Grade 7 Maths - Part 2

(Mastermind)

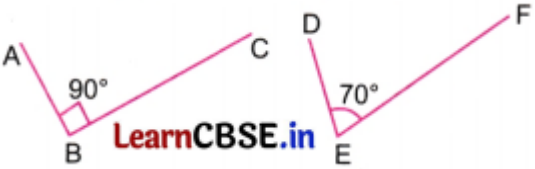
Chapter 1 Geometric Twins

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, ∠ABC does not coincide with ∠DEF.
Hence, the given figures are not congruent.

Figure it out

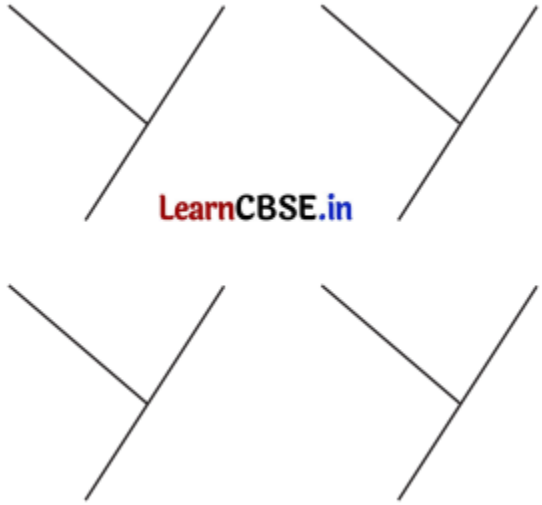
Question 1.
Circle the pairs that appear congruent.

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.

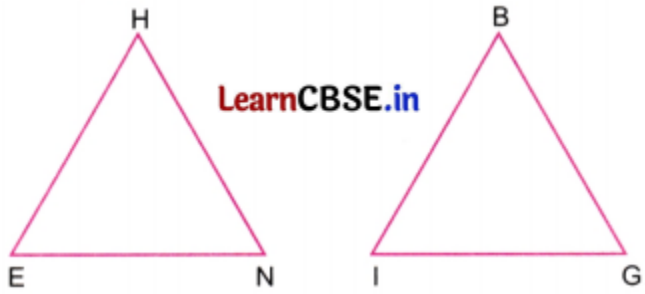
Question 4.
How would we check if two figures like the one below are congruent?

Use this to identify whether each of the following pairs is congruent.



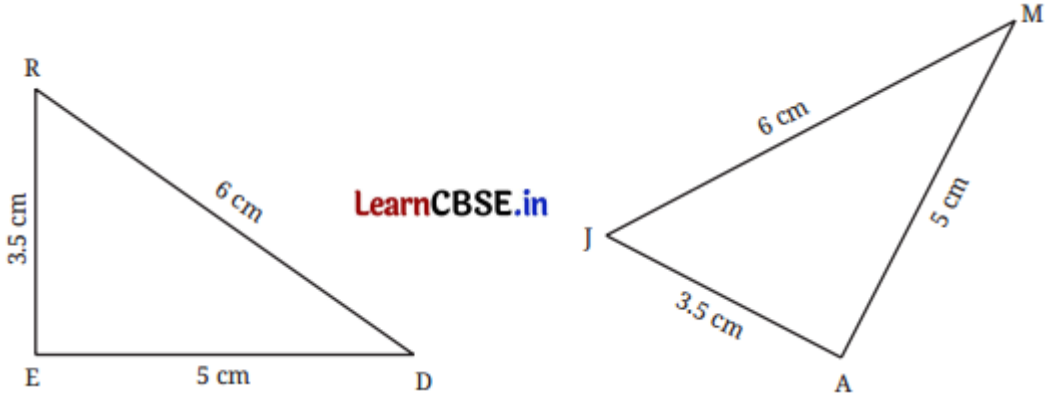
Solution:
To check if the two figures are congruent, one would need to measure the lengths of the corresponding line segments and the angle between them.
Yes, each of the given figures is congruent. Length of line segments in each figure is 3.3 cm (Horizontal line) and 2.3 cm (Vertical line), and the angle between them is 82°.

Question 5.
Suppose ΔHEN is congruent to ΔBIG. List all the other correct ways of expressing this congruence.
Solution:
Given



ΔHEN = ΔBIG 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) ΔHNE ≅ ΔBGI
(ii) ΔEHN ≅ ΔIBG
(iii) ΔENH ≅ ΔIGB
(iv) ΔNHE ≅ ΔGBI
(v) ΔNEH ≅ ΔGIB

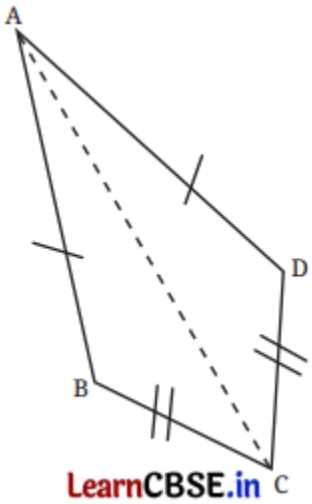
Question 6.
Determine whether the triangles are congruent. If yes, express the congruence.



Solution:
Given the side lengths of the two triangles

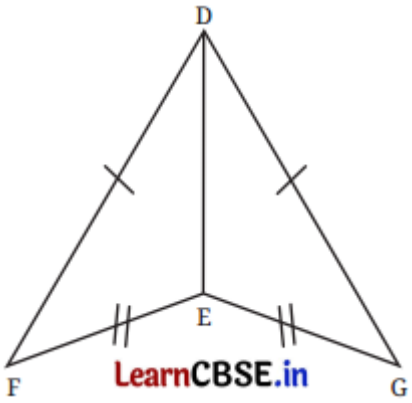
RE = 3.5 cm, ED = 5 cm, RD = 6 cm
and JA = 3.5 cm, AM = 5 cm, JM = 6 cm
Clearly RE = JA = 3.5 cm
ED = AM = 5 cm
RD = JM = 6 cm
Hence ΔRED ≅ ΔJAM.

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 ∠BAD and ∠BCD into two equal parts? Give reasons.



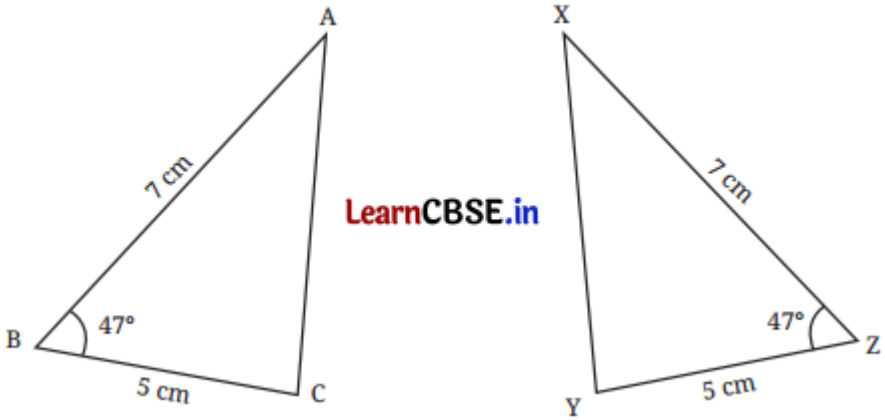
Solution:
Given AD = AB
CB = CD
AC = AC (Common side)
Since all three sides of ΔABC are equal to the corresponding three sides ΔADC, the triangles are congruent by the side-side-side (SSS) congruence criterion.
Hence ΔABC ≅ ΔADC
Yes, AC divides ∠BAD and ∠BCD into equal parts.
Since ΔABC ≅ ΔADC
Then, ∠BAC = ∠DAC and ∠BCA = ∠DCA
This means that AC bisects both ∠BAD and ∠BCD.

Question 8.
In the figure below, are ΔDFE and ΔGED 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 ΔDFE and ΔDGE
Hence, by the SSS congruence criterion
ΔDFE ≅ ΔDGE
The order of the vertices matters in congruence statements.
The vertices must correspond correctly.
In ΔDFE and ΔDGE
DF corresponds to DG
FE corresponds to EG
ED is common.
Given statements DF = DG and FE = GE do not support the congruence of ΔDFE and ΔGED because the corresponding sides are not equal.

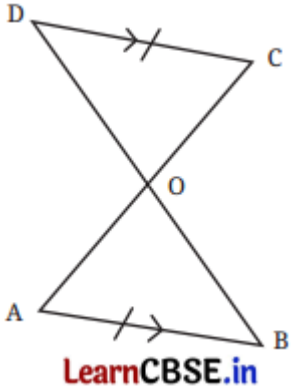
Question 9.
Identify whether the triangles below are congruent. What conditions did you use to establish their congruence? Express the congruence.



Solution:
Here, BC = ZY = 5 cm
BA = ZX = 7 cm
∠ABC = ∠XZY = 47°
ΔABC ≅ ΔXZY

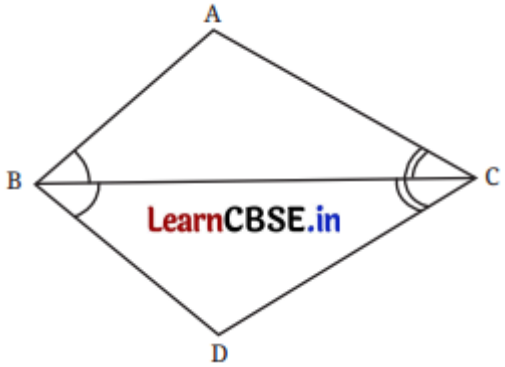
Since the two sides and the included angle of triangle ABC are equal to the two sides and the included angle of triangle XZY.
The triangles are congruent by the side-angle-side condition.
It can be expressed as ΔABC ≅ ΔXZY.

