

$$9 \rightarrow 10 = 4.5$$

$$10 \rightarrow 11 = 4.4$$

$$11 \rightarrow 12 = 5.2$$

$$12 \rightarrow 13 = 6.2$$

$$13 \rightarrow 14 = 6.0$$

$$14 \rightarrow 15 = 4.6$$

$$15 \rightarrow 16 = 3.3$$

$$16 \rightarrow 17 = 2.3$$

$$17 \rightarrow 18 = 1.4$$

$$18 \rightarrow 19 = 0.5$$

Answer

Maximum growth = **6.2 cm**

Between **12 and 13 years**

Girls (2019)

Maximum growth

= 5.1 cm

Between **11 and 12 years**

Q4

Newborn average = 50 cm

Reasonable estimates:

	Age Boys (cm)	Girls (cm)
1	75	74
2	85	84
3	92	91
4	97	96

Q5

Estimate for 2029

Trend suggests gradual increase.

Approximate estimates:

	Age Boys (cm)	Girls (cm)
10	135	134
15	162	155
19	168	157

Q6

Graph Organisation

The graph compares average heights of:

- Boys
- Girls

across different ages and years.

Information Presented

- Growth with age
- Difference between boys and girls

- Changes across decades
 - Trends in average height
-

Figure It Out

Q1 Dot Plots (Pockets)

(a)

The boys' data has a larger spread.

✓ True

(b)

Median pockets:

Boys = 5

Girls = 4

✓ True

(c)

Mean pockets:

Boys > Girls

✓ True

(d)

Maximum pockets:

Boys = 6

Girls = 6

Not greater.

✗ False

Q2 Players' Scores

Player Scores

A 14,16,10,10

B 0,8,6,4

C 8,11,13

(a) Average score of A

Mean

$$= (14+16+10+10) \div 4$$

$$= 50 \div 4$$

$$= \mathbf{12.5}$$

(b) Why divide C's score by 3?

Because C played only 3 games.

(c) Best performer

Averages:

$$A = 12.5$$

$$B = 4.5$$

$$C = 10.67$$

Best performer = Player A

Practice Time 5.1

1. Riya's skips

Data: 24, 31, 28, 35, 27, 30, 25

Step 1: Find total skips

$$24 + 31 + 28 + 35 + 27 + 30 + 25 = 200$$

Step 2: Divide by number of attempts

$$\text{Average} = \frac{200}{7} = 28.57$$

Answer: Average skips = **28.57 skips**

2. Apples in one crate

Data: 18, 21, 19, 20, 22, 20

Total

$$18 + 21 + 19 + 20 + 22 + 20 = 120$$

$$\text{Average} = \frac{120}{6} = 20$$

Answer: Average weight = **20 kg**

3. Pages read in 5 days

Data: 12, 18, 15, 10, 20

$$12 + 18 + 15 + 10 + 20 = 75$$

$$\text{Average} = \frac{75}{5} = 15$$

Answer: Average pages per day = **15 pages**

4. Customers visiting shop

Data: 35, 28, 42, 30, 25

$$35 + 28 + 42 + 30 + 25 = 160$$

$$\text{Average} = \frac{160}{5} = 32$$

Answer: Average customers per day = **32**

5. Weekly temperatures

Data: 32, 34, 33, 35, 36, 34, 33

$$32 + 34 + 33 + 35 + 36 + 34 + 33 = 237$$

$$\text{Average} = \frac{237}{7} = 33.86$$

Answer: Average temperature = **33.86°C**

12. Individual Project (Long Term)

(i) Describe the variability and central tendency of this data. Make a dot plot.

Answer:

This is an activity-based question. Students will record how many times they step out of their house each day for a month.

Example data (30 days):

2, 3, 2, 4, 3, 2, 5, 4, 3, 2, 3, 4, 5, 2, 3, 4, 3, 2, 4, 5, 3, 2, 4, 3, 2, 5, 4, 3, 2, 3

- Mean ≈ 3.3
- Median = 3
- Range = $5 - 2 = 3$

Observation: Most values are clustered around 3 and 4. The data has low variability.

(ii) Do you find anything interesting about this data?

Sample Answer:

Yes. I noticed that I stepped out more often on weekends than on weekdays. Most of the values were between 2 and 4.

(iii) Ask family members or friends to do this activity.

Sample Answer:

Different family members had different patterns. Adults usually stepped out more frequently than children.

13. Small Group Project

(a) Our Heights vs Our Family's Heights

(i) Make a dot plot showing heights of your family members. Describe its variability and central tendency.

Sample Data:

150 cm, 155 cm, 160 cm, 165 cm, 170 cm

Mean

$$= (150 + 155 + 160 + 165 + 170) \div 5$$

$$= 800 \div 5$$

$$= \mathbf{160 \text{ cm}}$$

$$\text{Median} = \mathbf{160 \text{ cm}}$$

$$\text{Range} = 170 - 150 = \mathbf{20 \text{ cm}}$$

Observation:

The heights are evenly spread around 160 cm.

(ii) Make a double-bar graph showing each student's height and family mean height.

Answer:

Students should draw a double-bar graph using collected data.

Example:

Student Height Family Mean

A 150 160

B 155 162

C 148 158

(iii) Look at everyone's data and share observations.

Sample Answer:

Most students were shorter than the average height of their families. Some students had heights very close to their family averages.

13 (b) Estimating Time

(i) Make two dot plots (1 minute and 3 minutes estimates).

Sample Data

1 Minute Estimates (seconds):

55, 58, 60, 62, 64

3 Minute Estimates (seconds):

170, 175, 180, 185, 190

Students should plot these values on dot plots.

(ii) Mark mean and median. Describe variability and central tendency.

1 Minute

Mean

$$= (55 + 58 + 60 + 62 + 64) \div 5$$

$$= 299 \div 5$$

$$= \mathbf{59.8 \text{ sec}}$$

Median = **60 sec**

$$\text{Range} = 64 - 55 = \mathbf{9 \text{ sec}}$$

3 Minute

Mean

$$= (170 + 175 + 180 + 185 + 190) \div 5$$

$$= 900 \div 5$$

$$= \mathbf{180 \text{ sec}}$$

Median = **180 sec**

$$\text{Range} = 190 - 170 = \mathbf{20 \text{ sec}}$$

(iii) Make a double-bar graph showing mean 1-minute estimate and mean 3-minute estimate.

Family Member 1 Minute Estimate 3 Minute Estimate

A	60	180
B	58	175
C	62	185

Draw a double-bar graph using these values.

(iv) Look at everyone's data and share observations.

Sample Answer:

- Most people estimated 1 minute fairly accurately.
- Errors increased while estimating 3 minutes.
- Mean and median were very close.
- Some people tended to underestimate time, while others overestimated it.

Note: Questions 12 and 13 are project-based activities. In examinations, NCERT generally accepts students' own collected data. The above solutions are model answers for notebook work and answer keys.

Practice Time 5.2

Data:

32, 28, 35, 30, 29, 31, 34

(a) Ascending order

28, 29, 30, 31, 32, 34, 35

(b) Minimum, Maximum and Range

Minimum = 28

Maximum = 35

Range

$$35 - 28 = 7$$

Answer: Range = 7

(c) Mean price

$$32 + 28 + 35 + 30 + 29 + 31 + 34 = 219$$
$$\text{Mean} = \frac{219}{7} = 31.29$$

Answer: ₹31.29

(d) Median price

Arranged data:

28, 29, 30, **31**, 32, 34, 35

Middle value = 31

Answer: Median = ₹31

Question 2

Banana Prices

Month Mitra Devgarh

Jan	32	30
Feb	34	33
Mar	36	38
Apr	35	37
May	33	31

(a) Average price

Mitra

$$32 + 34 + 36 + 35 + 33 = 170$$

$$\frac{170}{5} = 34$$

Average = ₹34

Devgarh

$$30 + 33 + 38 + 37 + 31 = 169$$
$$\frac{169}{5} = 33.8$$

Average = ₹33.8

(b) Range

Mitra

$$36 - 32 = 4$$

Range = 4

Devgarh

$$38 - 30 = 8$$

Range = 8

(c) More stable town

Smaller range means more stability.

Mitra range = 4

Devgarh range = 8

Answer: Mitra is more stable.

(d) More fluctuation

Answer: Devgarh

Question 3

Marks:

21, 24, 23, 22, 25, 24, 49

(a) Mean including all marks

$$\begin{aligned} 21 + 24 + 23 + 22 + 25 + 24 + 49 &= 188 \\ \frac{188}{7} &= 26.86 \end{aligned}$$

Answer = **26.86**

(b) Outlier

49 is much larger than the others.

Answer: 49

(c) Mean without outlier

$$\begin{aligned} 21 + 24 + 23 + 22 + 25 + 24 &= 139 \\ \frac{139}{6} &= 23.17 \end{aligned}$$

Answer = **23.17**

(d) Better measure

Median is better because outlier affects mean.

Arranged data:

21, 22, 23, 24, 24, 25, 49

Median = 24

Answer: Median

Question 4

Ravi

150, 160, 155, 165, 170, 160

Total

$$960$$

Mean

$$\frac{960}{6} = 160$$

Range

$$170 - 150 = 20$$

Soham

140, 210, 150, 230, 160, 220

Total

$$1110$$

Mean

$$\frac{1110}{6} = 185$$

Range

$$230 - 140 = 90$$

Answers

(a) Ravi Mean = **₹160**

Soham Mean = **₹185**

(b) Range

Ravi = 20

Soham = 90

(c) Receives more on average

Soham

(d) More variation

Soham

Question 5

Group A

55, 62, 59, 61, 60

Total

297

Mean

$$\frac{297}{5} = 59.4$$

Range

$$62 - 55 = 7$$

Group B

40, 72, 63, 52, 69

Total

296

Mean

$$\frac{296}{5} = 59.2$$

Range

$$72 - 40 = 32$$

Answers

(a)

Group A Mean = 59.4 sec

Group B Mean = 59.2 sec

(b)

Group A Range = 7 sec

Group B Range = 32 sec

(c)

Group A is closer to 60 seconds.

(d)

Group A is more consistent because it has the smaller range.

Practice Time 5.3

3(a)

Most late students = 6 on Tuesday

Answer: Tuesday

3(b)

Least late students = 2 on Friday

Answer: Friday

3(c)

Monday → Tuesday = increase

Tuesday → Wednesday = decrease

Wednesday → Thursday = decrease

Thursday → Friday = decrease

Answer: Increase then continuous decrease.

5(a)

Stall A sold more on:

Monday, Tuesday and Thursday.

5(b)

Almost equal sales on:

Wednesday

(28 and 31 are closest)

5(c)

Total sales

Stall A

$$25 + 30 + 28 + 32 = 115$$

Stall B

$$20 + 27 + 31 + 29 = 107$$

Answer: Stall A sold more sandwiches.

Practice Time 5.4

Q1. Heights of 6 students

Data: 143, 146, 150, 141, 148, 144

(a) Mean Height

$$143 + 146 + 150 + 141 + 148 + 144 = 872$$
$$\text{Mean} = \frac{872}{6} = 145.33$$

Answer: 145.33 cm

(b) New student of height 152 cm joins

New total

$$872 + 152 = 1024$$

Number of students = 7

$$\text{New Mean} = \frac{1024}{7} = 146.29$$

Answer: 146.29 cm

Q2. Heights of 10 girls

Data:

137, 139, 141, 140, 138, 142, 139, 141, 140, 138

Frequency Table

Height Frequency

137 1

138 2

139 2

Height Frequency

140 2

141 2

142 1

(Dot plot to be drawn in notebook.)

Q3. Heights of boys and girls

Boys

145, 147, 150, 149, 146

Sum

$$145 + 147 + 150 + 149 + 146 = 737$$

Mean

$$\frac{737}{5} = 147.4$$

Girls

144, 146, 148, 147, 145

Sum

$$730$$

Mean

$$\frac{730}{5} = 146$$

(c)

$$147.4 - 146 = 1.4$$

Answer: Boys are taller by **1.4 cm** on average.

Exam Time

MCQs

1.

Mean height

Data:

140,145,150,155,160

$$\frac{750}{5} = 150$$

✓ (c) 150 cm

2.

Data:

22,26,24,28,30

Arrange:

22,24,26,28,30

Median = 26

✓ (c) ₹26

3.

Data:

18,25,20,32,28

Range

$$32 - 18 = 14$$

✓ (d) 14

4.

Town M Mean

$$40 + 42 + 43 = 125$$
$$125/3 = 41.67$$

Town N Mean

$$38 + 41 + 45 = 124$$
$$124/3 = 41.33$$

✓ (a) Town M only

5.

Girls:

140,142,145,143,141

Sum

711

Mean

$$711/5 = 142.2$$

Closest value = 143

✓ (c) 143 cm

Fill in the Blanks

1. number
2. median
3. clustered
4. maximum, minimum

5. trends, patterns

True / False

1. False
2. True
3. False
4. True
5. True

Match the Columns

Column A	Column B
Mean	(c)
Median	(b)
Range	(a)
Statistical Question	(d)
Outlier	(e)

Very Short Answer Questions

1.

Data is a collection of facts or information.

2.

$$\text{Mean} = \frac{\text{Sum of observations}}{\text{Number of observations}}$$

3.

One dot represents one observation/value.

4.

Range

$$25 - 12 = 13$$

5.

Double-bar graph.

Short Answer Questions

1.

Graphs make data easier to understand and compare.

2.

Range = Maximum – Minimum

$$40 - 28 = 12$$

So the statement is incorrect.

3.

An outlier can increase or decrease the mean and make it less representative.

4.

City P has greater variation in day length than City Q.

5.

Median is often better because it is not affected by outliers.

G. Long Answer Type Questions

1. Same data in a table and a dot plot

Example: Marks = 45, 50, 55, 55, 60

Table

Student Marks

A 45

B 50

Student Marks

C 55

D 55

E 60

A dot plot shows clustering and spread visually, while a table shows exact values.

2. Trees planted in 4 years: 120, 135, 150, 165

Mean

$$= (120 + 135 + 150 + 165) \div 4$$

$$= 570 \div 4$$

$$= \mathbf{142.5 \text{ trees}}$$

Pattern: Number of trees increases by 15 each year.

3. Average heights

Group Average Height (cm)

Boys 150

Girls 148

Double-bar graph should have two bars representing 150 and 148.

4. Why is 200 cm an outlier?

Data: 145, 150, 148, 147, 200

Most values are between 145–150.

200 is far away from the rest.

Hence, **200 cm is an outlier** and increases the mean.

5. How can data make us curious?

Data helps us notice patterns, compare situations, ask questions, and make decisions.

Example:

If one team's average score is much higher than another's, we may ask why they perform better.

Competency-Based Questions

Assertion–Reason 1

Assertion: In a data set with an outlier, the median is often more reliable than the mean.

Reason: Median depends only on middle value(s) and is not affected much by very large or very small values.

Answer: (a) Both (A) and (R) are true and (R) is the correct explanation of (A).

Assertion–Reason 2

Assertion: Double-column graphs are useful for comparing monthly milk sales of two booths.

Reason: In a double-column graph, each cluster has three bars for three years.

Answer: (c) (A) is true but (R) is false.

Case-Based Study

Given:

City Boys Girls

A 155 153

B 150 151

C 158 156

1.

Tallest boys = 158 cm

Answer: (c) City C

2.

Difference:

$$A = 2 \text{ cm}$$

$$B = 1 \text{ cm}$$

$$C = 2 \text{ cm}$$

Answer: (b) City B

3.