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 || AB; AB = CD
∠OCD = ∠OAB; ∠OBA = ∠ODC (∵ Alternate Angles)
∠DOC = ∠BOA
OA = OC; OB = OD

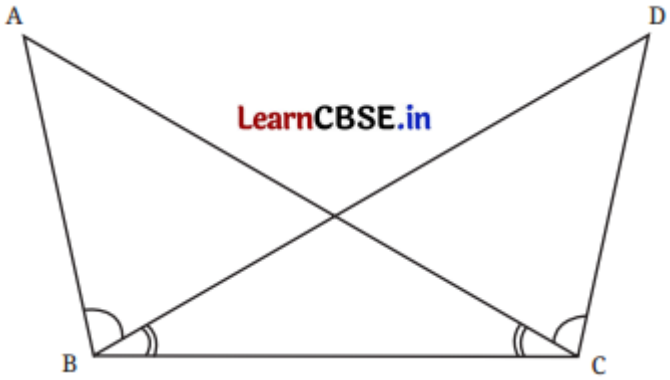
Question 11.
Given that ∠ABC = ∠DBC and ∠ACB = ∠DCB, show that ∠BAC = ∠BDC.
Are the two triangles congruent?



Solution:
Let ∠ABC = a = ∠DBC
and let ∠ACB = b = ∠DCB
BC is a common side of the two triangles, then ΔABC ≅ ΔDBC

Angle Side Angle Congruence:
When two triangles are congruent, their corresponding parts are equal [CPCT]
Since ΔABC ≅ ΔDBC, their corresponding angles are equal.
Hence ∠BAC = ∠BDC

Question 12.
Identify the equal parts in the following figure, given that ∠ABD = ∠DCA and ∠ACB = ∠DBC.



Solution:
Given ∠ABD = ∠DCA; ∠ACB = ∠DBC
∠AOB = ∠DOC (∵ They are vertically opposite angles)
AO = DO; CO = BO
ΔCOD ≅ ΔBOA

Practice Time 1.1

Q1. Name the angle congruent to:

Given:
∠AOB = ∠BOC = ∠COD

(a) ∠AOB

Answer: ∠BOC and ∠COD

(b) ∠BOD

∠BOD = ∠BOC + ∠COD

Since ∠BOC = ∠COD,

∠BOD = 2 equal parts

Similarly,

∠AOC = ∠AOB + ∠BOC

∠AOC = 2 equal parts

Answer: ∠AOC

Q2.

Given:
∠POQ ≅ ∠ROS

Since

∠POR = ∠POQ + ∠QOR

and

∠QOS = ∠QOR + ∠ROS

Given ∠POQ = ∠ROS

Therefore

∠POR = ∠QOS

Answer: Yes, ∠POR ≅ ∠QOS.

Q3.

Given:
a = b = c

∠AOC = a + b + c

∠AOB = a + b

∠BOC = b + c

Since a = b = c,

∠AOB = 2a

∠BOC = 2a

Therefore

∠AOB ≅ ∠BOC

Q4.

Given:
$PQ \cong RS$

Need to check if $PR \cong QS$.

On line AB:

$PR = PQ + QR$

$QS = QR + RS$

Given $PQ = RS$

Therefore

$PR = QS$

Answer: Yes, $PR \cong QS$.

Q5.

Given:

$\Delta ABC \cong \Delta FED$

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 ≅ Rectangle PQRS

AB = 6 cm

QR = 4 cm

In congruent rectangles

AB = PQ

BC = QR

Therefore

PQ = 6 cm

BC = 4 cm

Practice Time 1.2

Q1(a)

ΔCOD and ΔAOB

CD = AB = 5 cm

∠C = 40° = ∠B

∠D = 60° = ∠A

Two angles and included side equal

Property:

ASA

Congruence:

ΔCOD ≅ ΔBOA

Q1(b)

PQ = PR

LM = MN

∠P = ∠M = 70°

Included sides equal

Property:

SAS

Congruence:

$\Delta PQR \cong \Delta MLN$

Q1(c)

Right triangles

$YX = NP = 6$ cm

$ZX = MP = 8$ cm

$\angle Y = \angle N = 90°$

Property:

RHS

Congruence:

$\Delta YXZ \cong \Delta NPM$

Q1(d)

Opposite sides marked equal

$PQ = SR$

$PS = QR$

QS common

Property:

SSS

Congruence:

$\Delta PQS \cong \Delta SRQ$

Q1(e)

BC = DE = 6 cm

∠B = 60°

∠C = 40°

∠E = 60°

∠D = 40°

Property:

ASA

Congruence:

ΔABC ≅ ΔFED

Q1(f)

AB = QR = 6 cm

AC = PR = 5 cm

BC = PQ = 3 cm

Property:

SSS

Congruence:

ΔABC ≅ ΔRQP

Q2

Given:

PL ⊥ OB

PM ⊥ OA

PL = PM

In ΔPLO and ΔPMO

∠PLO = 90°

∠PMO = 90°

OP common

PL = PM

Therefore by RHS

Answer:

ΔPLO ≅ ΔPMO

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.

ΔABC ≅ ΔDEF

Q4

Given

AD bisects ∠A

$AD \perp BC$

In ΔADB and ΔADC

$\angle ADB = \angle ADC = 90°$

AD common

$\angle BAD = \angle DAC$

Therefore

(a)

$\Delta ADB \cong \Delta ADC$

(b)

ASA

Q5

AB and CD bisect each other at O

AO = OB

CO = OD

$\angle AOC = \angle BOD$ (vertically opposite)

Therefore by SAS

(a)

$\Delta AOC \cong \Delta BOD$

(b)

$AC \parallel BD$

(c)

AC = BD

Practice Time 1.3

Q1

AB = AC

$\Rightarrow \angle B = \angle C$

Sum of angles = 180°

$\angle B + \angle C = 180° - 40°$

$= 140°$

Each angle = 70°

Answer:

$\angle B = 70°, \angle C = 70°$

Q2

PQ = PR

$\Rightarrow \angle Q = \angle R$

$\angle Q = 55°$

$\angle R = 55°$

$\angle P = 180° - 55° - 55°$

$= 70°$

Answer:

$\angle R = 55°, \angle P = 70°$

Q3

XY = XZ

$\Rightarrow \angle Y = \angle Z$

$\angle Z = 48°$

$\angle Y = 48°$

$\angle X = 180° - 48° - 48°$

$= 84°$

Answer:

$\angle Y = 48°, \angle X = 84°$

Q4

LM = LN

⇒ ∠M = ∠N

∠M = 62°

∠N = 62°

∠L = 180° − 62° − 62°

= 56°

Answer:

∠N = 62°, ∠L = 56°

Q5

DE = DF

⇒ ∠E = ∠F

∠D = 110°

∠E + ∠F = 70°

Each = 35°

Answer:

∠E = 35°, ∠F = 35°

Exam Time

MCQs

1.

AB = AC

Angles opposite equal sides are equal

Answer:

(b) ∠B = ∠C

2.

AB = AC and ∠A = 50°

Remaining angles = 130°

Each = 65°

Answer:

(b) 65°

3.

Equilateral triangle

Each angle = 60°

Answer:

(c) 60°

4.

60°, 60°, 60°

All sides equal

Answer:

(c) Equilateral

5.

PQ = PR

Angles opposite equal sides equal

Answer:

(b) ∠Q and ∠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 ∠A = ∠B = ∠C = **60°**.
3. Sum of angles of any triangle is **180°**.
4. In ΔABC, if AB = AC, then ∠B = **∠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 ∠A = ∠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	**Column B**
1. Isosceles triangle	(b) Two sides equal
2. Equilateral triangle	(a) All sides equal
3. Congruent triangles	(d) Same shape and same size
4. Similar triangles	(c) Same shape, different sizes
5. Base angles (isosceles)	(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 ΔABC, which angles are equal?

Since equal sides subtend equal angles,

∠B = ∠C

---

5. Write the measure of each angle of an equilateral triangle.

Each angle =

180° ÷ 3 = **60°**

F. Short Answer Type Questions

1. In ΔABC, AB = AC and ∠A = 36°. Find ∠B and ∠C.

Given:

AB = AC

⇒ ∠B = ∠C

Let

∠B = ∠C = x

Using angle sum property,

$x + x + 36° = 180°$

$2x = 144°$

$x = 72°$

Answer:

$\angle B = 72°$

$\angle C = 72°$

---

2. In ΔPQR, PQ = PR and ∠Q = 58°. Find ∠R and ∠P.

Given:

PQ = PR

$\Rightarrow \angle Q = \angle R$

$\angle R = 58°$

Using angle sum property,

$\angle P + 58° + 58° = 180°$

$\angle P = 180° - 116°$

$\angle P = 64°$

Answer:

$\angle R = 58°$

$\angle P = 64°$

G. Long Answer Type Questions

1. In ΔABC, AB = AC and ∠A = 80°. Draw altitude AD ⊥ BC. Prove ∠B = ∠C using RHS congruence.

Proof

Given:

AB = AC

AD ⊥ BC

Consider ΔADB and ΔADC

$AD = AD$ (common)

$AB = AC$ (given)

$\angle ADB = \angle ADC = 90°$

Therefore,

$\Delta ADB \cong \Delta ADC$ (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 ΔABC be an equilateral triangle.

$AB = BC = CA$

Therefore,

$\angle A = \angle B = \angle C$

Let each angle = x

Using angle sum property,

$x + x + x = 180°$

$3x = 180°$

$x = 60°$

Therefore,

$\angle A = \angle B = \angle C = 60°$

Hence proved.

---

3. In ΔABC, AB = AC and $\angle B = 2x + 10°$, $\angle C = 3x - 5°$. Find x and all angles.

AB = AC

$\Rightarrow \angle B = \angle C$

$2x + 10 = 3x - 5$

$x = 15$

$\angle B = 2(15) + 10$

$= 40°$

$\angle C = 3(15) - 5$

$= 40°$

$\angle A = 180° - 40° - 40°$

$= 100°$

Answer:

$x = 15$

$\angle A = 100°$

$\angle B = 40°$

$\angle C = 40°$

---

4. In ΔPQR, PQ = PR. The vertex angle $\angle P = (5y + 20)°$ and each base angle $= (2y + 10)°$. Find y and all angles.

Using angle sum property,

$(5y + 20) + (2y + 10) + (2y + 10) = 180$

$9y + 40 = 180$

$9y = 140$

$y = 140/9$

≈ 15.56

Angles:

$\angle P = 5(140/9) + 20$

$= 880/9°$

$\approx 97.78°$

$\angle Q = \angle R$

$= 2(140/9) + 10$

$= 370/9°$

$\approx 41.11°$

Answer:

$y = 140/9$

$\angle P \approx 97.78°$

$\angle Q = \angle R \approx 41.11°$

---

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 ΔABC, then ∠B = ∠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

∠A = 70°

$AD \perp BC$

1. Which triangles are used to apply RHS congruence?

Answer: (b) ΔADB and ΔADC

---

2. What is ∠B equal to?

$AB = AC$

$\Rightarrow$ Base angles are equal

Answer: (b) ∠C

---

3. Value of each base angle

$\angle B + \angle C = 180° - 70°$

$= 110°$

Each angle = 55°

Answer: (b) 55°

C. Maths Booster

1. Angle Riddle

Triangle has two equal angles.

Third angle = 96°

Remaining angles:

$180° - 96° = 84°$

Each equal angle:

$84° \div 2 = 42°$

Answer:

42° and 42°

---

2. Find the Mystery x

Base angles = (3x + 5)° each

Vertex angle = (2x + 10)°

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

$= 10 \times (-5)$

$= -50°C$

Final temperature

$= 32 + (-50)$

$= -18°C$

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 ÷ 8

= 4000

Answer: 4000 bags

---

6. Fill the blanks

(a)

(−3) × □ = 27

□ = −9

Answer: −9

(b)

5 × □ = −35

□ = −7

Answer: −7

(c)

□ × (−8) = −56

□ = 7

Answer: 7

(d)

□ × (−12) = 132

□ = −11

Answer: −11

(e)

□ ÷ (−8) = 7

□ = −56

Answer: −56

(f)

□ + 12 = −11

□ = −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

$3 \times (-6) =$ _____

$2 \times (-6) =$ _____

$1 \times (-6) =$ _____

$0 \times (-6) = 0$

$(-1) \times (-6) =$ _____

$(-2) \times (-6) =$ _____

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) × (+7)

Solution

Positive × 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 × 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 × 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 × 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

18×3

$= 54$

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 × (−8)

= −56

Since LHS = RHS,

Verified (Commutative Property).

---

4. Check if

(−6) × (−9) = (−9) × (−6)

LHS

(−6) × (−9)

= 54

RHS

(−9) × (−6)

= 54

Since LHS = RHS,

Verified (Commutative Property).

---

5. Find the sign and value of

(−3) × 2 × (−5) × 4

Solution

First,

(−3) × 2

= −6

Then,

−6 × (−5)

= 30

Then,

30 × 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) × (−3) is:

Negative × Negative = Positive

Answer: (a) Positive

---

5. The value of (−4) × 6 is:

= −24

Answer: (b) −24

B. Fill in the Blanks

1.

(−1) × a = _____

Using multiplication rule:

(−1) × a = −a

Answer: −a

2.

(−6) × (−9)

= 54

Answer: 54

3.

0 × (−5)

= 0

Answer: 0

4.

(−100) ÷ 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	**Column B**
1. $a \times (b + c)$	(b) Distributive Property
2. $(a \times b) \times c$	(d) Associative Property
3. $a \times b = b \times a$	(a) Commutative Property
4. $1 \times a$	(c) Identity Element
5. Even number of negatives	(e) Product is Positive

Answers

1 → (b)

2 → (d)

3 → (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 × (−17)?

0 × any number = 0

Answer: 0

---

3. What is the sign of (+) × (−)?

Positive × Negative = Negative

Answer: Negative

---

4. What is (−1) × 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

+ × + Positive

− × − Positive

+ × − Negative

Signs Product

− × + Negative

Examples:

4 × 5 = 20

(−4) × (−5) = 20

4 × (−5) = −20

(−4) × 5 = −20

---

3. Write the missing-factor meaning of a ÷ b.

a ÷ b means:

"What number multiplied by b gives a?"

Example:

20 ÷ 5 = 4

because

5 × 4 = 20

---

4. Check whether

5 × (4 + (−7)) = 5 × 4 + 5 × (−7)

LHS:

5 × (4 − 7)

= 5 × (−3)

= −15

RHS:

5 × 4 + 5 × (−7)

= 20 − 35

= −15

LHS = 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 × 4 = 12

3 × 3 = 9

3 × 2 = 6

3 × 1 = 3

3 × 0 = 0

3 × (−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 × Fortune = Fortune (+ × + = +)
2. Debt × Debt = Fortune (− × − = +)
3. Fortune × Debt = Debt (+ × − = −)
4. Debt × Fortune = Debt (− × + = −)

Example 1

$(-5) \times (-3)$

$= +15$

Debt × Debt = Fortune

Example 2

$6 \times (-4)$

$= -24$

Fortune × Debt = Debt

Competency-Based Questions

A. Assertion–Reason

1.

Assertion:

$(-6) \times (-4) = +24$ True

Reason:

Product of two negatives is positive True

Reason correctly explains assertion.

Answer: (a)

2.

Assertion:

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

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

∴ 90 = 2 × 3 × 3 × 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

∴ 105 = 3 × 5 × 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

∴ 132 = 2 × 2 × 3 × 11
Hence, factors of 132 are 1, 2, 3, 4, 6, 11, 12, 22, 33, 44, 66, 132.
Total factors = 12

(d) 360
Here

2	360
2	180
2	90
3	45
3	15
5	5
	1

∴ 360 = 2 × 2 × 2 × 3 × 3 × 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

2	840
2	420
2	210
3	105
5	35
7	7
	1

∴ 840 = 2 × 2 × 2 × 3 × 5 × 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

2	50
5	25
	5

$\therefore 50 = \boxed{2} \times 5 \times \boxed{5}$

and 60

2	60
2	30
3	15
5	5
	1

$\therefore 60 = \boxed{2} \times 2 \times 3 \times \boxed{5}$

$\therefore$ Common factors of 50 and 60 are 2, 5, and HCF (50, 60) = $2 \times 5 = 10$.

(b) Here 140 and 275

2	140
2	70
5	35
7	7
	1

5	275
5	55
11	11
	1

$\therefore 140 = 2 \times 2 \times 5 \times 7$ 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
11	11
	1

and

5	725
5	145
29	29
	1

$\therefore 77 = 7 \times 11$ 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
5	185
37	37
	1

and

2	592
2	296
2	148
2	74
37	37
	1

∴ 370 = 2 × 5 × 37 and 592 = 2 × 2 × 2 × 2 × 37
∴ Common factors = 1, 2, 37, and HCF (370, 592) = 2 × 37 = 74

(e) Here 81 and 243

3	81
3	27
3	9
3	3
	1

and

3	243
3	81
3	27
3	9
3	3
	1

∴ 81 = 3 × 3 × 3 × 3 and 243 = 3 × 3 × 3 × 3 × 3
∴ Common factors = 3 × 3 × 3 × 3 and HCF (81, 243) = 3 × 3 × 3 × 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

Now 24 = 2 × 2 × 2 × 3
and 180 = 2 × 2 × 3 × 3 × 5

Clearly, the common prime factors are 2 and 3.
∴ HCF (24, 180) = 2 × 2 × 3 = 4 × 3 = 12

(b) Given 42, 75, 24
Now

42 = 2 × 7 × 3
75 = 5 × 5 × 3
24 = 2 × 2 × 3 × 2

Clearly only common prime factor is 3.
∴ HCF (42, 75, 24) = 3.

(c) Here 240 and 378

2	240
2	120
2	60
2	30
3	15
5	5
	1

2	378
3	189
3	63
3	21
7	7
	1

$\therefore \quad 240 = 2 \times 2 \times 2 \times 2 \times 3 \times 5$

and $\quad 378 = 2 \times 3 \times 3 \times 3 \times 7$

Hence, HCF(240, 378) = 2 × 3 = 6

(d) Here 400 and 2500

2	400
2	200
2	100
2	50
5	25
5	5
	1

2	2500
2	1250
5	625
5	125
5	25
5	5
	1

$\therefore \quad 400 = 2 \times 2 \times 2 \times 2 \times 5 \times 5$

and $\quad 2500 = 2 \times 2 \times 5 \times 5 \times 5 \times 5$

∴ HCF(400, 2500) = 2 × 2 × 5 × 5 = 100.