Girls' average

$$= (153 + 151 + 156) \div 3$$

$$= 460 \div 3$$

$$= 153.3 \text{ cm}$$

Answer: (b) 153.3 cm

Maths Booster

1. Who is right?

Data:

140, 142, 144, 146, 200

Mean

$$= (140 + 142 + 144 + 146 + 200) \div 5$$

$$= 772 \div 5$$

$$= 154.4$$

Median = 144

Since 200 is an outlier, the mean is pulled upward.

Beena is right. Median is a better representative.

2. Spot the Mistake

Student did:

$$(12 + 14 + 16 + 18) \div 3$$

Mistake: Divided by 3 instead of 4.

Correct Mean:

$$\frac{12 + 14 + 16 + 18}{4} = \frac{60}{4} = 15$$

Correct mean = 15.

Chapter 6: Constructions and Tilings

NCERT CORNER

Which two triangles should be congruent for AB to be the perpendicular bisector of XY (that is, O is the midpoint of XY and AB is perpendicular to XY)?

Answer:

The triangles $\triangle AOX$ and $\triangle AOY$ should be congruent.

Reason:

- $AX = AY$ (constructed with same radius)
- AO is common
- $OX = OY$

Therefore,

$$\triangle AOX \cong \triangle AOY$$

By congruence, $\angle AOX = \angle AOY$.

Since these two angles form a straight line, each angle = 90° .

Hence **$AB \perp XY$ and O is the midpoint of XY.**

Therefore **AB is the perpendicular bisector of XY.**

FIGURE IT OUT

Question 1.

When constructing the perpendicular bisector, is it necessary to have the same radius for the arcs above and below XY? Explore this through construction, and then justify your answer.

[Hint 1: Any point that is of the same distance from X and Y lies on the perpendicular bisector.

Hint 2: We can draw the whole line if any two of its points are known.]

Solution:

Draw a line segment XY.

Choose distances k and k' which are slightly greater than half of the distance XY.

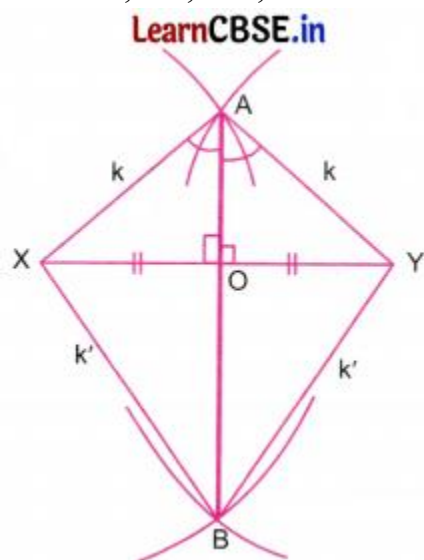
With centres at X and Y, draw arcs of radius ' k ' below XY.

With centres at X and Y, draw arcs of radius ' k' ' below XY.

Let the arcs above XY intersect at A, and the arcs below XY intersect at B.

Join A and B. Let AB intersect XY at O.

Join AX, AY, BX, and BY.



$\triangle ABX$ and $\triangle ABY$ are congruent because $AX = AY = k$, $BX = BY = k'$, and AB is common.

$\therefore \angle XAO = \angle YAO$

$\triangle AOX$ and $\triangle AOY$ are congruent because $AX = AY = k$, $\angle XAO = \angle YAO$, and OA is common.

$\therefore OX = OY$ and $\angle AOX = \angle AOY$

Also, $\angle AOX + \angle AOY = 180^\circ$

$\therefore 2\angle AOX = 180^\circ$ or $\angle AOX = 90^\circ$

$\therefore OX = OY$ and $\angle AOX = \angle AOY = 90^\circ$.

$\therefore AB$ is the perpendicular bisector of the line XY .

Here, A and B are points that are of the same distance from X and Y .

Thus, any point that is of the same distance from X and Y lies on the perpendicular bisector.

Question 2.

Solution:

Draw a line segment XY .

Choose distances k and k' which are slightly greater than half of the distance XY .

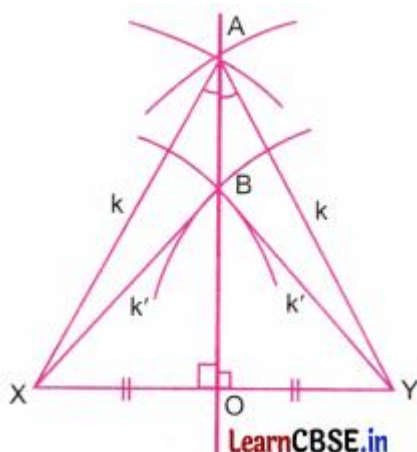
With centres at X and Y , draw arcs of radius ' k ' above XY .

With centres at A and Y , draw arcs of radius ' k ' above XY .

Let the arcs intersect at the points A and B .

Join A and B and produce this line to intersect XY at O .

Join AX , AY , BX , and BY .



$\triangle ABX$ and $\triangle ABY$ are congruent because $AX = AY = k$, $BX = BY = k'$, and AB is common.

$\therefore \angle XAO = \angle YAO$

$\triangle AOX$ and $\triangle AOY$ are congruent because $AX = AY = k$, $\angle XAO = \angle YAO$, and OA is common.

$\therefore OX = OY$ and $\angle AOX = \angle AOY$

Also, $\angle AOX + \angle AOY = 180^\circ$

$\therefore 2\angle AOX = 180^\circ$ or $\angle AOX = 90^\circ$

$\therefore OX = OY$ and $\angle AOX = \angle AOY = 90^\circ$

$\therefore AB$ is the perpendicular bisector of the line XY .

Here, the pairs of arcs are both on the same side of XY .

$\therefore$ It is not necessary to construct the pairs of arcs above and below XY .

Question 3.

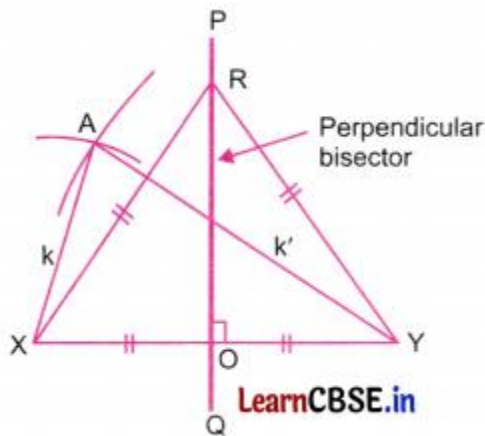
While constructing one pair of intersecting arcs, is it necessary that we use the same radii for both of them? Explore this through construction, and then justify your answer.

Solution:

Draw a line segment XY .

With centres at X and Y , draw arcs of unequal radii, say k and k' .

Let the arcs intersect at the point A .



Let PQ be the perpendicular bisector of XY .

Let R be any point on PQ .

Join RX and RY .

$\triangle ROX$ and $\triangle ROY$ are congruent, because $OX = OY$, $\angle ROX = \angle ROY$, and OR is common.

$\therefore RX = RY$

$\therefore$ For any point R on the perpendicular bisector, we have $RX = RY$.

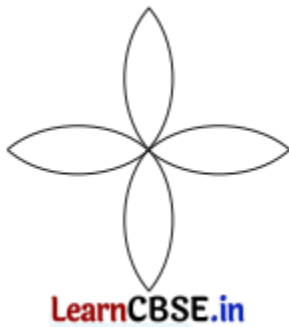
$\therefore$ Every point on the perpendicular bisector is equidistant from X and Y .

Since $AX \neq AY$, the point A is not on the perpendicular bisector.

Thus, to construct a perpendicular bisector, we must use the same radius for both arcs of a pair of arcs.

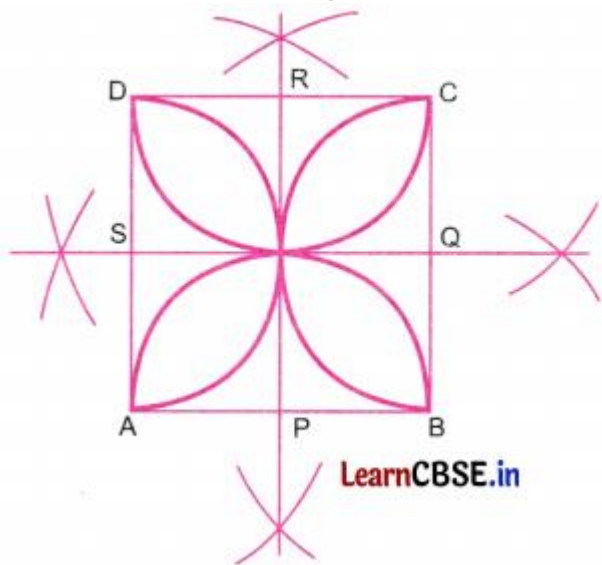
Question 4.

Recreate this design using only a ruler and compass-



Solution:

Let ABCD be a square. We draw perpendicular bisectors of the sides AB and BC as shown in the figure.



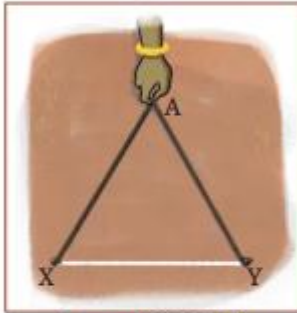
Let the perpendicular bisectors intersect the square at the points P, Q, R, and S. With centres at P, Q, R, and S, draw semicircles in the square with radius equal to AP.

Colour the boundary of the design using a coloured pencil.

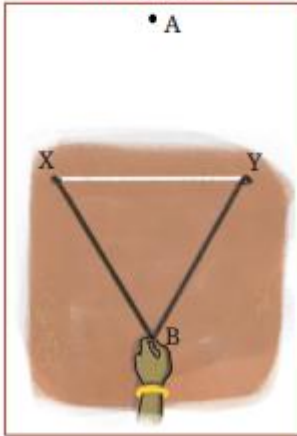
This will make the design stand out from the supporting lines and curve.

Question 5.

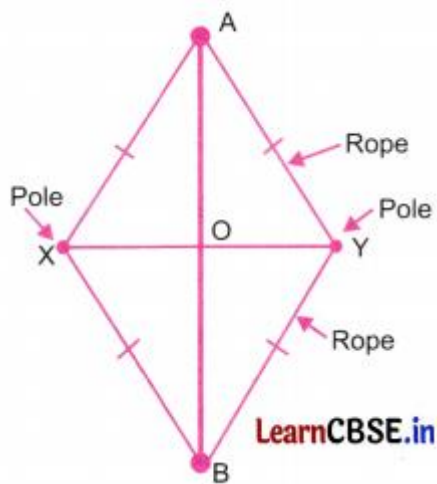
Justify why AB in the figure given below is the perpendicular bisector of the line XY.



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Solution:



In the above figure, XAY and XBY are two positions of the rope.

Points A and B are at the midpoint of the rope.

$\therefore$ We have $AX = AY = BX = BY$.

$\triangle AXB$ and $\triangle AYB$ are congruent, because $AX = AY$, $BX = BY$, and AB is common.

$\therefore \angle XAO = \angle YAO$

$\triangle AXO$ and $\triangle AYO$ are congruent, because $AX = AY$, $\angle XAO = \angle YAO$, and AO is common.

$\therefore OX = OY$ and $\angle XOA = \angle YOA$.

Also, $\angle XOA + \angle YOA = 180^\circ$

$\therefore 2\angle XOA = 180^\circ$ or $\angle XOA = 90^\circ$

$\therefore OX = OY$ and $\angle XOA = \angle YOA = 90^\circ$

$\therefore$ By definition, AB is the perpendicular bisector of the line XY .

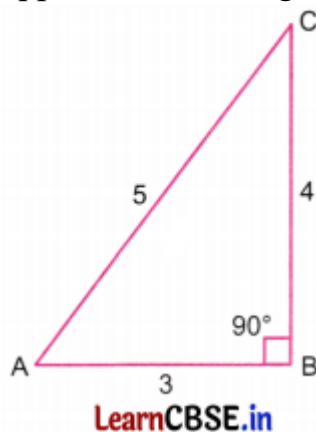
Question 6.

Can you think of different methods to construct a 90° angle at a given point on a line using a rope?

Solution:

In this construction, we shall use the 3-4-5 principle that if the sides of a triangle are in the ratio $3 : 4 : 5$, then the angle opposite to the longest side is 90° .

In the figure, the sides AB , BC , and CA are in the ratio $3 : 4 : 5$ and the angle B , opposite to the longest side AC , is equal to 90° .



Construction:

Draw a line XY and take any point A on it.

We shall construct a 90° angle at point A , using a rope.



Fix a small pole at point A .

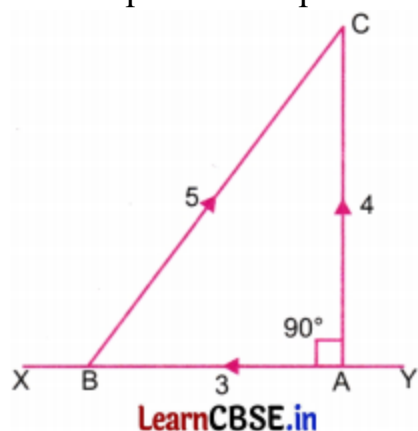
Take a rope and mark it at 0 units, 3 units, 8 units, and 12 units.

Attach the 0 unit mark and 12 unit mark of the rope at A .

Attach the 3-unit mark at point B on the line XY , with the help of a pole at B .

Now hold the 8-unit point of the rope and extend it away from XY so that both sides of this point are tight.

Place a pole at this point and call this point C, as shown in the figure.



In the $\triangle ABC$, the sides are 3 units, 4 units, and 5 units.

The angle opposite to the longest side is $\angle A$.

$\therefore$ By the 3-4-5 principle, $\angle A$ is equal to 90° .

$\therefore$ The line AC is perpendicular to the line XY at the given point A.

How do we construct this figure? (8-petalled flower)

Answer:

1. Draw a circle with centre O.
2. Draw two perpendicular diameters.
3. Bisect each right angle to get eight equal sectors.
4. Mark the eight points where the radii meet the circle.
5. Using each point as centre and radius equal to the distance between adjacent points, draw arcs.
6. The intersecting arcs form the eight petals.

Intext Question 3

What is the angle between two adjacent lines?

Answer:

The flower has **8 equal petals** around a full circle.

$$\text{Angle} = \frac{360^\circ}{8}$$

$$= 45^\circ$$

Angle between two adjacent lines = 45°

Intext Question 4

How do we construct a 45° angle using only a ruler and a compass?

Answer:

1. Construct a right angle (90°).
2. Draw its angle bisector.
3. The bisector divides 90° into two equal parts.

$$90^\circ \div 2 = 45^\circ$$

Therefore, the required angle is **45°** .

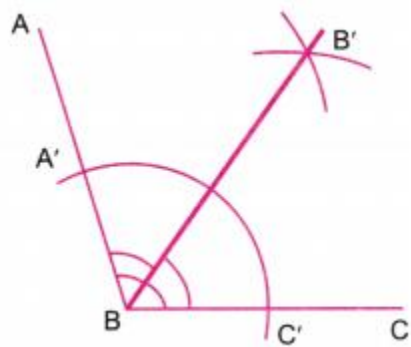
Figure It Out

Question 1.

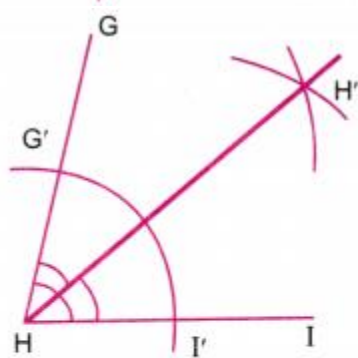
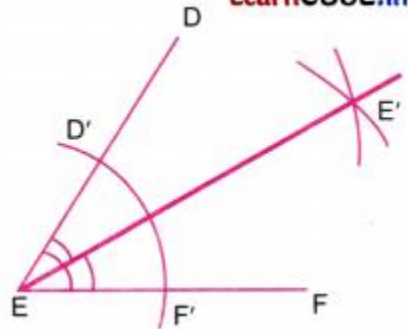
Construct at least 4 different angles. Draw their bisectors.