(e) Here 300 and 800

2	300
2	150
3	75
5	25
5	5
	1

and

2	800
2	400
2	200
2	100
2	50
5	25
5	5
	1

$\therefore \quad 300 = 2 \times 2 \times 3 \times 5 \times 5$

$\quad 800 = 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5$

∴ HCF(300, 800) = 2 × 2 × 5 × 5 = 100.

Question 4.
Consider the numbers 72 and 144. Suppose they are factorised into composite numbers as: 72 = 6 × 12 and 144 = 8 × 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 × 12
144 = 8 × 18
These are not prime factorisations.
Both 6 and 12 are composite numbers, as are 8 and 18.
Prime factorisation of 72 = 2 × 2 × 2 × 3 × 3
Prime factorisation of 144 = 2 × 2 × 2 × 2 × 3 × 3
∴ HCF(72, 144) = 2 × 2 × 2 × 3 × 3 = 8 × 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.

$$7 = 7$$

$$10 = 2 \times 5$$

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?

$$14 = 2 \times 7$$

$$35 = 5 \times 7$$

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
Here 30 = 2 × 3 × 5
(One occurrence of 2, one occurrence of 3, and one occurrence of 5)
and $72 = 2 \times 2 \times 2 \times 3 \times 3$
(Three occurrences of 2s and two occurrences of 3s)
∴ LCM (30, 72) = 2 × 2 × 2 × 3 × 3 × 5
(Three occurrences of 2s and two occurrences of 3s, and one occurrence of 5)
= 8 × 9 × 5
= 360

(b) 36, 54
Here 36 = 2 × 2 × 3 × 3
(Two occurrences of 2s and two occurrences of 3s)
and 54 = 2 × 3 × 3 × 3
(One occurrence of 2, and three occurrences of 3s)
∴ LCM(36, 54) = 2 × 2 × 3 × 3 × 3 = 4 × 27 = 108
(One occurrence of 2, and three occurrences of 3s)
∴ LCM(36, 54) = 2 × 2 × 3 × 3 × 3 = 4 × 27 = 108

(c) 105, 195, 65
Here 105, 195, and 65
Now 105 = 3 × 5 × 7
195 = 3 × 5 × 13
65 = 5 × 13
∴ LCM(105, 195, 65) = 3 × 5 × 7 × 13 = 1365

(d) 222, 370
Here 222, 370

2	222
3	111
37	37
	1

2	370
5	185
37	37
	1

222 = 2 × 3 × 37 and 370 = 2 × 5 × 37
∴ LCM(222, 370) = 2 × 3 × 5 × 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 7$k$is a number, what could be the other number?

The other number may be **7**.

Since 7divides 7k, the HCF can be 7.

Answer: 7

---

2. What happens to the HCF if both numbers are doubled?

Example:

HCF(12, 18) = 6

Doubling both numbers:

24 and 36

HCF(24, 36) = 12

$$12 = 2 \times 6$$

Another example:

HCF(15, 25) = 5

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)
HCF (2, 4) = 2
(ii) (6, 8)
HCF (6, 8) = 2
(iii) (10, 12)
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)
HCF (3, 5) = 1
(ii) (7, 9)
HCF (7, 9) = 1
(iii) (11, 13)
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)

HCF (4, 10) = 2
(ii) (8, 12)
HCF (8, 12) = 4
(iii) (14, 20)
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)
HCF (7, 8) = 1
(ii) (14, 15)
HCF (14, 15) = 1
(iii) (20, 21)
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)
HCF (4, 9) = 1
(ii) (5, 8)
HCF (5, 8) = 1
(iii) (7, 10)
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
LCM (2, 4) = 2 × 2 = 4

(ii) LCM of 5 and 10: The LCM is 10.
Prime factorization of 5: 5
Prime factorization of 10: 2 × 5
LCM (5, 10) = 2 × 5 = 10

(iii) LCM of 6 and 12: The LCM is 12.
Prime factorization of 6: 2 × 3
Prime factorization of 12: 2 × 2 × 3
LCM (6, 12) = 2 × 2 × 3 = 12

(iv) LCM of 7 and 49: The LCM is 49.
Prime factorization of 7: 7
Prime factorization of 49: 7 × 7
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 × 2 × 5 × 5
LCM (10, 100) = 2 × 2 × 5 × 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 ÷ 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: LCM(a, b) = b if and only if b = k × 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)
LCM (6, 9) = 18
(ii) (9, 12)
LCM (9, 12) = 36
(iii) (12, 18)
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)
LCM (2, 4) = 4
(ii) (6, 8)
LCM (6, 8) = 24
(iii) (10, 12)
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.
or LCM (2n, 2n + 2) =

+ 2n

(c) Two Consecutive Numbers
Examples:
(i) (7, 8)

LCM (7, 8) = 56
(ii) (9, 10)
LCM (9, 10) = 90
(iii) (10, 11)
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)
LCM (4, 9) = 36
(ii) (5, 8)
LCM (5, 8) = 40
(iii) (7, 10)
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) $10 \times 38, 10 \times 21$

$\text{HCF} = 10 \times \text{HCF}(38,21)$

$= 10 \times 1$

= **10**

(c) $5 \times 13,\ 5 \times 20$

HCF = $5 \times \text{HCF}(13,20)$

= 5×1

= **5**

(d) $12 \times 16,\ 12 \times 20$

HCF = $12 \times \text{HCF}(16,20)$

= 12×4

= **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) HCF = $90 \neq 18$ ❌
- (b) HCF = 10 = 10 ✅
- (c) HCF = 5 = 5 ✅
- (d) 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,

HCF = $12 \times \text{HCF}(7,15)$

$= 12 \times 1$

$=$ **12**

Answer: 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 HCF ≥ 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

$$45 = 3^2 \times 5$$
$$105 = 3 \times 5 \times 7$$

LCM = $3^2 \times 5 \times 7 = 315$

Product = $45 \times 105 = 4725$

$$4725 \div 315 = 15$$

So LCM is a factor.

Multiplier = 15

(b) 275, 352

$$275 = 5^2 \times 11$$
$$352 = 2^5 \times 11$$

LCM = $2^5 \times 5^2 \times 11 = 8800$

Product = $275 \times 352 = 96800$

$$96800 \div 8800 = 11$$

Multiplier = 11

(c) 222, 370

$$222 = 2 \times 3 \times 37$$

$$370 = 2 \times 5 \times 37$$

LCM = 1110

Product = $222 \times 370 = 82140$

$$82140 \div 1110 = 74$$

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

HCF = 2

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 $a = 5 \times 7 \times 11 \times 11$
$6 = 5 \times 7 \times 7 \times 11 \times 2$
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 $12 \times 7 \times 11 = 2 \times 2 \times 3 \times 7 \times 11$
$\therefore$ HCF $= 3 \times 7 = 21$
$\therefore$ LCM $= 2 \times 2 \times 3 \times 3 \times 5 \times 7 \times 7 \times 11$.

(b) Here $45 = 3 \times 3 \times 5$
$36 = 2 \times 2 \times 3 \times 3$
HCF $(45, 36) = 3 \times 3$
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 HCF = 1, LCM = 66

⇒ a × b = 1 × 66 = 66
∴ 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.
LCM (3, 5, 7) = 3 × 5 × 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 × 2 × 3, 18 = 2 × 3 × 3, and 36 = 2 × 2 × 3 × 3
Common factors = 2 × 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 ✗ (9 doesn't divide 12 evenly)
(b) 6 cm ✓ (divides 12, 18, and 36 exactly)
(c) 4 cm ✗ (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) = HCF (306, 36)

Now

2	306
3	153
3	51
17	17
	1

$\therefore 306 = \boxed{2} \times \boxed{3 \times 3} \times 17$
$36 = \boxed{2} \times 2 \times \boxed{3 \times 3}$

HCF (306, 36) = 2 × 3 × 3 = 18.
∴ (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:
LCM(3, 4, 5,7) = 3 × 4 × 5 × 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 × 1 = 420
When divided by 11 leaves a remainder of 2
11 × 38 + 2 = 420
But we require 10 as a remainder
∴ 2k = 10
⇒ k = 5
Hence number = 420 × 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 ⇒ the total number N is divisible by 6.
"No one got out" when 9 was called ⇒ N is divisible by 9.
"Some people got out" when 10 was called ⇒ N is not divisible by 10.
If N is divisible by both 6 and 9, then it must be divisible by their LCM:
LCM (6, 9) = 18.
So N is a multiple of 18, but not a multiple of 10.
Now check the options:
(a) 72 = 18 × 4 – divisible by 18 and not by 10 → possible.
(b) 90 = 18 × 5 – divisible by 18 but is divisible by 10 → not possible.
(c) 45 – not divisible by 18 → not possible.
(d) 3 – not divisible by 18 → not possible.
(e) 36 = 18 × 2 – divisible by 18 and not by 10 → 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 × n
(e) Greater than m × n
Solution:
LCM of two different prime numbers, m and n, is their product of m × 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.

$$LCM = 2^3 \times 3^2 \times 5 \times 7$$
$$= 8 \times 9 \times 5 \times 7$$
$$= 2520$$

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**

$$\frac{8}{15} = \frac{672}{1260}$$
$$\frac{1}{20} = \frac{63}{1260}$$
$$\frac{7}{36} = \frac{245}{1260}$$
$$\frac{11}{63} = \frac{220}{1260}$$
$$\frac{1}{21} = \frac{60}{1260}$$

Adding:

$$\frac{672 + 63 + 245 + 220 + 60}{1260} = \frac{1260}{1260} = 1$$

Answer: $\boxed{1}$

Practice Time 3.1

1.

80 rose plants and 100 jasmine plants.

HCF(80,100) = 20

Answer: 20 plants in each row.

2.

54 apples and 81 oranges

HCF(54,81)=27

Answer: 27 fruits per basket.

3.

96 m and 120 m ropes

HCF(96,120)=24

Answer: 24 m

4.

72 boys and 90 girls

HCF(72,90)=18

Answer: 18 students per row.

5.

108 red balloons and 180 blue balloons

HCF(108,180)=36

Answer: 36 balloons per packet.

Practice Time 3.2

1.

$36 = 2^2 \times 3^2$

$48 = 2^4 \times 3$

HCF = $2^2 \times 3 = 12$

Answer: 12

2.

$54 = 2 \times 3^3$

$90 = 2 \times 3^2 \times 5$

HCF = $2 \times 3^2 = 18$

Answer: 18

3.

$32 = 2^5$

$56 = 2^3 \times 7$

HCF = $2^3 = 8$

Common factors = 1, 2, 4, 8

4.

$84 = 2^2 \times 3 \times 7$

$126 = 2 \times 3^2 \times 7$

$210 = 2 \times 3 \times 5 \times 7$

HCF = $2 \times 3 \times 7 = 42$

5.

$50 = 2 \times 5^2$

$75 = 3 \times 5^2$

HCF = 25

Common factors = 1, 5, 25

6.

$96 = 2^5 \times 3$

$144 = 2^4 \times 3^2$

HCF = $2^4 \times 3 = 48$

Answer: 48

Practice Time 3.3

1.

LCM(4,9)

$$4 = 2^2,\ 9 = 3^2$$

LCM = $2^2 \times 3^2 = 36$

2.

LCM(8,12)

$$8 = 2^3,\ 12 = 2^2 \times 3$$

LCM = $2^3 \times 3 = 24$

3.

LCM(10,15)

$$10 = 2 \times 5,\ 15 = 3 \times 5$$

LCM = $2 \times 3 \times 5 = 30$

4.

LCM(16,20)

$$16 = 2^4,\ 20 = 2^2 \times 5$$

LCM = $2^4 \times 5 = 80$

5.

LCM(6,9,12)

$$6 = 2 \times 3$$

$$9 = 3^2$$

$$12 = 2^2 \times 3$$

LCM = $2^2 \times 3^2 = 36$

Practice Time 3.4

1.

HCF(8,32)=8

Yes, HCF is one of the numbers.

2.

HCF(11,55)=11

Because 55 = 11 × 5.

3.

HCF(9,81)=9

Yes, 9 is a factor of 81.

4.

HCF(16,64)=16

Relation:

64 = 4 × 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 × 5 = 160

48 × 5 = 240

New HCF = Old HCF × 5

= 16 × 5

= **80**

---

2. Find the HCF of 21 and 35. Then find the HCF of 214 × 21 and 354 × 35.

HCF(21,35) = 7

HCF(214×21, 354×35)

= 7 × HCF(214×3, 354×5)

= 7 × HCF(642,1770)

= 7 × 6

= **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 × 7

= **63**

---

4. Two numbers are mn and 8n where m is a natural number.

(a) What is their HCF?

HCF = n × HCF(m,8)

Answer: $n \times \text{HCF}(m, 8)$

(b) If n = 11, write the pair and their HCF.

Numbers:

11m and 88

HCF = 11 × HCF(m,8)

For example, if m = 4:

Numbers = 44 and 88

HCF = 44

---

5. The numbers m × 12 and n × 18 have HCF 6n.

Verify for m = 4.

Numbers:

48 and 18n

Taking n = 2:

48 and 36

HCF = 12 = 6 × 2

Verified.

Exam Time

A. Multiple Choice Questions

1.

HCF(72,120)

= 24

Answer: (c) 24

2.

LCM(8,12)

= 24

Answer: (b) 24

3.

HCF(36,84)

$36 = 2^2 \times 3^2$

$84 = 2^2 \times 3 \times 7$

HCF = 12

Answer: (b) 12

4.

HCF(24,40) = 8

HCF(3×24,3×40)

= 3 × 8

= 24

Answer: (c) 24

B. Fill in the Blanks

1. HCF(48,60) = **12**
2. LCM(10,15) = **30**
3. HCF(25,35)=5 and LCM(25,35)= **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. HCF × 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

$54 = 2 \times 3^3$

$90 = 2 \times 3^2 \times 5$

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)

HCF = 24

LCM = 360

---

4. Show that if numbers are n and 5n, HCF is n.

n is common to both.

HCF(n,5n)

$= n \times \text{HCF}(1,5)$

$= n$

Hence proved.

---

5. Verify HCF × LCM = Product

Numbers = 28 and 42

HCF = 14

LCM = 84

14 × 84 = 1176

28 × 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

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.

HCF = 9

LCM = 180

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

Fraction	Decimal
457/100	4.57
71/100	0.71
43/100	0.43
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 × 248 = 147808, find 5.96 × 24.8

$$5.96 = \frac{596}{100}$$
$$24.8 = \frac{248}{10}$$
$$5.96 \times 24.8 = \frac{596 \times 248}{1000}$$
$$= \frac{147808}{1000}$$
$$= 147.808$$

Answer: $\boxed{147.808}$

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 × 0.3 = 7 × 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) Here, $27.34 \times 6 = \frac{2734}{100} \times 6 = \frac{16404}{100}$

$= 164.04$

(2 decimals)

(b) Here $4.23 \times 3.7 = \frac{423 \times 37}{100 \times 10}$

(2 decimals) (1 decimal)

$= \frac{15651}{1000} = 15.651$ (3 decimals)

(c) 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 × 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

∴ Cost of 4 notebooks = 4 × 15.50

= 4×1550100

= 6200100

= ₹ 62

and cost of 1 eraser = ₹ 2.75

∴ Cost of 3 erasers = 3 × ₹ 2.75

= 3×275100

= 825100

= ₹ 8.25

∴ 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:

Thickness of 1 coin = 1.45 mm

Total thickness of 36 coins = 36 × 1.45

= 36×145100

= 5220100

= 52.2 mm

Now 10 mm = 1 cm

1 mm = 110 cm

∴ 52.2 mm = 52.210 = 5.22 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

= 5650×2250100×1000

= 12712500100000

= ₹ 127.125

Now 56.5 × 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 × No. of notebooks

= 6.4 × 50

= ₹ 320

Question 7.

Given that 18 × 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:

	×10	×100	×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.

$\frac{18\times2}{5\times2} = \frac{36}{10}$ = 3.6

Verification

18 ÷ 5

Dividing 1 ten and 8 ones into 5 equal parts.

1 < 5

It means we need to regroup 1 ten as 10 ones,

i.e., 10 + 8 = 18 ones

18 ones ÷ 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 Tenths ÷ 5 = 6

Then, 18 ÷ 5 = 3.6

```
          T O Tenths
5 ) 18 ( 0 3 . 6
   -15
    30
   -30
     0
```

(b)

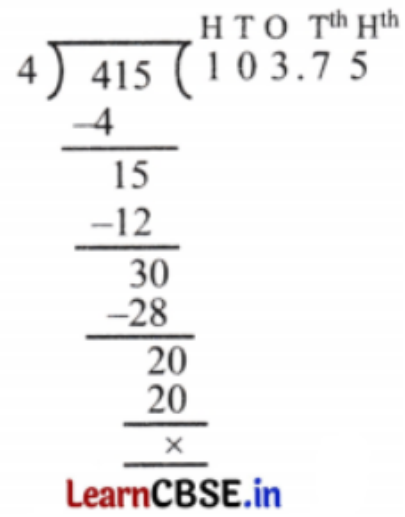
(b) Given $\frac{415}{4}$

To convert the denominator 4 into 100, multiply both the Nr and Dr by 25.

$\frac{415\times25}{4\times25} = \frac{10375}{100}$ = 103.75

Verification

By following the steps



∴ 414 ÷ 4 = 103.75

Hence verified.

(c)

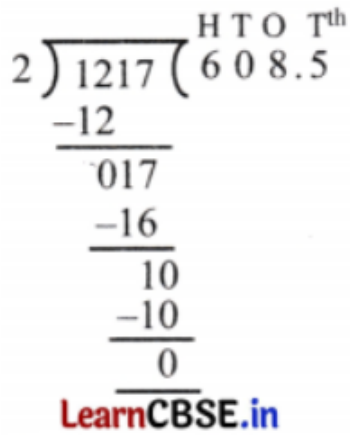
(c) Given $\frac{1217}{2}$

To convert the denominator 2 into 10, multiply both the Nr and Dr by 5.

$\frac{1217\times5}{2\times5} = \frac{6085}{10}$ = 608.5

Verification

By following the steps:



∴ 1217 ÷ 2 = 608.5

Hence verified.

(d)

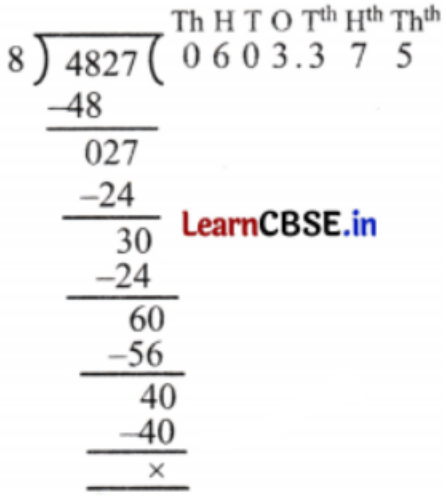
(d) Given $\frac{4827}{8}$

To convert the denominator 8 into 1000, multiply both the Nr and Dr by 12

$\frac{4827\times125}{8\times125} = \frac{603375}{1000}$ = 603.375

Verification

By following the steps:



We get 4827 ÷ 8 = 0603.375

Hence verified.