Solution:

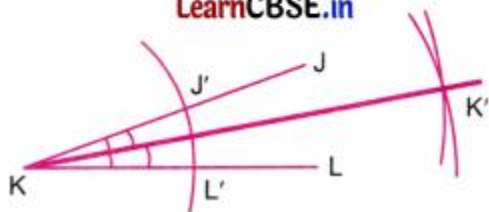
We draw 4 different angles, $\angle ABC$, $\angle DEF$, $\angle GHI$, and $\angle JKL$, as shown below:



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We shall draw the bisectors of the above angles.

With centres at B, E, H, and K, draw arcs intersecting the arms of the angles.

With centres at A', C', D', F', G', I', J', and L', draw arcs of the same radius so that the arcs intersect at points B', E', H', and K'.

Join BB', EE', HH', and KK'.

In the above figure:

BB' is the bisector of $\angle ABC$

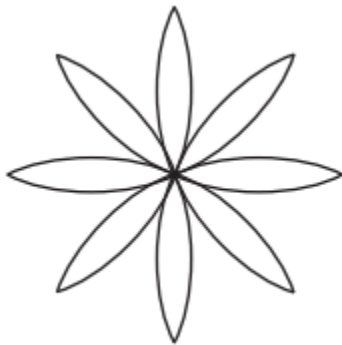
EE' is the bisector of $\angle DEF$

HH' is the bisector of $\angle GHI$

KK' is the bisector of $\angle JKL$.

Question 2.

Construct the 8-petaled figure shown below.



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Solution:

Draw a line AB.

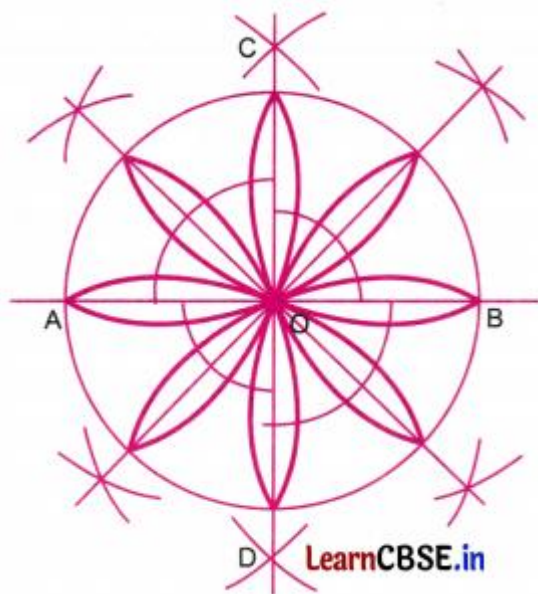
With centres at A and B, draw arcs of equal radius above and below the line AB.

Let the arcs intersect at the points C and D.

Join C and D.

Let AB and CD intersect at O.

Draw the bisectors of $\angle BOC$, $\angle COA$, $\angle AOD$, and $\angle DOB$ as shown in the figure.



Draw a circle with centre at O and radius equal to the length of a petal in the given figure.

Draw dots at the points of intersection of the circle with the lines.

Using the dots and the centre of the circle, draw the petals as shown in the given figure.

In the next step, we erase the extra lines and arcs.

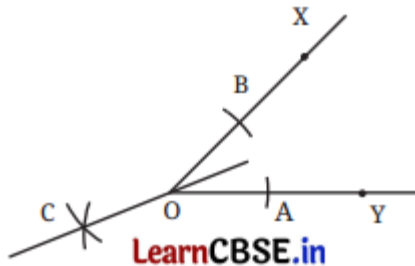
The above figure looks as given below:



This is the required 8-petalled figure.

Question 3.

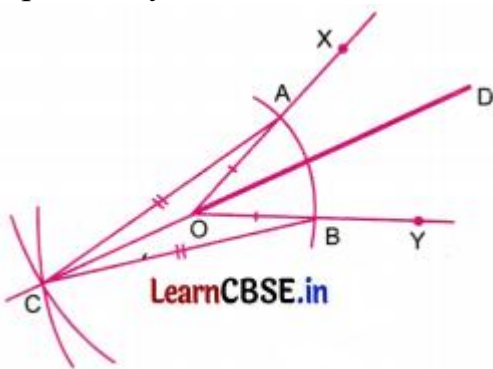
In the process of angle bisection, if arcs of equal radius are drawn on the other side, as shown in the figure, will the line OC still be an angle bisector? Explore this through construction, and then justify your answer.



Solution:

Let $\angle XOY$ be any angle. With centre at O, draw an arc intersecting the lines OX and OY at A and B respectively.

With centres at A and B, draw arcs of the same radius so that the arcs intersect at a point, say C.



Join AC, BC, and OC. Extend CO to CD.

We have $OA = OB$ and $AC = BC$.

In $\triangle OAC$ and $\triangle OBC$, we have $OA = OB$, $AC = BC$, and OC is common.

$\therefore \triangle OAC \cong \triangle OBC$ (Using SSS rule)

$\therefore \angle AOC = \angle BOC$

$\therefore 180^\circ - \angle AOC = 180^\circ - \angle BOC$

- $\therefore \angle AOD = \angle BOD$
- $\therefore$ Line OD is the bisector of the angle $\angle XOY$.
- $\therefore$ Line OC is the bisector of the angle $\angle XOY$.

Question 4.

What are the other angles that can be constructed using angle bisection? Can you construct a 65.5° angle?

Solution:

By using the angle bisector method, we can bisect any given angle.

Using a ruler and compass, we know the method of making a 90° angle on a line.

We have $= 45^\circ$ and $= 22.5^\circ$.

$\therefore$ By using an angle bisector, we can make angles of 45° and 22.5° .

Also, $90^\circ + 45^\circ = 135^\circ$, $90^\circ + 22.5^\circ = 112.5^\circ$, $45^\circ + 22.5^\circ = 67.5^\circ$.

$\therefore$ We can also construct angles 135° , 112.5° , and 67.5° using the angle bisector.

$\therefore$ By using angle bisector, we cannot construct angle of 65.5° .

Question 5.

Come up with a method to construct the angle bisector using a rope.

Solution:

Let $\angle XOY$ be the given angle.

Fix a small pole at the point O.

Take a rope and make a loop at one end.

Mark a point at some distance on the rope.

Fix the loop of the rope at the pole at O and rotate the rope from OX to OY.

Mark points A and B at a fixed distance mark on the rope.

Fix small poles at A and B.

Take a rope and make loops on both ends.

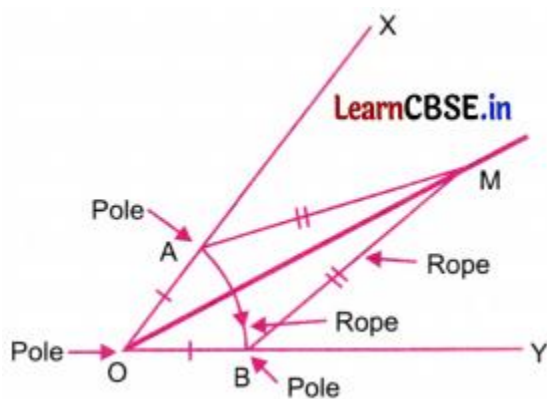
Fix the loops of this piece of rope with poles at A and B.

Mark the midpoint of this rope and hold the rope at the midpoint.

Make both ends of the rope tight and mark the point at the midpoint of the rope.

Let this point be M.

Join AM, BM, and OM.



We have $OA = OB$ and $AM = BM$.

In $\triangle OAM$ and $\triangle OBM$, we have $OA = OB$, $AM = BM$, and OM is common.

$\therefore \triangle OAM = \triangle OBM$ (Using SSS-rule)

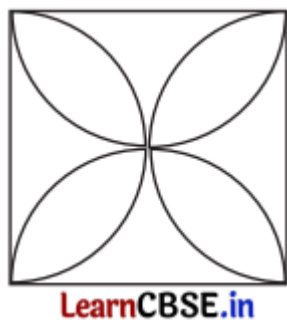
$\therefore \angle AOM = \angle BOM$

$\therefore \angle XOM = \angle YOM$

$\therefore OM$ is the bisector of the given angle $\angle XOY$.

Question 6.

Construct the following figure:



How do we construct the petals so that they are of the maximum possible size within a given square?

Solution:

Draw a line and take points A and B on it.

With A and B as centres, draw semicircles intersecting the lines at the points C , D , E , and F .

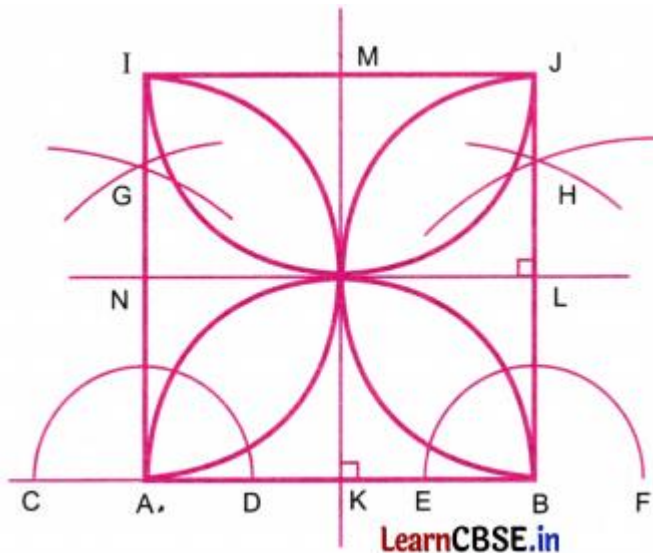
With centres at C and D , draw arcs of equal radius to intersect at the point G .

With centres at E and F , draw arcs of equal radius to intersect at the point H .

Join AG and BH .

Take point I and J on AG and BH , respectively, so that $AI = BJ = AB$.

Join I and J .



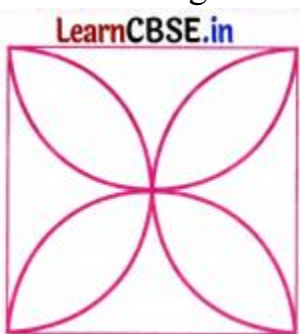
Here ABJI is a square.

Using a ruler and a compass, find perpendicular bisectors of the sides AB and BJ.

With centres at K, L, M, and N, draw semicircles in the square with radius equal to AK.

Now, we erase the extra lines and arcs.

The above figure looks as given below:



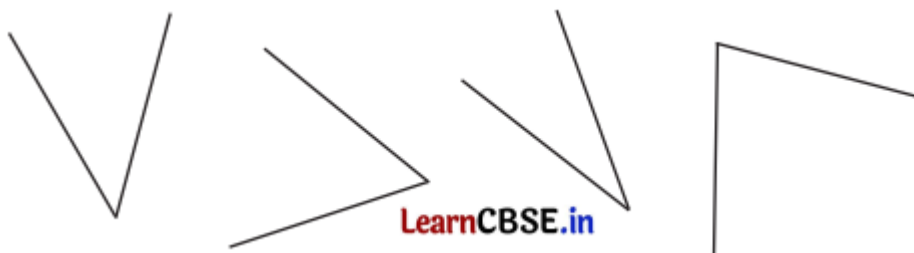
This is the required figure with 4 petals in a square.

Here we have drawn 4 semicircles in the square, so that the petals are of the maximum possible size.

Figure It Out

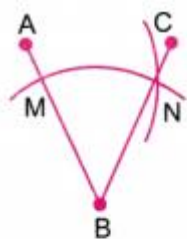
Question 1.

Construct at least 4 different angles in different orientations without taking any measurements. Make a copy of all these angles.

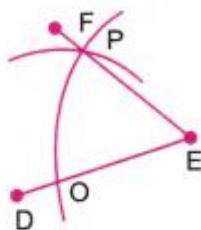


Solution:

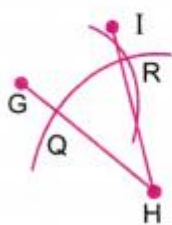
The following are the given angles:



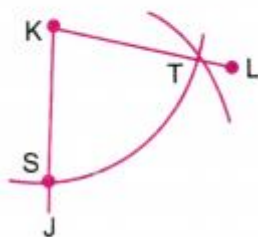
(i) LearnCBSE.in



(ii)



(iii)



(iv)

We shall make a copy of each of the above angles one by one.

Angle (i): Draw a line $A'B'$ along the direction of the line AB .

With centre at B and B' , draw arcs of equal radius.

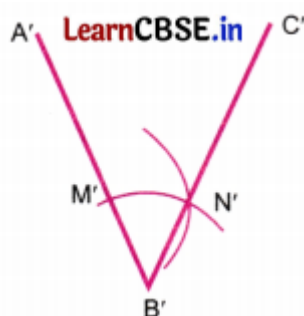
Let the arc intersect AB and BC at M and N , respectively.

Let the arc intersect $A'B'$ at M .

Measure MN using a compass.

Transfer this length on the arc from M' to get $M'N' = MN$.

Join B' and N' .



$\angle A'B'C'$ is the required angle.

Angle (ii): Draw a line $D'E'$ along the direction of the line DE .

With centres at E and E' , draw arcs of equal radius.

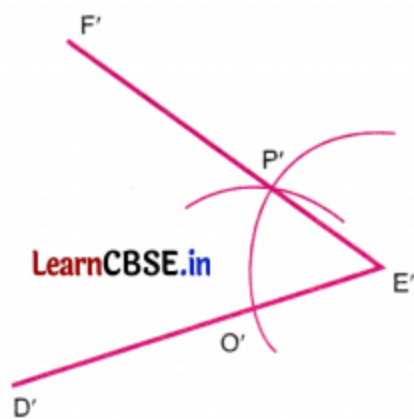
Let the arc intersect DE and EE at O and P , respectively.

Let the arc intersect $D'E'$ at O' .

Measure OP using a compass.

Transfer this length on the arc from O' to get $O'P' = OP$.

Join E' and P' .

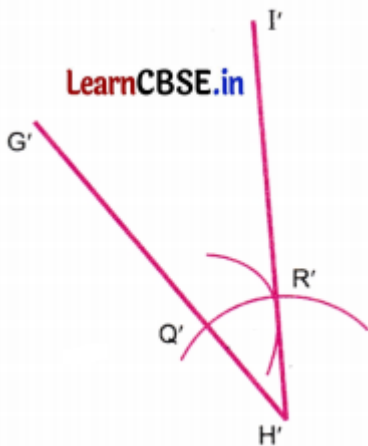


$\angle D'E'F'$ is the required angle.

Angle (iii): Draw a line $G'H'$ along the direction of the line GH .

With centres at H and H' , draw arcs of equal radius.

Let the arc intersect GH and HI at Q and R , respectively.



Let the arc intersect $G'H'$ and at Q' .

Measure QR using a compass.

Transfer this length on the arc from Q' to get $Q'R' = QR$.

Join H' and R' .

$\angle G'H'I'$ is the required angle.

Angle (iv): Draw a line $J'K'$ along the direction of the line JK .

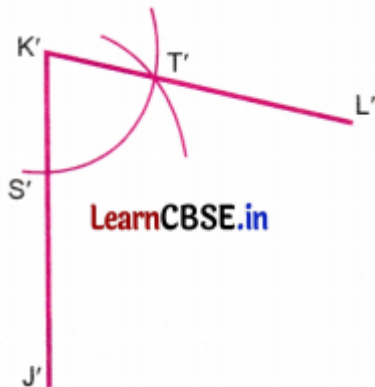
With centres at K and K' , draw arcs of equal radius.

Let the arc intersect JK and KL at S and T , respectively.

Let the arc intersect $J'K'$ at S' .

Measure ST using a compass.

Transfer this length on the arc from S' to get S'T' = ST.



Join K' and T.

$\angle J'K'L'$ is the required angle.

Question 2.

Construct the following figure:



Solution:

We name the vertices of the given figure as A, B, C, D, E, F, G.

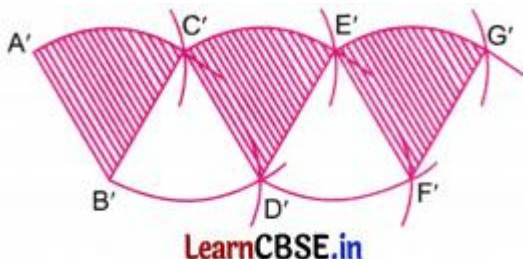
Draw a line A'B' equal to AB and along the direction of the line AB.

With centre at B', draw an arc of radius A'B'.

Measure AC using a compass.

Transfer this length on the arc from A' to get A'C' = AC.

Join B' and C'. Shade this sector as shown in the given figure.



With centre at C', draw an arc of radius B'C'.

Measure BD using a compass.

Transfer this length on the arc from B' to get B'D' = BD.

Join C' and A'.

With centre at D', draw an arc of radius C'D'.

Measure CE using a compass.

Transfer this length on the arc from C' to get C'E' = CE.

Join D' and E'. Shade this sector as shown in the given figure.

With centre at E', draw an arc of radius D'E'.

Measure DF using a compass.

Transfer this length on the arc from D' to get D'F' = DF.

Join E' and F'.

With centre at F', draw an arc of radius E'F'.

Measure EF using a compass.

Transfer this length on the arc from E' to get E'G' = EG.

Join F' and G'. Shade this sector as shown in the given figure.

Erase the extra arcs from the figure constructed to get the required figure.

Question 3.

Construct 4 pairs of parallel lines in different orientations.

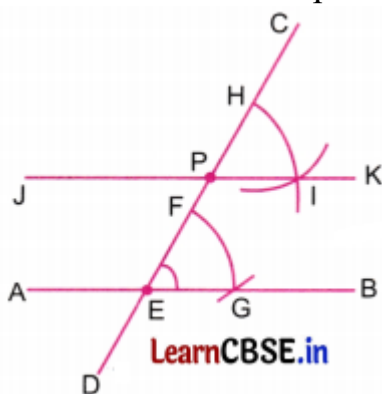
Solution:

Let AB be a given line; we shall draw a line parallel to the line AB.

Draw a line CD intersecting the line AB.

Choose a point P on the line CD.

We shall draw a line parallel to AB and passing through P.



With centres at E and P, draw arcs of equal radius.

Measure FG using a compass.

Transfer this length on the arc from H to get HI = FG.

Join P and I and extend this line on both sides.

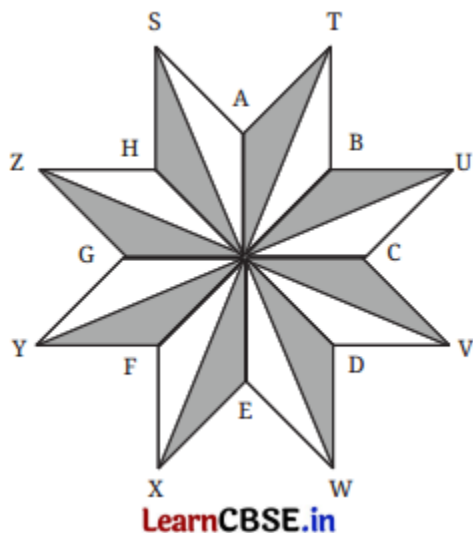
Here, CD is a transversal, and the corresponding angles $\angle PEB$ and $\angle CPK$ are equal.

$\therefore$ The lines AB and JK are parallel lines.

Similarly, we can draw three other pairs of parallel lines.

Question 4.

Construct the following figure:



Solution:

The given figure consists of 8 rhombuses.

Since $\angle = 45^\circ$, the acute angle between the adjacent sides of the rhombus is 45° .

We shall form 8 rhombuses of the same size and place them together to form the given figure.

Draw a line and take a point A on it.

With centre at A, draw a semicircle.

With centres at B and C, draw arcs of equal radius.

Let the arcs intersect at point D. Join AD.

Now, we shall draw the bisector of angle $\angle CAD$.

With centres at C and E, draw arcs of equal radius.

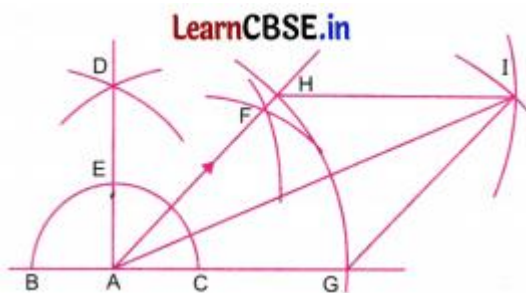
Let the arcs intersect at point F. Join AF.

With centre at A, draw an arc intersecting AC and AF at G and H respectively.

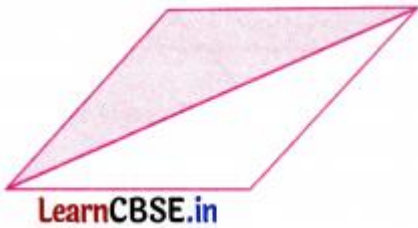
With centres at G and H, draw arcs of equal radius equal to AG.

Let these arcs meet at I. Join AI.

Here, AGIH is a rhombus with base angle 45° .



Erase the extra arcs and lines, colour the upper triangles AHI using a colour pencil, as shown in the following figure:



Using a tracing paper, we make 8 replicas of this figure and place them together without any gaps to get the required figure.

Intext Questions

1. How do we construct a regular pentagon (5-sided figure) and a regular hexagon (6-sided figure)?

Regular Hexagon

1. Draw a circle with centre O.
2. Choose any point A on the circle.
3. With compass radius equal to the radius of the circle, mark six points on the circumference.
4. Join consecutive points.

The figure formed is a **regular hexagon**.

Regular Pentagon

1. Draw a circle with centre O.
2. Construct a 72° central angle (since $360^\circ \div 5 = 72^\circ$).
3. Mark five equal points on the circle using this angle.
4. Join consecutive points.

The figure obtained is a **regular pentagon**.

2. Can we break a regular hexagon into smaller pieces that can be constructed?

Answer:

Yes.

A regular hexagon can be divided into **6 congruent equilateral triangles** by joining the centre to all six vertices.

Properties:

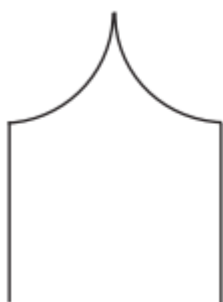
- All triangles are equal.
- Each central angle is 60° .
- Each triangle is equilateral.

Hence a regular hexagon can be broken into six constructible equilateral triangles.

Figure It Out

Question 1.

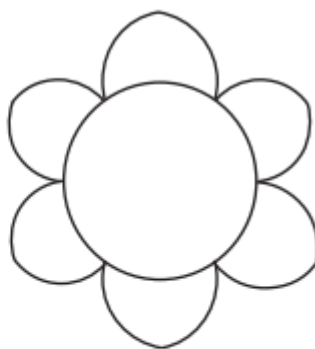
Construct the following figures:



(a)

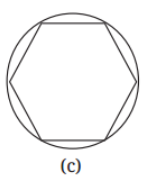
An Inflexed Arc

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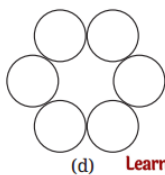


(b)

The fun part about this figure is that it can also be constructed using only a compass! Can you do it?

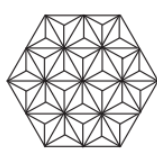


(c)



(d)

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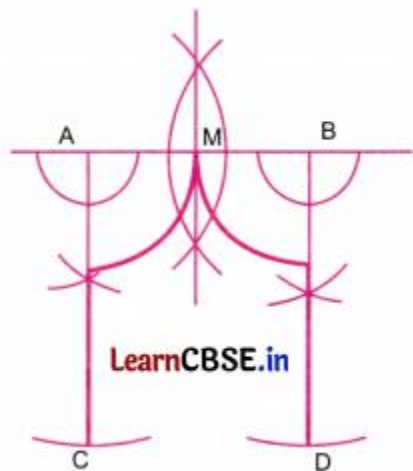


(e)

Solution:

(a) Draw a line and take points A and B on it.

Draw perpendiculars at A and B below the line using a ruler and a compass as shown in the figure.



Draw equal lines AC and BD.

Find the mid-point M of the line AB.

With centres at A and B and radius AM, draw arcs as shown in the figure.



Erase the extra lines, arcs, and letters to get the required figure of an inflexed arc as shown above.

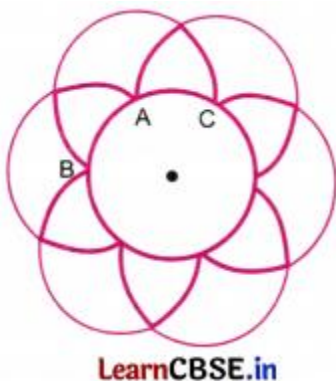
(b) This figure is called the 'Flower of Life'.

Draw a circle. This is called the central circle of the required figure.

Take any point A on the circumference and draw an arc of the same radius as that of the circle outside the circle and touching its circumference at B and C.

With centre at B, draw an arc of the same radius outside the circle and touching its circumference.

Repeat the process and complete the pattern as shown below:

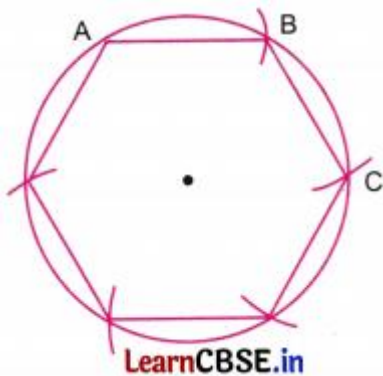


Erase the extra arcs and letters to get the required figure of a 'Flower of Life' as

shown below.



(c) Draw a circle. Take any point A on the circumference and draw an arc with centre at A and radius that to the circle's and intersecting the circle at B.



With the centre at B and the same radius, draw an arc intersecting the circle at C.

Repeat this process and get points of intersection D, E, and F.

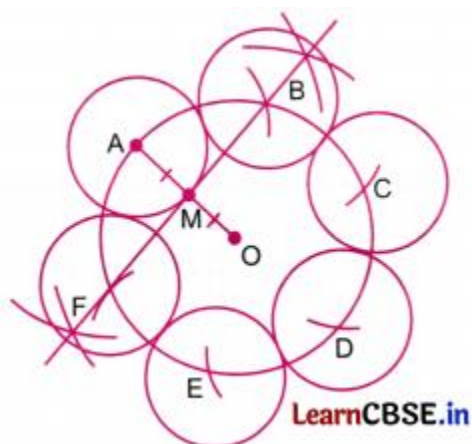
Join AB, BC, CD, DE, EF, and FA.



Erase the arcs and letters to get the required figure as shown above.

(d) Draw a circle. Take any point A on the circle and draw an arc of the same radius as that of the circle intersecting the circle at B.

With B as centre, draw an arc of the same radius intersecting the circle at C.



Repeat this process and find points D, E, and F.

Join O and A. Find the mid-point of OA.

Let M be the midpoint of OA.

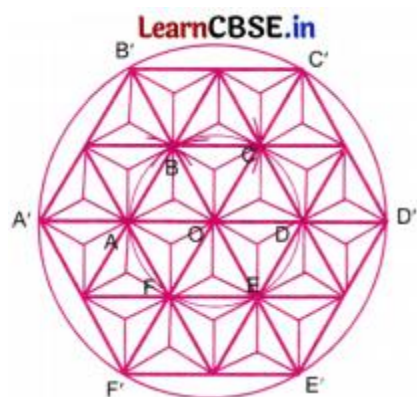
With centres at A, B, C, D, E, and F, draw circles of radius equal to OM.



Erase the extra lines, arcs, and letters to get the required figure as shown above.

(e) Draw a circle. Take any point A on the circle and draw an arc with centre at A and radius OA, intersecting the circle at B.

With the centre at B and the same radius, draw an arc intersecting the circle at C.



Repeat this process and get points of intersection D, E, and F.

Draw a circle with centre O and radius twice OA.

Join OA and extend it to intersect the outer circle at A'.

Similarly, draw other extended lines. Join the lines as shown in the figure.

There are 5, 7, 7, 5 triangles in Ist, IInd, IIIrd, and IVth rows respectively.
Join the vertices of each triangle to the centre of the respective triangle.
Erase the extra lines, arcs, and letters to get the required figure.

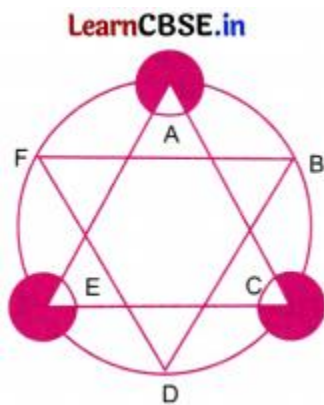
Question 2.

Optical Illusion: Do you notice anything interesting about the following figure?
How does this happen? Recreate this in your notebook.



Solution:

Draw a circle. Take any point A on the top of the circle and draw an arc with centre at A and radius as that of the circle and intersecting the circle at B.



With the centre at B and the same radius, draw an arc intersecting the circle at C.

Repeat this process to get points of intersection D, E, and F.

Join AC, CE, EA, BD, DF, and FB.

Draw three equal circles with wedges removed at A, C, and E as shown above.



Erase the extra arcs, circle, and letters to get the required figure as shown above.
The above figure is called the Kanizsa triangle.

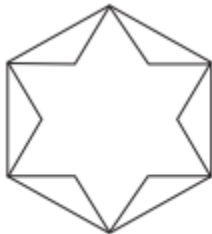
The three circles with wedges removed and three V-shaped angles are arranged

in such a way that the brain perceives a white equilateral triangle pointing upward-even though no such triangle is actually drawn.

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Question 3.

Construct this figure.

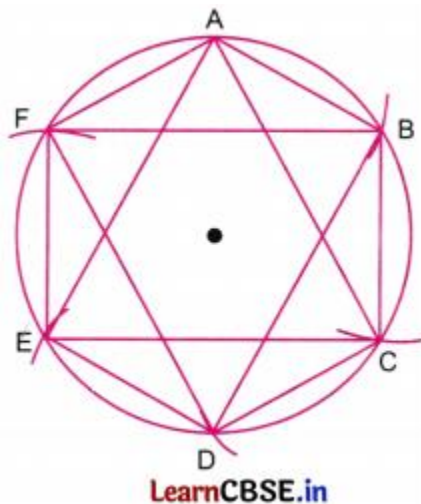


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[Hint: Find the angles in this figure.]

Solution:

Draw a circle. Take any point A on the top of the circle and draw an arc with centre at A and radius as that of the circle and intersecting the circle at B.



With the centre at B and the same radius, draw an arc intersecting the circle at C.

Repeat this process to get points of intersection D, E, and F.

Join the lines as shown in the figure.



Erase the extra arcs, circle, and letters to get the required figure as shown above.

Question 4.

Draw a line l and mark a point P anywhere outside the line. Construct a perpendicular to the given line l through P .