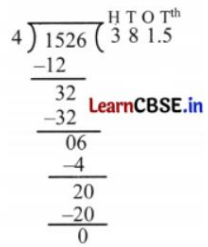
Question 12.

Choose the correct answer:

Solution:

(a) $\frac{1526}{4}$

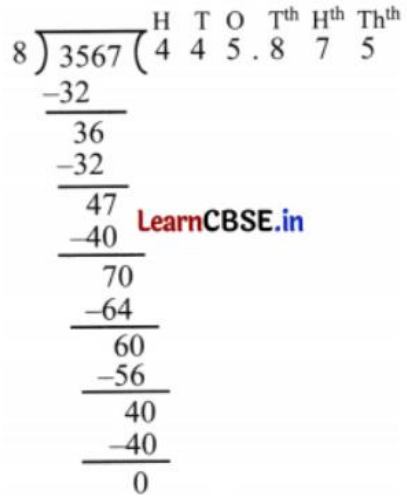
By using the Long Division Method:



Hence, option (iii) is correct.

(b) Given $\frac{3567}{8}$

By using the Long Division Method:



Hence, option (iii) is correct.

Question 3.

What is the quotient?

(a) 132 ÷ 4 = _____

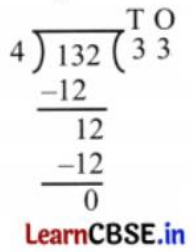
(b) 13.2 ÷ 4 = _____

(c) 1.32 ÷ 4 = _____

(d) 0.132 ÷ 4 = _____

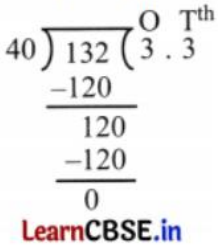
Solution:

(a) $\frac{132}{4}$



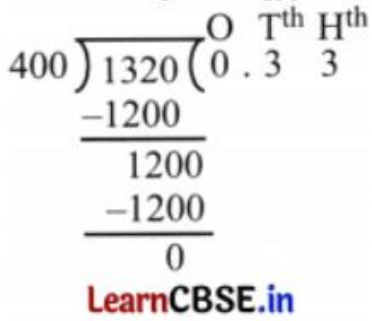
∴ Quotient = 33

(b) $\frac{13.2}{4} = \frac{132}{40}$



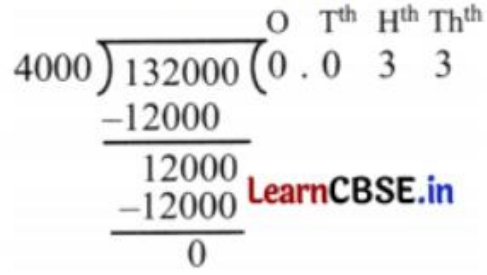
∴ Quotient = 3.3

(c) Here $\frac{1.32}{4} = \frac{132}{400}$



∴ Quotient = 0.33

(d) Here $\frac{0.132}{4} = \frac{132}{4000}$



∴ Quotient = 0.033

Question 4.

What is the quotient?

(a) 126 ÷ 8 = _____

(b) 12.6 ÷ 8 = _____

(c) 1.26 ÷ 8 = _____

(d) 0.126 ÷ 8 = _____

(e) 0.0126 ÷ 8 = _____

Solution:

(a) $\frac{126}{8}$

T O T^{th} H^{th}

8) 126 (1 5 . 7 5

−8

46

−40

60

−56

40

−40

0

Hence quotient = 15.75

(b) $\frac{12.6}{8}$

T O T^{th} H^{th}

8) 12.6 (1.5 7 5

−8

46

−40

60

−56

40

−40

0

Hence quotient = 1.575

(c) Here 1.26 ÷ 8

O T^{th} H^{th} Th^{th} TTh^{th}

8) 1.26 (0.1 5 7 5

−0

12

−8

46

−40

60

−56

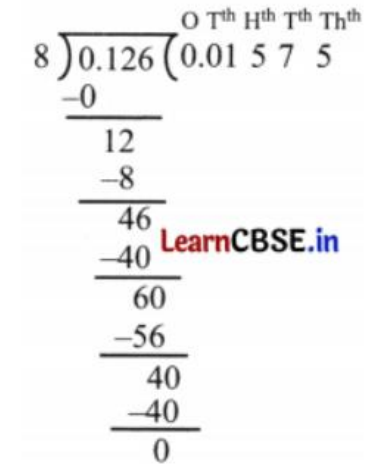
40

40

0

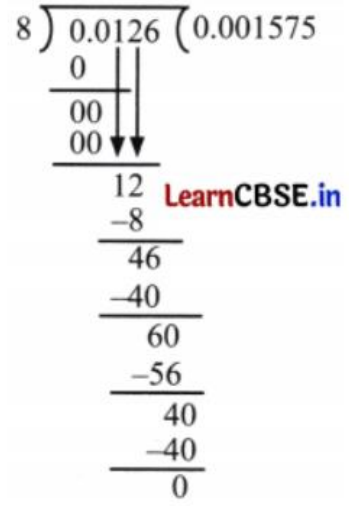
Hence quotient = 0.1575

(d) Here 0.126 ÷ 8



Hence quotient = 0.01575

(e) Here 0.0126 ÷ 8



Hence quotient = 0.001575

INTEXT QUESTIONS

1. To find one such number, you can find 1 ÷ 17 in decimal and use the repeating block of digits.

$$1 \div 17 = 0.0588235294117647 \ldots$$

The repeating block is:

$$0588235294117647$$

One such number is:

$$\boxed{0.0588235294117647}$$

---

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 ÷ 1.2

(b) 5.728 ÷ 1.52

Solution:

Solution:

(a) Here 24.86 ÷ 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

$$\begin{array}{r|l} 120 & 2486\ (20.7166 \\ & -240 \\ \hline & 860 \\ & -840 \\ \hline & 200 \\ & -120 \\ \hline & 800 \\ & -720 \\ \hline & 80 \end{array}$$

∴ Quotient = 20.7166...

(b) Converting division into a fraction, we get

$$5.728 \div 1.52 = \frac{5.728}{1.52} = \frac{5728 \times 100}{152 \times 1000}$$

$$= \frac{5728}{1520}. \text{ Now } \begin{array}{r|l} 1520 & 5728\ (3.76 \\ & -4560 \\ \hline & 11680 \\ & -10640 \\ \hline & 10400 \\ & -9120 \\ \hline & 1280 \end{array}$$

∴ Quotient = 3.76

Question 3.

Evaluate the following using the information 156 × 12 = 1872.

(a) 15.6 × 1.2 = _____

(b) 187.2 ÷ 1.2 = _____

(c) 18.72 ÷ 15.6 = _____

(d) 0.156 × 0.12 = _____

Solution:

Given 156 × 12 = 1872 .....(i)

$\Rightarrow 156 = \frac{1872}{12}$ .....(ii)

$\Rightarrow 12 = \frac{1872}{156}$ .....(iii)

(a) Now converting division into a fraction

$15.6 \times 1.2 = \frac{156 \times 12}{10 \times 10} = \frac{1872}{100} = 18.72$ [using (i)]

(b) Converting division into a fraction 187.2 ÷ 1.2

$187.2 \div 1.2 = \frac{187.2}{1.2} = \frac{1872}{12} = 156$ [using (ii)]

(c) Converting division into a fraction 18.72 ÷ 15.6, we get

$18.72 \div 15.6 = \frac{18.72}{15.6} = \frac{1872 \times 10}{156 \times 100} = \frac{12}{10} = 1.2$ [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 ÷ _____ = 0.025

(b) 25 ÷ _____ = 250

(c) 25 ÷ _____ = 2.5

(d) 25 ÷ 10 = 25 × _____

(e) 25 ÷ 0.10 = 25 × _____

(f) 25 ÷ 0.01 = 25 × _____

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) $25 \div x = 2.5$

$$\Rightarrow x = \frac{25}{2.5} = \frac{25 \times 10}{25} = 1 \times 10 = 10$$

(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 ÷ 1.5 = _____

(b) 2.46 ÷ 0.15 = _____

(c) 2.46 ÷ 0.015 = _____

Is the quotient obtained in 24.6 ÷ 1.5 the same as the quotient obtained in 2.46 ÷ 0.15?

Solution:

Solution:

Converting 2.46 ÷ 1.5 into fraction

$\frac{2.46}{1.5} = \frac{246 \times 10}{15 \times 100} = \frac{246}{150}$

$$\begin{array}{r|l} 150 & 246 \; (1.64 \\ & -150 \\ \hline & 960 \\ & -900 \\ \hline & 600 \\ & -600 \\ \hline & 0 \end{array}$$

∴ Quotient = 1.64

(b)

(b) Converting 2.46 ÷ 0.15 into a fraction, we get

$\frac{2.46}{0.15} = \frac{246 \times 100}{15 \times 100} = \frac{246}{15}$

$$\begin{array}{r|l} 15 & 246 \; (16.4 \\ & -15 \\ \hline & 96 \\ & -90 \\ \hline & 60 \\ & -60 \\ \hline & 0 \end{array}$$

∴ Quotient = 16.4

(c)

(c) Converting 2.46 ÷ 0.015 into a fraction, we get

$\frac{2.46}{0.015} = \frac{246 \times 1000}{15 \times 100} = \frac{2460}{15}$

$$\begin{array}{r} 15\overline{)2460}\,(164 \\ -15 \\ \hline 96 \\ -90 \\ \hline 60 \\ -60 \\ \hline 0 \end{array}$$

∴ Quotient = 164

Now $\frac{24.6}{1.5} = \frac{246 \times 10}{15 \times 10} = \frac{246}{15}$

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 ÷ 1.5 is the same as the quotient obtained in 2.46 ÷ 0.15.