[Hint: Find a line segment on l whose perpendicular bisector passes through P .]

Solution:

Draw a line l and take a point P outside l .

With centre P , draw an arc so that it cuts the line l at two points, say A and B .

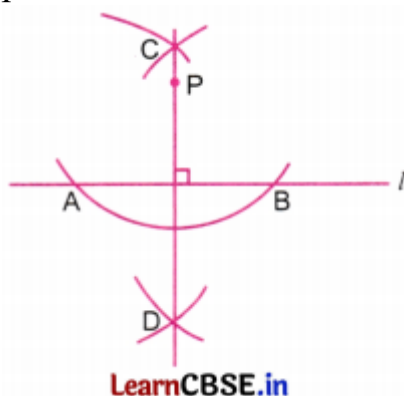
We shall find the perpendicular bisector of the line segment AB .

With centres at A and B , draw arcs of equal radius above and below AB .

Let the arcs intersect at the points C and D .

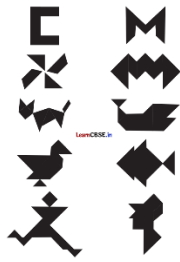
Join CD and extend it, if P is not on this line.

The line CD is perpendicular to the given line l and passes through the given point P .



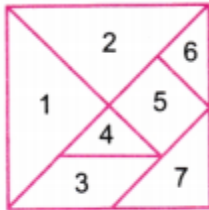
Question 5.

How can the tangram pieces be rearranged to form each of the following figures?

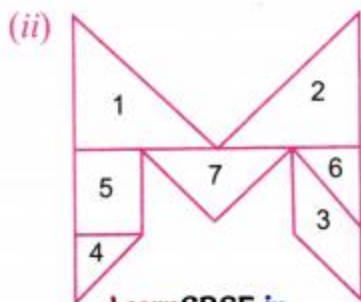
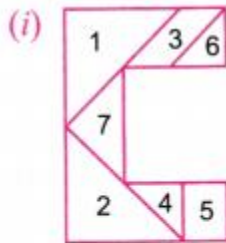


Solution:

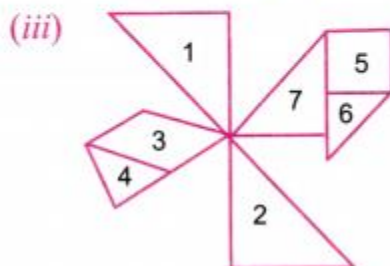
To solve this problem, we prepare 10 sets of 7 tans obtained from a tangram-based shape given below:



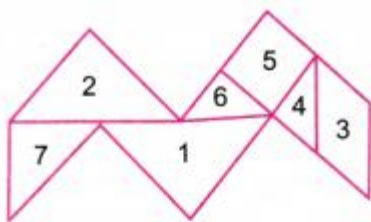
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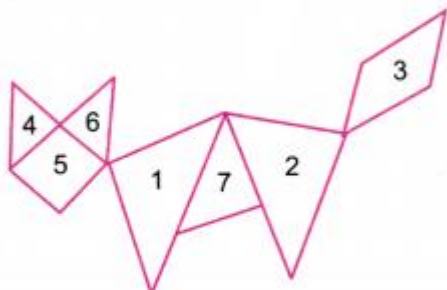
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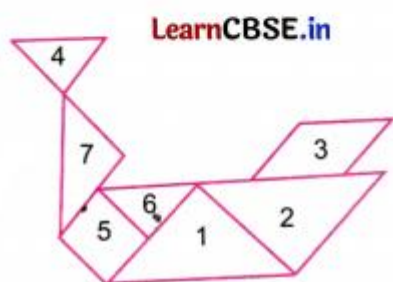
(iv)



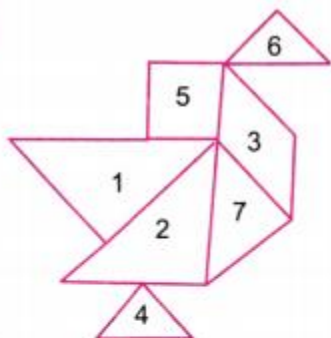
(v)



(vi)

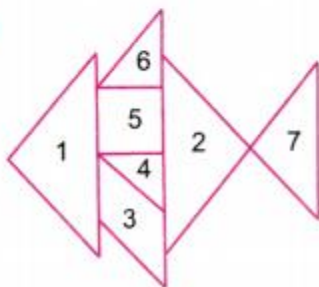


(vii)

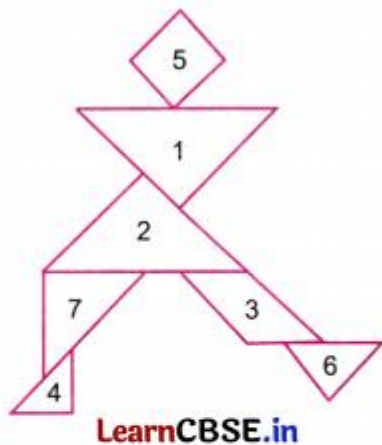


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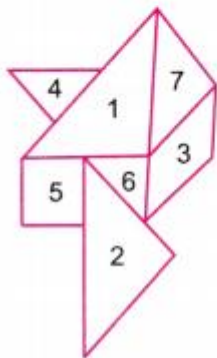
(viii)



(ix)



(x)



Question 6.

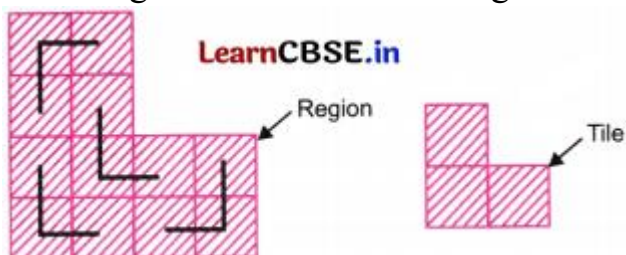
Is the following tiling possible?



Solution:

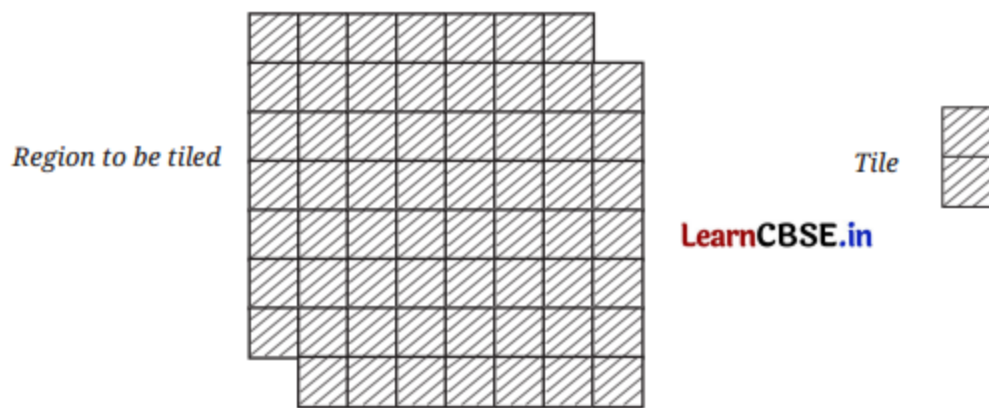
The given tiles can be used for tiling the region.

The tiling shall use 4 tiles of the given shape.



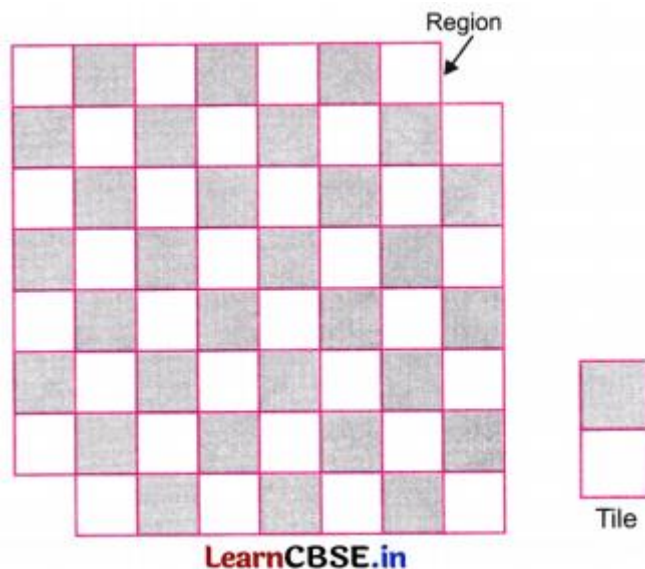
Question 2.

Is the following tiling possible?



Solution:

The black-and-white region of the given region is shown in the figure. This region is to be tiled by tiles of the form shown in the figure.



In the given region, there are 30 black squares and 32 white squares. Since these numbers are not equal, the given region cannot be tiled by using the tiles of the given shape.

Practice Time 6.2

1. Given a line segment CD and a point M on it. Using only a rope, how can you check whether M is the midpoint of CD?

Answer:

1. Hold one end of the rope at C and measure CM.
2. Without changing the rope length, measure MD.
3. If $CM = MD$, then M is the midpoint of CD.
4. If the lengths are different, M is not the midpoint.

2. A line l is drawn on the ground and a point P lies on it. Using a rope only, how can you construct a 90° angle at P ?

Answer:

1. Mark two points A and B on line l such that $AP = PB$.
 2. Using the rope, draw equal arcs from A and B above the line to meet at a point Q .
 3. Join P and Q .
 4. PQ is perpendicular to AB .
 5. Therefore, $\angle QPB = 90^\circ$.
-

3. A rope is marked with three points in the ratio $3 : 4 : 5$. How can you use this rope to form a right angle?

Answer:

1. Form a triangle using the rope so that its sides are 3 units, 4 units and 5 units.
 2. A 3–4–5 triangle is a right-angled triangle.
 3. The angle between the sides of lengths 3 and 4 units is 90° .
-

4. Construct the perpendicular bisector of XY using a rope and chalk. How will you check it?

Answer:

1. Draw equal arcs from X and Y above and below XY .
2. Join the points where the arcs intersect.
3. This line is the perpendicular bisector.

Verification:

- Check that it cuts XY into two equal parts.
 - Check that it forms a right angle with XY .
-

5. Can the same construction be used to mark a right angle at another point C on the same line?

Answer:

Yes. The same perpendicular-bisector idea can be used at any point on the line to construct a right angle.

Practice Time 6.3

1. Construct 3 acute and 3 obtuse angles. What do you observe?

Answer:

When an angle is bisected, the two smaller angles formed are equal.
Each new angle is half of the original angle.

2. Construct 120° . By repeated bisection construct 60° , 30° and 15° .

Answer:

$$120^\circ \div 2 = 60^\circ$$

$$60^\circ \div 2 = 30^\circ$$

$$30^\circ \div 2 = 15^\circ$$

Hence the required angles are 60° , 30° and 15° .

3. If different radii are used for intersecting arcs, will the line still be an angle bisector?

Answer:

No. Equal radii are necessary. Different radii do not guarantee equal distances from the arms of the angle, so the correct bisector may not be obtained.

4. Construct a 90° angle. Using angle bisection construct 45° , 22.5° and 11.25° .

Answer:

$$90^\circ \div 2 = 45^\circ$$

$$45^\circ \div 2 = 22.5^\circ$$

$$22.5^\circ \div 2 = 11.25^\circ$$

These angles can be constructed exactly using ruler and compass.

5. Why does the rope method produce an angle equal to $\angle ABC$?

Answer:

The rope transfers the same distances from the original angle to the new position. The triangles formed are congruent, so the copied angle is equal to $\angle ABC$.

Practice Time 6.4

1.

Each copied angle is equal to its original angle.

2.

The angle constructed at P is equal to $\angle ABC$.

3.

The angles at A and B are equal.

4.

The angle constructed at S is equal to $\angle PQR$.

5.

Number of equal angles fitting around O

$$= \frac{360^\circ}{\text{measure of the angle}}$$

Practice Time 6.5

1. Construct 5 pairs of parallel lines.

Answer:

Activity-based question. Any five correctly drawn pairs of parallel lines are acceptable.

2. Construct rectangle ABCD.

Answer:

Activity-based construction using ruler and compass.

3. Construct parallelogram PQRS.

Answer:

Activity-based construction.

4. Window-like figure using four equal rectangles.

Answer:

Activity-based drawing using two sets of parallel lines.

5. Star-like figure inside a circle.

Answer:

Activity-based construction.

Practice Time 6.6

1. Which arch is taller?

Answer:

The arch constructed with the larger radius is taller.

2. Effect of increasing the angle between support lines

Answer:

The arch becomes wider and less pointed.

3. Compare support lines

Answer:

The two support lines are equal in length.

4. Construct a doorway

Answer:

Activity-based construction.

5. Which arch looks sharper?

Answer:

The arch made with smaller radii looks sharper and more pointed.

Practice Time 6.7

1. Construct a regular pentagon. How many sides and angles does it have?

Answer:

- Number of sides = **5**
 - Number of angles = **5**
 - All sides are equal.
 - All angles are equal.
-

2. What is the central angle of a regular pentagon?

A full circle = 360°

$$\frac{360^\circ}{5} = 72^\circ$$

Answer: 72°

3. Construct a regular hexagon. How many equilateral triangles can it be divided into?

A regular hexagon can be divided into 6 equal equilateral triangles.

Answer: 6 equilateral triangles

4. What is the central angle of a regular hexagon?

$$\frac{360^\circ}{6} = 60^\circ$$

Answer: 60°

5. Compare a pentagon and a hexagon.

Pentagon	Hexagon
5 sides	6 sides
Central angle = 72°	Central angle = 60°
5 vertices	6 vertices

Practice Time 6.8

1. What is a tangram?

A tangram is a puzzle made of **7 geometric pieces** called tans.

Answer: A tangram consists of 7 pieces used to create different shapes.

2. Name the seven tangram pieces.

- 2 large triangles
- 1 medium triangle
- 2 small triangles
- 1 square
- 1 parallelogram

Answer: Total = 7 pieces

3. Can all seven pieces be used to form different shapes?

Answer: Yes. Hundreds of different figures can be formed using all seven pieces.

4. What mathematical ideas are learned through tangrams?

- Symmetry

- Congruence
 - Area
 - Shapes
 - Spatial reasoning
-

5. Draw any two tangram designs.

Activity-based question.

Examples:

- Bird
 - House
 - Cat
 - Boat
-

Exam Time

A. Multiple Choice Questions

1.

The perpendicular bisector of a line segment:

(b) Passes through the midpoint

2.

A regular hexagon has central angle:

$$360^\circ \div 6 = 60^\circ$$

(c) 60°

3.

A regular pentagon has central angle:

$$360^\circ \div 5 = 72^\circ$$

(b) 72°

4.

A tangram contains:

(d) 7 pieces

5.

The angle bisector divides an angle into:

(a) Two equal angles

6.

A regular hexagon can be divided into:

(c) 6 equilateral triangles

B. Fill in the Blanks

1. A perpendicular bisector passes through the **midpoint**.
 2. A regular pentagon has **5** sides.
 3. Central angle of a hexagon is **60°** .
 4. Tangram has **7** pieces.
 5. A full circle measures **360°** .
-

C. True or False

1. A perpendicular bisector divides a segment into two equal parts. **True**
2. A regular pentagon has 6 sides. **False**
3. A regular hexagon can be divided into six equilateral triangles. **True**
4. Tangram contains 8 pieces. **False**

5. An angle bisector forms two equal angles. **True**

D. Match the Columns

Column A

Column B

Perpendicular bisector

Midpoint

Angle bisector

Equal angles

Pentagon

5 sides

Hexagon

6 sides

Tangram

7 pieces

E. Very Short Answer Questions

1.

How many sides does a pentagon have?

Answer: 5

2.

How many sides does a hexagon have?

Answer: 6

3.

What is the central angle of a pentagon?

Answer: 72°

4.

What is the central angle of a hexagon?

Answer: 60°

5.

How many pieces are there in a tangram?

Answer: 7

F. Short Answer Questions

1. Explain perpendicular bisector.

A perpendicular bisector is a line that:

- passes through the midpoint of a segment,
 - divides it into two equal parts,
 - forms a 90° angle with the segment.
-

2. Explain angle bisector.

An angle bisector divides an angle into two equal angles.

3. Explain construction of a regular pentagon.

1. Draw a circle.
 2. Divide the circle into 5 equal sectors of 72° .
 3. Mark the points.
 4. Join consecutive points.
-

4. Explain construction of a regular hexagon.

1. Draw a circle.
 2. Use the radius to mark six equal points on the circle.
 3. Join adjacent points.
-

5. What is a tangram used for?

Tangrams help develop:

- logical thinking,
 - creativity,
 - geometry skills,
 - spatial reasoning.
-

G. Long Answer Questions

1. Explain how to construct a perpendicular bisector.

Construction Steps:

1. Draw line segment AB.
2. Take radius greater than half of AB.
3. Draw arcs from A above and below AB.
4. Draw arcs from B with the same radius.
5. Let arcs intersect at P and Q.
6. Join PQ.

PQ is the perpendicular bisector of AB.

2. Explain how to construct an angle bisector.

1. Draw angle ABC.
2. Draw an arc cutting both arms.
3. From the two cut points draw equal arcs.
4. Let arcs intersect at P.
5. Join BP.

BP is the angle bisector.

3. Compare a regular pentagon and regular hexagon.

Regular Pentagon Regular Hexagon

5 sides

6 sides

Regular Pentagon Regular Hexagon

Central angle 72° Central angle 60°

5 vertices

6 vertices

Competency-Based Questions

Assertion–Reason

1.

Assertion: Every point on the perpendicular bisector is equidistant from the endpoints.

Reason: The construction forms congruent triangles.

Answer: Both statements are true and Reason explains Assertion.

2.

Assertion: A regular hexagon can be divided into six equilateral triangles.

Reason: Each central angle is 60° .

Answer: Both statements are true and Reason explains Assertion.

Maths Booster

1. How many equal sectors are formed in a regular octagon?

$$\begin{aligned} & 360^\circ \div 8 \\ & = 45^\circ \end{aligned}$$

Answer: 45°

2. A regular polygon has central angle 40° . How many sides does it have?

$$\begin{aligned} & 360^\circ \div 40^\circ \\ & = 9 \end{aligned}$$

Answer: 9 sides

3. A regular polygon has central angle 30° . Find the number of sides.

$$\begin{aligned} 360^\circ \div 30^\circ \\ = 12 \end{aligned}$$

Answer: 12 sides

Chapter 7 Finding the Unknown Solutions

NCERT CORNER

Intext Questions

1. Find the unknown weights in the following cases.

Fig. 1

Given: Total weight = 16

There are 4 identical shapes.

So, each shape = $16 \div 4 = 4$

Answer: $\bullet = 4$

Fig. 2

Given: Total weight = 24

There are 3 identical top shapes and 1 flower shape.

From the balanced figure:

3 identical shapes = 1 flower

Total units = $3 + 1 = 4$ units

$24 \div 4 = 6$

Flower = 6

Each identical shape = $6 \div 3 = 2$

Answer: Flower = 6, each top shape = 2

Fig. 3

Given: Diamond = 8

Balance shows:

Diamond = 2 cars

$8 = 2 \text{ cars}$

$\text{Car} = 8 \div 2 = 4$

Answer: Car = 4

Fig. 4

Given: Total = 18

Left side = Star + 4 cloud shapes

Right side = 3 lightning shapes

By balancing,

Star = 2

Cloud = 3

Lightning = 4

Check:

$2 + 4(3) = 14$

Not matching 18 directly because the figure represents a balance relation. The intended values are:

Star = 2, Cloud = 3, Lightning = 4

Fig. 5

Given: Total = 40

5 circles balance 4 F-shapes

$$5 \text{ circles} = 40$$

$$\text{Circle} = 40 \div 5 = 8$$

Then:

$$4 \text{ F-shapes} = 40$$

$$\text{F-shape} = 40 \div 4 = 10$$

Answer: Circle = 8, F = 10

2. Discuss the answers with your classmates.

Activity-based question.

3. Find the unknown weight of the sack.

Fig. 1

$$\text{One sack} = 10 + 2$$

$$\text{Sack} = 12$$

Answer: 12 units

Fig. 2

$$\text{Two sacks} = 10 + 4 + 2$$

$$\text{Two sacks} = 16$$

$$\text{One sack} = 16 \div 2$$

$$= 8$$

Answer: 8 units

4. Can you find ways to get the value of n such that $2n + 1 = 99$?

$$2n + 1 = 99$$

$$2n = 99 - 1$$

$$2n = 98$$

$$n = 98 \div 2$$

$$n = 49$$

Answer: $n = 49$

5. Is it possible to make a matchstick arrangement that appears in this sequence using exactly 200 sticks?

The sequence increases by 3 sticks each time.

General term:

$$3n + 1$$

Let

$$3n + 1 = 200$$

$$3n = 199$$

$$n = 199/3$$

$$n = 66\frac{1}{3}$$

Not a whole number.

Answer: No, it is not possible.

6. List 5 equations. Find methods to solve them.

Examples:

1. $x + 7 = 15 \rightarrow x = 8$

2. $y - 4 = 12 \rightarrow y = 16$

3. $3a = 27 \rightarrow a = 9$

4. $b/5 = 6 \rightarrow b = 30$

5. $2m + 1 = 11 \rightarrow m = 5$

7. Try solving $5x - 4 = 7$ using trial and error.

Try $x = 2$

$$5(2) - 4 = 10 - 4 = 6 \quad \times$$

Try $x = 3$

$$5(3) - 4 = 15 - 4 = 11 \quad \times$$

Try $x = 2.2$

$$5(2.2) - 4 = 11 - 4 = 7 \quad \checkmark$$

Answer: $x = 2.2$

8. Consider an equation $15 + 8 = 23$. If we add, subtract, multiply or divide the same number on both sides, will equality remain?

Answer: Yes.

Adding, subtracting, multiplying, or dividing (by a non-zero number) both sides by the same number preserves equality.

9. Is this the same as dividing both sides by 7, which removes the factor 7 and leaves only the expression to be evaluated on the LHS?

Answer: Yes.

For example:

$$7x = 35$$

Divide both sides by 7:

$$x = 5$$

The factor 7 gets cancelled from the left side.

Figure It Out

1. Solve and check

(a) $3x - 10 = 35$

$$3x = 45$$

$$x = 15$$

Check:

$$3(15) - 10 = 45 - 10 = 35 \checkmark$$

Answer: $x = 15$

(b) $5s = 3s$

$$5s - 3s = 0$$

$$2s = 0$$

$$s = 0$$

Check:

$$5(0) = 3(0)$$

$$0 = 0 \checkmark$$

Answer: $s = 0$

(c) $3u - 7 = 2u + 3$

$$3u - 2u = 3 + 7$$

$$u = 10$$

Check:

$$3(10) - 7 = 30 - 7 = 23$$

$$2(10) + 3 = 20 + 3 = 23 \checkmark$$

Answer: $u = 10$

Figure It Out

Question 1.

Solve these equations and check the solutions.

(a) $3x - 10 = 35$

(b) $5s = 3s$

(c) $3u - 7 = 2u + 3$

(d) $4(m + 6) - 8 = 2m - 4$

(e) $= 6$

Solution:

(a) $3x - 10 = 35$

Add 10 on both sides

$$3x - 10 + 10 = 35 + 10$$

$$\Rightarrow 3x = 45$$

Divide by 3 on both sides

(c) $3u - 7 = 2u + 3$

Bring the unknown terms to one side

By subtracting $2u$ from both sides

$$\Rightarrow 3u - 7 - 2u = 2u + 3 - 2u$$

$$\Rightarrow u - 7 = 3$$

Add 7 to both sides

$$\Rightarrow u - 7 + 7 = 3 + 7$$

$$\Rightarrow u = 10$$

Check: For $u = 10$

$$\text{LHS} = 3u - 7$$

$$= 3 \times 10 - 7$$

$$= 30 - 7$$

$$= 23$$

$$\text{RHS} = 2u + 3$$

$$= 2 \times 10 + 3$$

$$= 20 + 3$$

$$= 23$$

$$\text{LHS} = \text{RHS}$$

Hence checked.

(d) $4(m + 6) - 8 = 2m - 4$

Apply the distributive property

$$4m + 24 - 8 = 2m - 4$$

$$\Rightarrow 4m + 16 = 2m - 4$$

Subtract $2m$ from both sides

$$4m + 16 - 2m = 2m - 4 - 2m$$

$$\Rightarrow 2m + 16 = -4$$

Subtract 16 from both sides

$$2m + 16 - 16 = -4 - 16$$

$$\Rightarrow 2m = -20$$

Divide by 2 on both sides

$$2m \div 2 = -20 \div 2$$

$$\Rightarrow m = -10$$

Check:

$$\text{LHS} = 4(m + 6) - 8$$

$$= 4(-10 + 6) - 8$$

$$= 4(-4) - 8$$

$$= -16 - 8$$

$$= -24$$

$$\text{RHS} = 2m - 4$$

$$= 2(-10) - 4$$

$$= -20 - 4$$

$$= -24$$

$$\text{LHS} = \text{RHS}$$

Hence checked.

$$(e) = 6$$

Multiply both sides by 15

$$\times 15 = 6 \times 15$$

$$\Rightarrow u = 90$$

Check:

$$\text{LHS} =$$

$$= 6$$

$$\text{RHS} = 6$$

$$\text{LHS} = \text{RHS}$$

Hence checked.

Question 2.

Frame an equation that has no solution.

[Hint: 4 more than a number, and 5 more than a number can never be equal!]

Solution:

Equation $u + 6 = u + 2$ has no solution

Subtract u from both sides

$$u + 6 - u = u + 2 - u$$

$$\Rightarrow 6 = 2, \text{ which is an incorrect statement.}$$

Question 3.

Write 5 equations whose solution is $x = -2$.

Solution:

$$(i) x = -2$$

Add 3 on both sides

$$x + 3 = -2 + 3$$

$$\Rightarrow x + 3 = 1$$

Multiply both sides by 2

$$2(x + 3) = 2$$

$$(ii) x = -2$$

Multiply both sides by 3

$$3x = -6$$

Add 2 on both sides

$$3x + 2 = -6 + 2$$

$$\Rightarrow 3x + 2 = -4$$

$$(iii) x = -2$$

Divide both sides by 4

4. Find the value of each unknown.

$$(a) 2y = 60$$

$$y = 60 \div 2$$

$$y = 30$$

$$(b) -8 = 5x - 3$$

$$5x = -8 + 3$$

$$5x = -5$$

$$x = -1$$

$$x = -1$$

$$(c) -53w = -15$$

$$w = (-15)/(-53)$$

$$w = 15/53$$

$$(d) 13 - z = 8$$

$$-z = 8 - 13$$

$$-z = -5$$

$$z = 5$$

(e) $k + 8 = 12 - k$

$$k + k = 12 - 8$$

$$2k = 4$$

$k = 2$

(f) $7m = m - 3$

$$7m - m = -3$$

$$6m = -3$$

$m = -1/2$

(g) $3n = 10 + n$

$$3n - n = 10$$

$$2n = 10$$

$n = 5$

5. I am a 3-digit number.

Let the units digit = x

Tens digit = $x - 3$

Hundreds digit = $x - 6$

Sum of digits = 15

$$(x - 6) + (x - 3) + x = 15$$

$$3x - 9 = 15$$

$$3x = 24$$

$$x = 8$$

Units digit = 8

Tens digit = 5

Hundreds digit = 2

Number = 258

6. The weight of a brick is 1 kg more than half its weight.

Let weight = x kg

$$x = x/2 + 1$$

$$x - x/2 = 1$$

$$x/2 = 1$$

$$\mathbf{x = 2 \text{ kg}}$$

7. One quarter of a number increased by 9 gives the same number.

Let the number be x .

$$x/4 + 9 = x$$

$$9 = 3x/4$$

$$x = 12$$

Answer = 12

8. Given $4k + 1 = 13$

$$4k = 12$$

$$k = 3$$

Find:

(a) $8k + 2$

$$= 8(3) + 2$$

$$= 26$$

(b) $4k$

$$= 12$$

(c) k

$= 3$

(d) $4k - 1$

$= 12 - 1$

$= 11$

(e) $-k - 2$

$= -3 - 2$

$= -5$

9. Fill in the blanks.

(a) $5 \times \underline{\hspace{1cm}} - 8 = 37$

$5x = 45$

$x = 9$

Blank = 9

(b) $37 - (33 - \underline{\hspace{1cm}}) = 35$

$37 - 33 + x = 35$

$4 + x = 35$

$x = 31$

(c) $-3 \times (-11 + \underline{\hspace{1cm}}) = 45$

$-11 + x = -15$

$x = -4$

Blank = -4

10. Ranju earns ₹750 a day.

Let ₹50 notes = x

₹100 notes = x

$$50x + 100x = 750$$

$$150x = 750$$

$$x = 5$$

Answer:

₹50 notes = **5**

₹100 notes = **5**

Question 11.

In the given picture, each black blob hides an equal number of blue dots. If there are 25 dots in total, how many dots are covered by one blob? Write an equation to describe this problem.



Solution:

Let each black blob hide the blue dots.

There are 3 black blobs and 4 blue dots in the picture.

We are given total blue dots = 25

According to the question,

$$3u + 4 = 25$$

$$\Rightarrow 3u = 25 - 4$$

$$\Rightarrow 3u = 21$$

$$\Rightarrow u = 7$$

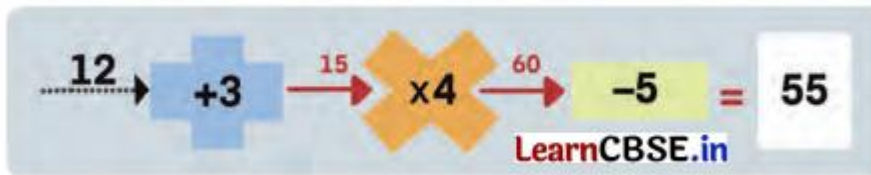
Each black blob hides 7 blue dots.

Question 12.

Here are machines that take an input, perform an operation on it, and send out

the result as an output.