Question 6.

A 4 m long wooden block has to be cut into 5pieces of equal length. What is the length of each piece?

Solution:

Here total length = 4 m

No. of pieces = 5

Length of each piece = $\frac{\text{Total length}}{\text{No. of pieces}}$

$= \frac{4}{5}$

= 0.8 m

Now

$$\begin{array}{r} 5\overline{)4}\,(0.8 \\ -0 \\ \hline 40 \\ -40 \\ \hline 0 \end{array}$$

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 0f a side = $\frac{\text{Perimeter}}{\text{No. of sides}}$

$= \frac{208.8}{12}$

= 17.4 cm

$$
\begin{array}{r}
17.4 \\
12\overline{)\,208.8} \\
-12 \\
\hline
88 \\
-84 \\
\hline
48 \\
-48 \\
\hline
0
\end{array}
$$

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

$\therefore$ Juice per friend = $\frac{3}{8}$ litre

$= \frac{3}{8} \times 1000$ ml

$= \frac{3000}{8}$

= 375 ml

$$
\begin{array}{r|l}
8 & 3000 \\
 & -24 \\
\hline
 & 60 \\
 & -56 \\
\hline
 & 40 \\
 & -40 \\
\hline
 & 0
\end{array}
\quad 375
$$

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

$$\text{Distance per litre} = \frac{\text{Total distance}}{\text{Total petrol}}$$

$$= \frac{234.45}{12.6}$$

$$= \frac{23445 \times 10}{126 \times 100}$$

$$= \frac{23445}{1260} = 18.607 \text{ km}$$

Now

$$\begin{array}{r} 1260\overline{)\,23445\,(18.607} \\ -1260 \\ \hline 10845 \\ -10080 \\ \hline 7650 \\ -7560 \\ \hline 9000 \\ -8820 \\ \hline 180 \end{array}$$

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

$$\begin{array}{r} 15\overline{)\,13.5\,(.9} \\ -13.5 \\ \hline 0 \end{array}$$

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?

$$\boxed{\text{February}}$$

---

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?

$$100 \div 4 = 25$$
$$\boxed{25}$$

---

5. Days in 100 calendar years with leap-year adjustment

$$36500 + 25$$
$$= \boxed{36525}$$

---

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.

$\therefore$ Cost per gram = $\frac{\mathbf{70.5}}{\mathbf{210}}$ = 0.3357

and cost of potato chips is ₹ 33.25 for 110 grams.

$\therefore$ Cost per gram = $\frac{\mathbf{33.25}}{\mathbf{110}}$ = 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 × 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 × 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?

Another Peek Beyond the Point Class 7 Solutions Maths Ganita Prakash Part 2 Chapter 4 Page 93 Q3

Solution:

Given that Shyamala bought 3 kg of bananas at ₹ 30 per kg.

Total cost = 3 × 30 = ₹ 90

She sold 35 bananas for ₹ 5 each.

Total revenue = 35 × 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 × 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 = $\frac{\mathbf{160\ cm}}{\mathbf{2.5\ cm}}$ = 64
64 books could be placed on the shelf.
The total thickness of these books = 64 × 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
∴ 5.5 km = 5.5 × 1000 = 5500 m

(ii) 1 m = 100 cm
∴ 35 cm = $\frac{\mathbf{35}}{\mathbf{100}}$ = 0.35 m

(iii) 1 cm = 10 mm
∴ 14.5 cm = 14.5 × 10 = 145 mm

(iv) 1 kg = 1000 g
∴ 68 g = $\frac{\mathbf{68}}{\mathbf{1000}}$ = 0068 kg

(v) 1 m = 1000 mm
∴ 9.02 m = 9.02 × 1000 = 9020 mm

(vi) 1 l = 1000 ml

∴ 125.5 ml = $\frac{125.5}{1000}$ = 0.1255 l

5.5 km = 5500 m	35 cm = 0.35 m	14.5 cm = 145 mm
68 g = 0.068 kg	9.02 m = 9020 mm	125.5 ml = 0.1255l

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:

Given $6\frac{1}{4} = 6 + \frac{1}{4} = 6 + 0.25 = 6.25$

and $2\frac{1}{2} = 2 + \frac{1}{2} = 2 + 0.5 = 2.5$

$60\frac{1}{4} = 60 + \frac{1}{4} = 60 + 0.25 = 60.25$

$3\frac{1}{2} = 3 + 0.5 = 3.5$

Now $6\frac{1}{4}$ is divided by $2\frac{1}{2}$.

$\Rightarrow \quad \frac{6.25}{2.5} = \frac{625 \times 10}{25 \times 100} = \frac{625}{250}$

$$\begin{array}{r} 250\overline{)\,625\,(2.5} \\ -500 \\ \hline 1250 \\ -1250 \\ \hline 0 \end{array}$$

$\therefore$ Quotient = 2.5

Also $60\frac{1}{4}$ is divided by $3\frac{1}{2}$.

$$\Rightarrow \frac{60.25}{3.5} = \frac{6025 \times 10}{35 \times 100} = \frac{6025}{350}$$

$$\begin{array}{r} \therefore\ 350\overline{)\,6025\,(17.21} \\ -350 \\ \hline 2525 \\ -2450 \\ \hline 750 \\ -700 \\ \hline 500 \\ -350 \\ \hline 150 \end{array}$$

∴ Quotient = 17.21

Question 7.

Fill the boxes in at least 2 different ways:

Solution:

(a) Here 1.2 × 2 = 2.4 and 0.4 × 6 = 2.4

(b) Here 2.9 × 5 = 14.5 and 14.5 × 1 = 14.5

Question 8.

Find the following quotients given that 756 ÷ 36 = 21:

(a) 75.6 ÷ 3.6

(b) 7.56 ÷ 0.36

(c) 756 ÷ 0.36

(d) 75.6 ÷ 360

(e) 7560 ÷ 3.6

(f) 7.56 ÷ 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)]

$= \frac{21}{100} = 0.21$

(e) Here $\frac{7560}{3.6} = \frac{7560}{36} \times 10 = \frac{756}{36} \times 10 \times 10$

$= 21 \times 10 \times 10 = 2100$ [Using (i)]

(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 ÷ 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 b the number in the corresponding row 'b'.

Given 1517 ÷ 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

Question 10.

Solution:

(a) 42.0 × 8.5 = 357

(b) 45.8 × 0.2 = 9.16

(c) 85.4 × 2.0 = 170.8

(d) 20.5 × 4.8 = 98.4

(e) 45.8 × 0.2 = 9.16

Question 11.

Sort the following expressions in increasing order:

(a) 245.05 × 0.942368

(b) 245.05 × 7.9682

(c) 245.05 ÷ 7.9682

(d) 245.05 ÷ 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 $A \times B = 245.05 \times 0.942368 < 245.05$

(∴ 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) $A \div C = 2.4505 \div 7.9682 < 245.05$

(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

∴ 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.

∴ (c) < (a)

Again, 0.942368 is closer to 1 than 7.9682 is to 1.

∴ Dividing by 0.942368 will result in a value closer to 245.05 than multiplying by 7.9682.

∴ (d) < (b)

Also, (f) 7.9682 is significantly smaller than 245.05; it will be the smallest value.

(f) ∴ 7.9682 < (e) 245.05 ÷ 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

$$1.25 \times 9$$
$$= 11.25L$$

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

$$0.9 \div 7.2$$
$$= 0.125km$$

Answer = 0.125 km per litre

---

4. Rope Problem

Rope length

$$= 96m$$

Each piece

$$= 1.6m$$
$$96 \div 1.6$$
$$= \frac{960}{16}$$
$$= 60$$

Answer = 60 pieces

---

5. Find

(a)

$$63 \div 0.09$$
$$= \frac{6300}{9}$$

$$= 700$$

(b)

$$7.35 \div 0.15$$
$$= \frac{735}{15}$$
$$= 49$$

Practice Time 4.5

1.

True year

$$= 365.2422 \text{ days}$$

Calendar year

$$= 365 \text{ days}$$

(a)

$$365.2422 - 365$$
$$= 0.2422$$

Answer = 0.2422 days

(b)

Convert into hours

$$0.2422 \times 24$$
$$= 5.8128$$

Answer = 5.8128 hours

2.

Error in 1 year

$$= 0.2422 \text{ day}$$

For 50 years

$$50 \times 0.2422$$
$$= 12.11$$

Answer = 12.11 days

---

3. Every 4th year is a leap year

(a)

$$200 \div 4 = 50$$

Answer = 50 leap years

(b)

$$200 \times 365 + 50$$
$$= 73000 + 50$$
$$= 73050$$

Answer = 73,050 days

4.

(a)

Actual days in 200 years

$$200 \times 365.2422$$
$$= 73048.44$$

Answer = 73,048.44 days

(b)

Difference

$$73050 - 73048.44$$
$$= 1.56$$

Answer = 1.56 days

(Calendar is longer by 1.56 days.)