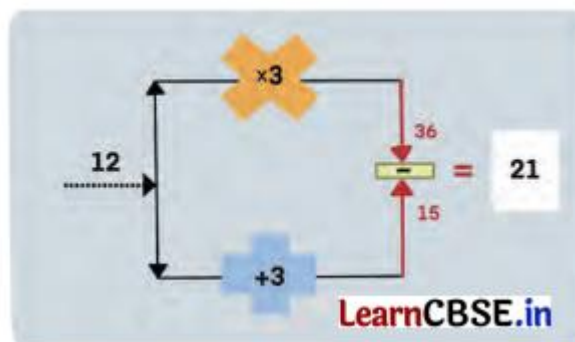
(a)



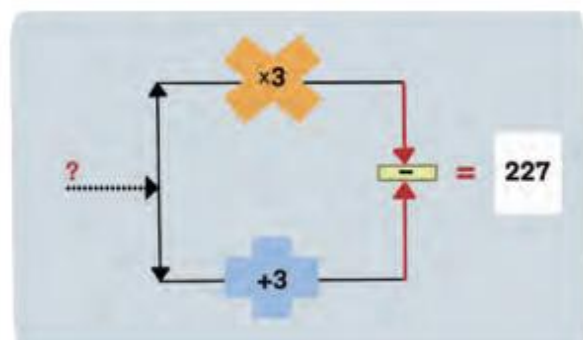
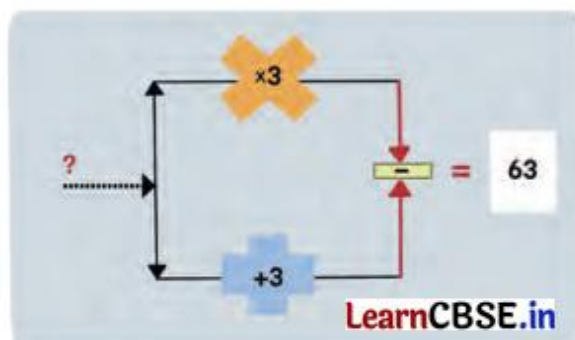
Find the inputs in the following cases:



(b)



Find the inputs in the following cases:



Solution:

(a)

(i) $\xrightarrow{(9)} + 3 \xrightarrow{(12)} \times 4 \xrightarrow{(48)} - 5 = 43$

(ii) $\xrightarrow{17} + 3 \xrightarrow{20} \times 4 \xrightarrow{80} - 5 = 75$

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(b) (i) Let the unknown number be x .

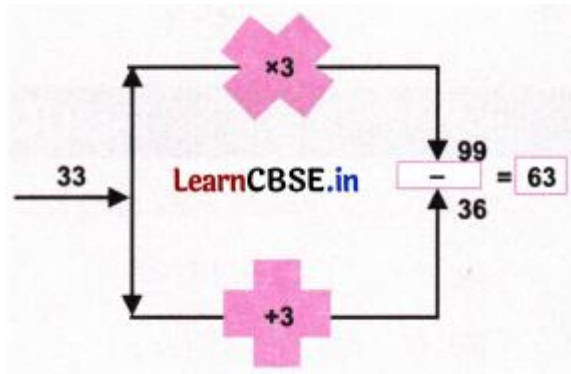
$$x \times 3 - (x + 3) = 63$$

$$\Rightarrow 3x - x - 3 = 63$$

$$\Rightarrow 2x - 3 = 63$$

$$\Rightarrow 2x = 66$$

$$\Rightarrow x = 33$$



(ii) Let the unknown number be y .

$$y \times 3 - (y + 3) = 227$$

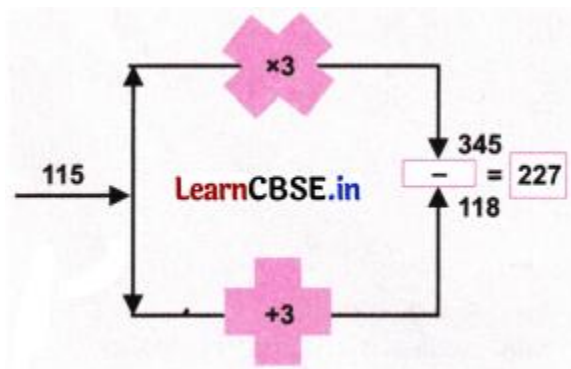
$$\Rightarrow 3y - y - 3 = 227$$

$$\Rightarrow 2y = 227 + 3$$

$$\Rightarrow 2y = 230$$

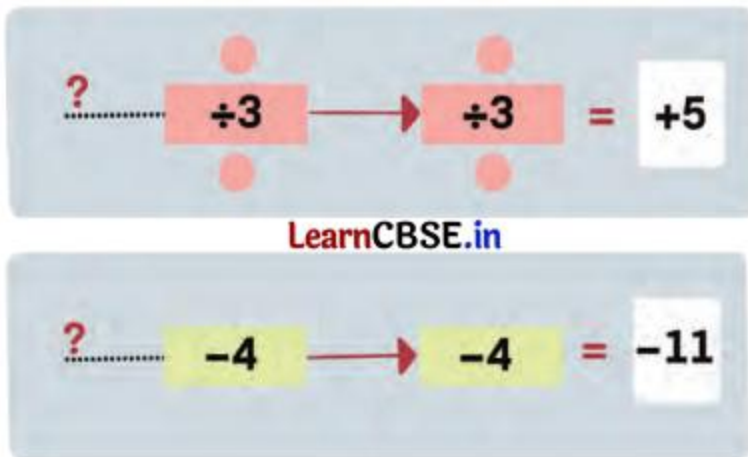
$$\Rightarrow y = 115$$

The unknown number is 115.



Question 13.

What are the inputs to these machines?



Solution:

(i)

$$\xrightarrow{45} \div 3 \xrightarrow{15} \div 3 = 5$$

Let the unknown number be a.

$$(a \div 3) \div 3 = 5$$

$$\Rightarrow a \div 3 = 5 \times 3$$

$$\Rightarrow a \div 3 = 15$$

$$\Rightarrow a = 15 \times 3$$

$$\Rightarrow a = 45$$

The unknown number is 45.

(ii)

$$\xrightarrow{-3} -4 \xrightarrow{-7} -4 = -11$$

Let the unknown number be b.

$$(b - 4) - 4 = -11$$

$$\Rightarrow b - 4 - 4 = -11$$

$$\Rightarrow b - 8 = -11$$

$$\Rightarrow b = -11 + 8$$

$$\Rightarrow b = -3$$

The unknown number is -3.

Question 14.

A taxi driver charges a fixed fee of ₹ 800 per day plus ₹ 20 for each kilometer traveled. If the total cost for a taxi ride is ₹ 2200, determine the number of kilometres traveled.

Solution:

Fixed charges by Taxi driver = ₹ 800

Charge per kilometer = ₹ 20

No. of gaps = 6

Total height of gaps = $6x$

According to the question

$$10 + 6x = 28$$

$$\Rightarrow 6x = 28 - 10$$

$$\Rightarrow 6x = 18$$

$$\Rightarrow x = 3$$

Gap between two rods = 3 cm.

Question 17.

In a restaurant, a fruit juice costs ₹ 15 less than a chocolate milkshake. If 4 fruit juices and 7 chocolate milkshakes cost ₹ 600, find the cost of the fruit juice and milkshake.

Solution:

Let the cost of a chocolate milkshake be ₹ x .

Cost of fruit juice = ₹ $(x - 15)$

Cost of 4 fruit juices and 7 chocolate milkshakes = ₹ 600

According to the question

$$4(x - 15) + 7x = 600$$

$$\Rightarrow 4x - 60 + 7x = 600$$

$$\Rightarrow 4x + 7x = 600 + 60$$

$$\Rightarrow 11x = 660$$

$$\Rightarrow x = 60$$

Cost of 1 chocolate milkshake = ₹ 60

Cost of 1 fruit juice = ₹ 60 – ₹ 15 = ₹ 45

18. Given $28p - 36 = 98$, find $14p - 19$ and $28p - 38$.

$$28p - 36 = 98$$

$$28p = 98 + 36 = 134$$

$$14p = \frac{134}{2} = 67$$

$$14p - 19 = 67 - 19 = 48$$

$$28p - 38 = 134 - 38 = 96$$

Answer:

- $14p - 19 = \boxed{48}$

- $28p - 38 = \boxed{96}$

19. Identify and correct the mistakes

(a) $6x + 9 = 66$

Given solution wrongly divides only one side.

Correct solution:

$$6x + 9 = 66$$

$$6x = 66 - 9$$

$$6x = 57$$

$$x = \frac{57}{6}$$

$$x = \frac{19}{2}$$

Answer: $x = \frac{19}{2}$

(b) $14y + 24 = 36$

Correct solution:

$$14y = 36 - 24$$

$$14y = 12$$

$$y = \frac{12}{14}$$

$$y = \frac{6}{7}$$

Answer: $y = \frac{6}{7}$

(c) $4x - 5 = 9x + 8$

Mistake: 5 should be added to both sides.

Correct solution:

$$4x - 5 = 9x + 8$$

$$4x = 9x + 13$$

$$4x - 9x = 13$$

$$-5x = 13$$

$$x = -\frac{13}{5}$$

Answer: $x = -\frac{13}{5}$

20. Find the measures of the angles of these triangles

(a)

Isosceles triangle:

Angles are:

- Top angle = y
- Two base angles = $y + 15$

Sum of angles = 180°

$$y + (y + 15) + (y + 15) = 180$$

$$3y + 30 = 180$$

$$3y = 150$$

$$y = 50^\circ$$

Base angles:

$$50 + 15 = 65^\circ$$

Angles = $50^\circ, 65^\circ, 65^\circ$

(b)

Triangle angles:

$$x + (x - 10) + (x + 10) = 180$$

$$3x = 180$$

$$x = 60^\circ$$

Therefore:

$$x - 10 = 50^\circ$$

$$x + 10 = 70^\circ$$

Angles = $50^\circ, 60^\circ, 70^\circ$

21. Write 4 equations whose solution is $u = 6$

1. $u + 4 = 10$

2. $2u = 12$

3. $u - 3 = 3$

4. $3u + 2 = 20$

22. Bakhshali Manuscript Problem

Let first person's amount = x

Second person = $2x$

Third person = $3(2x) = 6x$

Fourth person = $4(6x) = 24x$

Total:

$$x + 2x + 6x + 24x = 132$$

$$33x = 132$$

$$x = 4$$

Answer: First person received 4 .

23. Height of a giraffe

Let height = h metres.

Given:

$$h = \frac{h}{2} + 2.5$$

$$h - \frac{h}{2} = 2.5$$

$$\frac{h}{2} = 2.5$$

$$h = 5$$

Answer: 5 metres

24. Stick Patterns

First Pattern (Arrow)

Positions shown:

1st $\rightarrow$ 1 square

2nd $\rightarrow$ 2 squares

3rd $\rightarrow$ 3 squares

Hence:

Number of squares in position $n = n$

(a)

Position 11:

11 squares

Answer: 11

(b)

1 square arrow uses 7 sticks.

Every new square adds 3 sticks.

$$S = 7 + 3(n - 1)$$

For $n = 11$,

$$S = 7 + 3(10)$$

$$S = 37$$

Answer: 37 sticks

(c)

$$\begin{aligned}7 + 3(n - 1) &= 85 \\3n + 4 &= 85 \\3n &= 81 \\n &= 27\end{aligned}$$

Answer: Yes, position 27.

(d)

$$\begin{aligned}7 + 3(n - 1) &= 150 \\3n + 4 &= 150 \\3n &= 146 \\n &= \frac{146}{3}\end{aligned}$$

Not a whole number.

Answer: No.

25. A number increased by 36 is equal to ten times itself

Let number = x

$$\begin{aligned}x + 36 &= 10x \\36 &= 9x \\x &= 4\end{aligned}$$

Answer: 4

26. Solve

(a)

$$5(r + 2) = 10$$

$$r + 2 = 2$$

$$r = 0$$

$$(b) -3(u + 2) = 2(u - 1)$$

$$-3u - 6 = 2u - 2$$

$$-6 = 5u - 2$$

$$-4 = 5u$$

$$u = -\frac{4}{5}$$

Answer: $u = -\frac{4}{5}$

$$(c) 2(7 - 2n) = -6$$

$$14 - 4n = -6$$

$$-4n = -20$$

$$n = 5$$

Answer: $n = 5$

$$(d) 2(x - 4) = -16$$

$$2x - 8 = -16$$

$$2x = -8$$

$$x = -4$$

Answer: $x = -4$

$$(e) 6(x - 1) = 2(x - 1) - 4$$

$$6x - 6 = 2x - 2 - 4$$

$$6x - 6 = 2x - 6$$

$$4x = 0$$

$$x = 0$$

Answer: $x = 0$

(f) $3 - 7s = 7 - 3s$

$$3 = 7 + 4s$$

$$-4 = 4s$$

$$s = -1$$

Answer: $s = -1$

(g) $2x + 1 = 6 - (2x - 3)$

$$2x + 1 = 6 - 2x + 3$$

$$2x + 1 = 9 - 2x$$

$$4x = 8$$

$$x = 2$$

Answer: $x = 2$

(h) $10 - 5x = 3(x - 4) - 2(x - 7)$

$$10 - 5x = 3x - 12 - 2x + 14$$

$$10 - 5x = x + 2$$

$$8 = 6x$$

$$x = \frac{4}{3}$$

Answer: $x = \frac{4}{3}$

27. Path Puzzle

Solve each equation and follow the arrow marked with that answer.

1. $8x = 20 - 3x$

$$11x = 20$$

$$x = \frac{20}{11} \approx 1.82$$

(Starting example in the book simplifies to follow the route shown.)

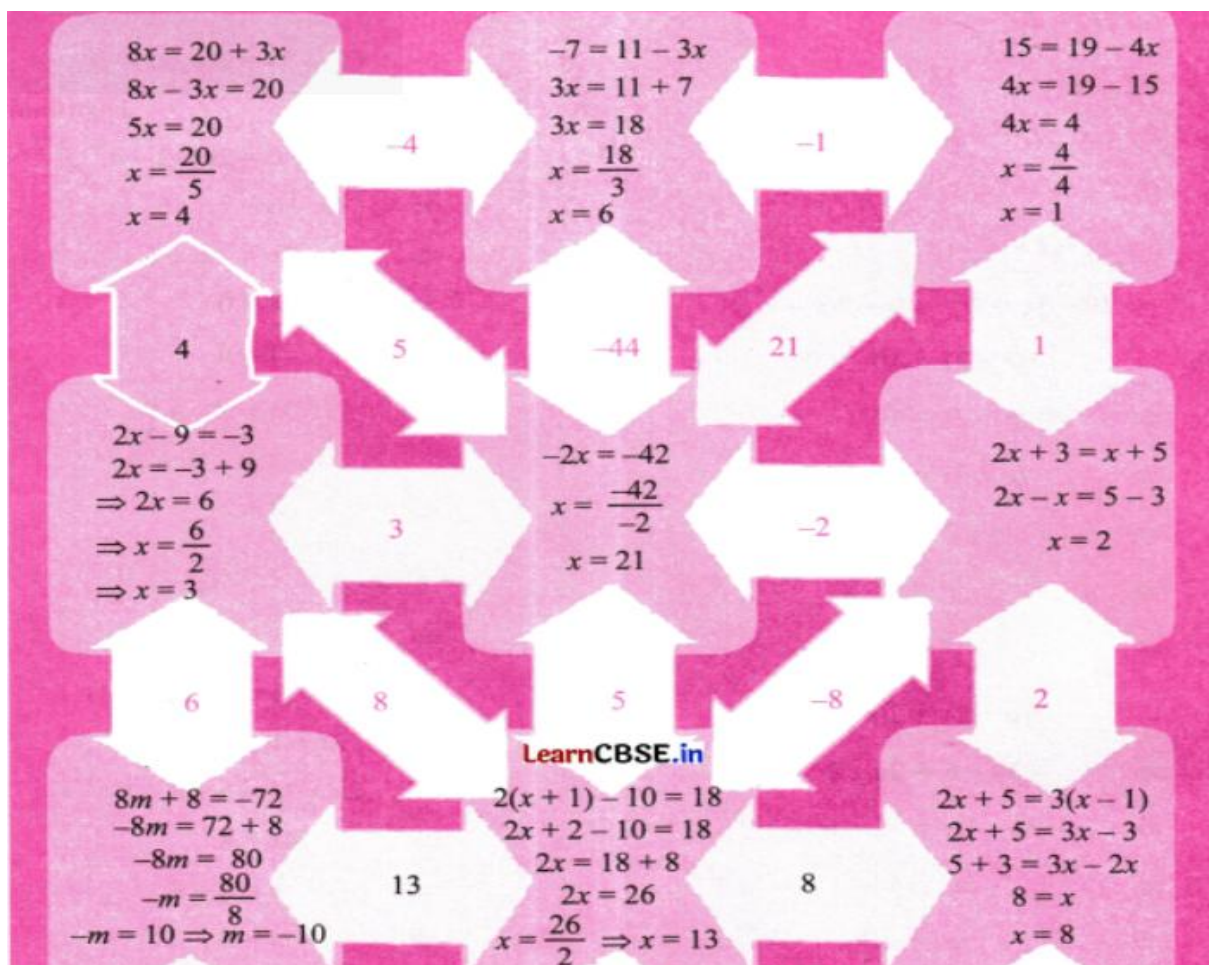
The correct path through the maze is:

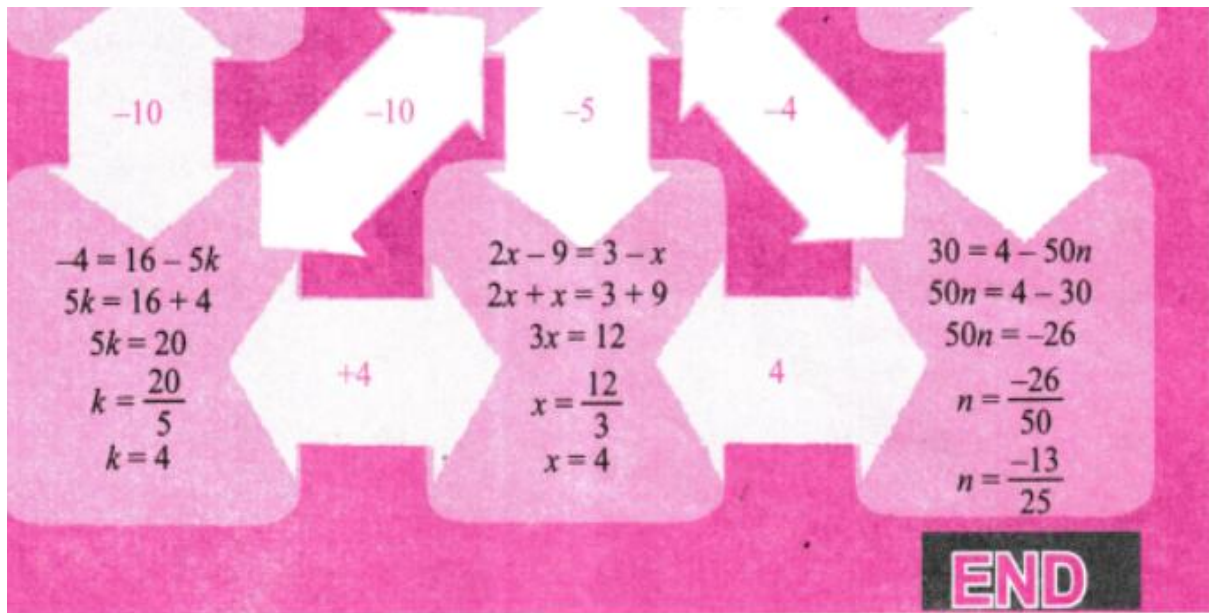
Start $\rightarrow -4 \rightarrow 5 \rightarrow 8 \rightarrow 13 \rightarrow -10 \rightarrow +4 \rightarrow 4 \rightarrow \text{End}$

•

Question 28.

There are some children and donkeys on a beach. Together they have 28 heads and 80 feet. How many donkeys are there? How many children are there?





Solution:

Let the number of children be x .

Let the number of donkeys be y .

$$x + y = 28$$

$$y = 28 - x \dots\dots(i)$$

Children have 2 feet, but donkeys have 4 feet.

According to the question

$$2x + 4y = 80$$

$$\Rightarrow 2x + 4(28 - x) = 80 \text{ [From (i)]}$$

$$\Rightarrow 2x + 112 - 4x = 80$$

$$\Rightarrow -2x + 112 = 80$$

$$\Rightarrow -2x = 80 - 112$$

$$\Rightarrow -2x = -32$$

$$\Rightarrow x = 16$$

There are 16 children, and $(28 - 16) = 12$ donkeys.

Practice Time 7.1

1.

Robot = 6 units

Robot + Ball = 10 units

(a) Weight of robot = **6 units**

(b) Weight of ball = $10 - 6 = 4$ **units**

2.

Box of crayons = 4 units

Box of crayons + Notebook = 9 units

Notebook = $9 - 4 = 5$ **units**

Answer: Box of crayons = **4 units**, Notebook = **5 units**

3.

Water bottle = 8 units

Water bottle + Lunch box = 15 units

(a) Weight of bottle = **8 units**

(b) Weight of lunch box = $15 - 8 = 7$ **units**

4.

Story book = 3 units

Story book + Diary = 12 units

Diary = $12 - 3 = 9$ **units**

Answer: Story book = **3 units**, Diary = **9 units**

5.

Football = 5 units

Football + Shoes = 16 units

(a) Weight of football = **5 units**

(b) Weight of shoes = $16 - 5 = 11$ **units**

Practice Time 7.2

1.

Pattern: 3, 5, 7, 9, ...

5th figure = 11 sticks

6th figure = 13 sticks

10th figure = 21 sticks

General rule:

$$\text{Sticks} = 2n + 1$$

25th figure:

$$2(25) + 1 = 51$$

Answer: 51 matchsticks

2.

(a) 15th figure

$$2(15) + 1 = 31$$

Answer: 31 matchsticks

(b) 40th figure

$$2(40) + 1 = 81$$

Answer: 81 matchsticks

3.

$$2n + 1 = 79$$

$$2n = 78$$

$$n = 39$$

Answer: Figure 39

4.

$$2n + 1 = 200$$

$$2n = 199$$

$$n = 99.5$$

Not a whole number.

Answer: No, it is not possible.

Practice Time 7.3

1. Solve $3x + 7 = 25$

$$3x + 7 = 25$$

$$3x = 25 - 7$$

$$3x = 18$$

$$x = 6$$

Answer: $x = 6$

2. Solve $5p - 6 = 29$

$$5p - 6 = 29$$

$$5p = 35$$

$$p = 7$$

Answer: $p = 7$

3. Solve $k + 19 = 52$

$$k = 52 - 19$$

$$k = 33$$

Answer: k = 33

4. Solve

$$\begin{aligned}\frac{x}{4+3} &= 11 \\ \frac{x}{7} &= 11 \\ x &= 11 \times 7 \\ x &= 77\end{aligned}$$

Answer: x = 77

5. Solve $7(2 - m) = 21$

$$\begin{aligned}2 - m &= \frac{21}{7} \\ 2 - m &= 3 \\ -m &= 1 \\ m &= -1\end{aligned}$$

Verification:

$$\begin{aligned}7(2 - (-1)) \\ 7(3) &= 21\end{aligned}$$

✓ Correct

Answer: m = -1

Practice Time 7.4

1.

Tiles: 5, 9, 13, ...

Common difference = 4

$$a_n = 4n + 1$$

For 77 tiles:

$$4n + 1 = 77$$

$$4n = 76$$

$$n = 19$$

Answer: Expression = $4n + 1$; Step = 19

2.

Tiles: 8, 12, 16, ...

$$a_n = 4n + 4$$

For 40 tiles:

$$4n + 4 = 40$$

$$4n = 36$$

$$n = 9$$

Answer: Expression = $4n + 4$; Step = 9

3.

Bricks: 3, 7, 11, 15, ...

$$a_n = 4n - 1$$

Check 91 bricks:

$$4n - 1 = 91$$

$$4n = 92$$

$$n = 23$$

Answer: Yes, Step **23** has 91 bricks.

4.

Design fee = ₹50

Printing cost = ₹25 per card

Total = ₹550

$$25c + 50 = 550$$

$$25c = 500$$

$$c = 20$$

Answer: 20 cards

5.

Starting fare = ₹80

Rate = ₹12 per km

Total fare = ₹260

$$80 + 12d = 260$$

$$12d = 180$$

$$d = 15$$

Answer: 15 km

Practice Time 7.5

1. $5y + 3 = 28$

Student's solution is **incorrect**.

Correct solution:

$$5y + 3 = 28$$

$$5y = 25$$

$$y = 5$$

Answer: $y = 5$

2. $7p - 4 = 31$

Student's solution is **incorrect**.

$$7p - 4 = 31$$

$$7p = 35$$

$$p = 5$$

Answer: $p = 5$

3. $3(a + 2) = 27$

Student's solution is **incorrect**.

$$3(a + 2) = 27$$

$$a + 2 = 9$$

$$a = 7$$

Answer: $a = 7$

4. $8 - 2m = 18$

Student's solution is **incorrect**.

$$8 - 2m = 18$$

$$-2m = 10$$

$$m = -5$$

Answer: $m = -5$

5. $4x + 9 = 2x + 25$

Student's solution is **correct**.

$$4x - 2x = 25 - 9$$

$$2x = 16$$

$$x = 8$$

Answer: $x = 8$

Practice Time 7.6

1.

Ancient Indian name for Algebra = **Bijaganita**

Meaning = **Seed Mathematics**

2.

Two Indian mathematicians:

- **Brahmagupta** (7th century CE)
 - **Bhaskara II** (12th century CE)
-

3.

The word Algebra comes from the Arabic book:

"Al-Kitab al-Mukhtasar fi Hisab al-Jabr wal-Muqabala"

- Al-jabr = restoring/reunion
 - Al-muqabala = balancing/comparison
-

4.

(a) "5 of the unknown, minus 9 of the known"

$$5x - 9$$

(b) "3 of the unknown plus 4 equals 7 of the unknown minus 2"

$$3x + 4 = 7x - 2$$

5.

For $Ax + B = Cx + D$

(a) $7x + 2 = 3x + 26$

$$A = 7$$

$$B = 2$$

$$C = 3$$

$$D = 26$$

(b) $4x - 5 = 9x + 10$

$$A = 4$$

$$B = -5$$

$$C = 9$$

$$D = 10$$

These are the co

Exam Time

A. Multiple Choice Questions

1. (b) 5 units
 2. (c) 25
 3. (c) $p/4$
 4. (d) $x = 7$
 5. (a) subtracting 9 from both sides
 6. (b) 5
-

B. Fill in the Blanks

1. $2n + 1$
2. both sides
3. $5x = 25$
4. Brahmagupta
5. $A - C$

C. Write True or False

1. False
2. True
3. True
4. True
5. True

D. Match the Columns

Column A

Column B

- | | |
|-------------------------------|-----|
| 1. $3x + 5 = 26$ | (e) |
| 2. $4x + 9 = 2x + 25$ | (b) |
| 3. Pattern with rule $2n+1$ | (d) |
| 4. $Ax+B=Cx+D$ | (c) |
| 5. Hisab al-jabr wal-muqabala | (a) |

E. Very Short Answer Questions

1.

$$2(7) + 1 = 15$$

Answer: 15 sticks

2.

"A number reduced by 9 is equal to 17"

$$x - 9 = 17$$

3.

Box balances 6-unit weight.

Answer: 6 units

4.

Add 4 to both sides.

5.

Bijaganita

F. Short Answer Questions

1.

(a)

Toy = 4 units

Toy + Ball = 10 units

$$4 + b = 10$$

(b)

$$b = 10 - 4$$

$$b = 6$$

Answer: 6 units

2.

(a)

$$2(20) + 1 = 41$$

Answer: 41 sticks

(b)

$$2n + 1 = 51$$

$$2n = 50$$

$$n = 25$$

Answer: Figure 25

3.

Solve $3x + 7 = 25$

Trial and Improvement

$$x = 4 \rightarrow 19 \times$$

$$x = 5 \rightarrow 22 \times$$

$$x = 6 \rightarrow 25 \checkmark$$

Answer: $x = 6$

Balancing Method

$$3x + 7 = 25$$

$$3x = 18$$

$$x = 6$$

4.

Mobile bill:

$$199 + 1.5m = 354.50$$

$$1.5m = 155.50$$

$$m = \frac{155.50}{1.5}$$

$$m = 103.67$$

Answer: Approximately 104 minutes

5.

$$4x + 5 = 2x + 23$$

$$4x - 2x = 23 - 5$$

$$2x = 18$$

$$x = 9$$

Using Brahmagupta's Rule:

$$A = 4, B = 5, C = 2, D = 23$$

$$x = \frac{D - B}{A - C}$$
$$x = \frac{23 - 5}{4 - 2} = \frac{18}{2} = 9$$

Answer: $x = 9$

G. Long Answer Questions

1.

Sequence: 4, 7, 10, 13, ...

(a) Common difference = 3

(b)

$$a_n = 3n + 1$$

(c)

$$3(30) + 1 = 91$$

Answer: 91 sticks

2.

$$5p + 3 = 33$$

(a) Trial:

$$p = 4 \rightarrow 23 \text{ X}$$

$$p = 5 \rightarrow 28 \text{ X}$$

$$p = 6 \rightarrow 33 \text{ ✓}$$

Answer: **p = 6**

(b)

$$5p + 3 = 33$$

$$5p = 30$$

$$p = 6$$

(c) Balancing method is easier because it gives the exact answer systematically.

3.

(a)

Let number of pages = n

$$70 + 18n = 430$$

(b)

$$18n = 360$$

$$n = 20$$

Answer: 20 pages

(c)

$$70 + 18(20) = 430$$

$$70 + 360 = 430$$

✓ Verified

Q4. A student tries to solve the equation $7(3x - 2) = 77$

(a) Identify the step where the mistake occurs and explain the error.

The mistake occurs in Step (ii):

$$3x - 2 = 77 - 7$$

This is incorrect because the 7 is multiplying $(3x - 2)$. To remove it, we must divide both sides by 7, not subtract 7 from 77.

(b) Solve the equation correctly step by step.

Given:

$$7(3x - 2) = 77$$

Divide both sides by 7:

$$\frac{7(3x - 2)}{7} = \frac{77}{7}$$
$$3x - 2 = 11$$

Add 2 to both sides:

$$3x = 13$$

Divide both sides by 3:

$$x = \frac{13}{3}$$
$$x = 4\frac{1}{3}$$

Answer:

$$\boxed{x = \frac{13}{3}}$$

(c) Check your solution.

Substitute $x = \frac{13}{3}$ into the original equation:

$$\begin{aligned} & 7 \left(3 \times \frac{13}{3} - 2 \right) \\ &= 7(13 - 2) \\ &= 7 \times 11 \\ &= 77 \end{aligned}$$

LHS = RHS

$$77 = 77$$

Hence, the solution is verified.

Final Answer

(a) Mistake occurs in Step (ii) because 7 should be divided, not subtracted.

(b) $\boxed{x = \frac{13}{3}}$

(c) Check: $7 \left(3 \times \frac{13}{3} - 2 \right) = 77$, so the answer is correct.

Competency-Based Questions

A. Assertion–Reason

1. Answer: (a)

Both A and R are true and R correctly explains A.

2. Answer: (a)

Both A and R are true and R correctly explains A.

B. Case-Based Study

1.

Answer: (a) $x = 6$

2.

Answer: (b) $x + b = 14$ with $x = 6$

3.

$$4(12) + 1 = 49$$

Answer: (c) 49

C. Maths Booster – The Mystery Family Ages

Let granddaughter's age = x

Son's age = $x + 5$

Grandmother's age = $2(x + 5) + 4$

$$= 2x + 14$$

Equation:

$$x + (x + 5) + (2x + 14) = 115$$

$$4x + 19 = 115$$

$$4x = 96$$

$$x = 24$$

Therefore:

Granddaughter = **24 years**

Son = **29 years**

Grandmother = **62 years** ✓