5.

(a)

Actual days in 100 years

$$100 \times 365.2422$$
$$= 36524.22$$

Answer = 36,524.22 days

(b)

Calendar days

$$= 36524$$

Difference

$$36524.22 - 36524$$
$$= 0.22$$

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	**Column B**
0.01	Hundredth place (c)
3.456	Thousands place (d)

Column A	Column B
9.6 ÷ 3	3.2 (e)
Year divisible by 4 but not by 100	Leap year (b)
365.2422 days	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

$$18.75 \times 6$$
$$= 112.50$$
$$\boxed{₹112.50}$$

---

3. 23.4 L milk into 8 bottles

$$23.4 \div 8$$
$$= 2.925$$
$$\boxed{2.925\ \text{L}}$$

---

4. Was 1900 a leap year?

1900 is divisible by 100 but not by 400.

Therefore,

$$\boxed{\text{1900 was not a leap year}}$$

---

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

$$400 \times 365.2422$$
$$= 146096.88$$

Answer = 146,096.88 days

(c) Error

$$146097 - 146096.88$$
$$= 0.12$$

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 ÷ 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

$$50 \times 0.2422 = 12.11$$

≈ 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

$$12.11 \text{ days}$$

Using 365.2:

Error per year

$$0.0422$$

50-year error

$$2.11 \text{ days}$$

Using 365.24:

Error per year

$$0.0022$$

50-year error

$$0.11 \text{ day}$$

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)

$$\text{Mean} = \frac{\text{Total number of bounces}}{\text{Number of attempts}}$$
$$= \frac{40}{8}$$
$$= 5$$

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

$$1555 + 1670 + 1750 + 2013 + 2040 + 2126$$
$$= 11154$$

Step 2: Number of years

$$n = 6$$

Step 3: Find the mean

$$\text{Mean} = \frac{\text{Sum of observations}}{\text{Number of observations}}$$
$$= \frac{11154}{6}$$
$$= 1859$$

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 ÷ 20 = **3.6**

Median

20 observations ⇒ Median = average of 10th and 11th terms

= (2 + 2) ÷ 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 ÷ 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 ≈ 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

$= (3.5+4.1+2.6+3.2+3.4+3.8) \div 6$

$= 20.6 \div 6$

= **3.43 kg**

Median

Ordered:

2.6, 3.2, 3.4, 3.5, 3.8, 4.1

Median

= (3.4+3.5) ÷ 2

= **3.45 kg**

Girls

4.0, 3.1, 3.4, 3.7, 2.5, 3.4

Mean

= 20.1 ÷ 6

= **3.35 kg**

Median

Ordered:

2.5, 3.1, 3.4, 3.4, 3.7, 4.0

Median

= (3.4+3.4) ÷ 2

= **3.4 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

Mean = 1199.2 ÷ 5

= **239.84 kg**

Mean weight of Ballet Dancers

(40.3 + 37.6 + 38.8 + 45.5 + 44.1 + 48.2)

= 254.5

Mean = 254.5 ÷ 6

= **42.42 kg**

Comparison

239.84 ÷ 42.42 ≈ 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

Sum = 5770

Mean = 5770 ÷ 17

= **339.4 seconds**

Median

17 observations

Median = 9th observation

= **320 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 ≈ 40,000

2023 ≈ 60,000

Increase = 20,000

Answer: Approximately 20,000 vehicles

(e) West Bengal

2022 ≈ 10,000

2024 ≈ 42,000

Increase factor

= 42,000 ÷ 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→6 = 6.0

6→7 = 5.5

7→8 = 4.9

8→9 = 4.5

9→10 = 4.5

10→11 = 4.4

11→12 = 5.2

12→13 = 6.2

13→14 = 6.0

14→15 = 4.6

15→16 = 3.3

16→17 = 2.3

17→18 = 1.4

18→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) ÷ 4

= 50 ÷ 4

= **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) ÷ 5

= 800 ÷ 5

= **160 cm**

Median = **160 cm**

Range = 170 − 150 = **20 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) ÷ 5

= 299 ÷ 5

= **59.8 sec**

Median = **60 sec**

Range = 64 − 55 = **9 sec**

---

3 Minute

Mean

= (170 + 175 + 180 + 185 + 190) ÷ 5

= 900 ÷ 5

= **180 sec**

Median = **180 sec**

Range = 190 − 170 = **20 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

$$21 + 24 + 23 + 22 + 25 + 24 + 49 = 188$$
$$\frac{188}{7} = 26.86$$

Answer = **26.86**

(b) Outlier

49 is much larger than the others.

Answer: 49

(c) Mean without outlier

$$21 + 24 + 23 + 22 + 25 + 24 = 139$$
$$\frac{139}{6} = 23.17$$

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) ÷ 4

= 570 ÷ 4

= **142.5 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 cm

B = 1 cm

C = 2 cm

Answer: (b) City B

3.

Girls' average

= (153 + 151 + 156) ÷ 3

= 460 ÷ 3

= 153.3 cm

Answer: (b) 153.3 cm

Maths Booster

1. Who is right?

Data:

140, 142, 144, 146, 200

Mean

= (140 + 142 + 144 + 146 + 200) ÷ 5

= 772 ÷ 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) ÷ 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 **△AOX** and **△AOY** should be congruent.

Reason:

- AX = AY (constructed with same radius)
- AO is common
- OX = OY

Therefore,

$$\triangle AOX \cong \triangle AOY$$

By congruence, ∠AOX = ∠AOY.

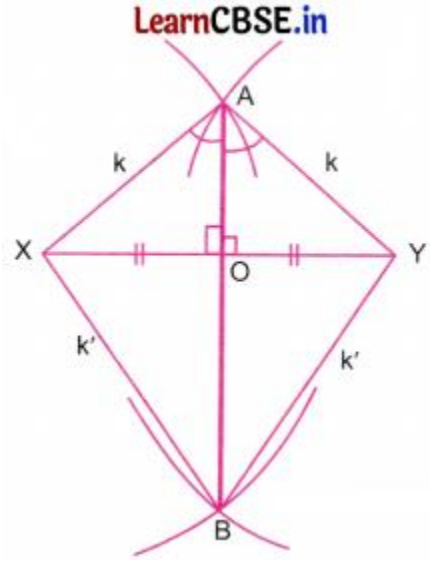
Since these two angles form a straight line, each angle = 90°.

Hence **AB ⊥ 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.



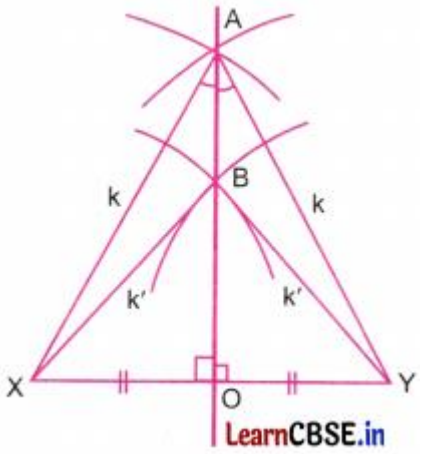
ΔABX and ΔABY are congruent because AX = AY = k, BX = BY = k', and AB is common.
∴ ∠XAO = ∠YAO
ΔAOX and ΔAOY are congruent because AX = AY = k, ∠XAO = ∠YAO, and OA is common.
∴ OX = OY and ∠AOX = ∠AOY

Also, ∠AOX + ∠AOY = 180°
∴ 2∠AOX = 180° or ∠AOX = 90°
∴ OX = OY and ∠AOX = ∠AOY = 90°.
∴ 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.

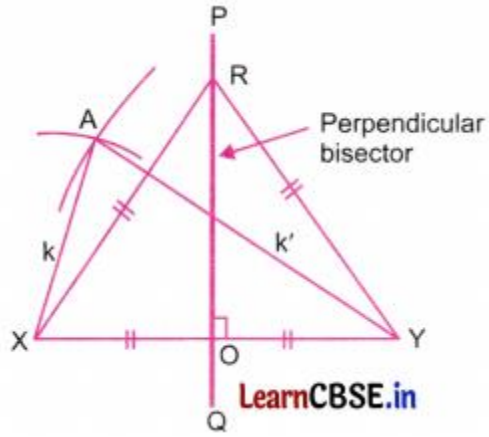
With centres at A and Y, draw arcs of radius 'k'' above XY.
Let the arcs intersect at the points A and B.
Join A and B and produce this line to intersect XY at O.
Join AX, AY, BX, and BY.



ΔABX and ΔABY are congruent because AX = AY = k, BX = BY = k', and AB is common.
∴ ∠XAO = ∠YAO
ΔAOX and ΔAOY are congruent because AX = AY = k, ∠XAO = ∠YAO, and OA is common.
∴ OX = OY and ∠AOX = ∠AOY
Also, ∠AOX + ∠AOY = 180°
∴ 2∠AOX = 180° or ∠AOX = 90°

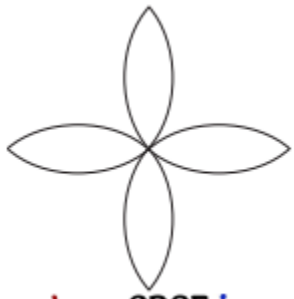
∴ OX = OY and ∠AOX = ∠AOY = 90°
∴ AB is the perpendicular bisector of the line XY.
Here, the pairs of arcs are both on the same side of XY.
∴ It is not necessary to construct the pairs of arcs above and below XY.

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.

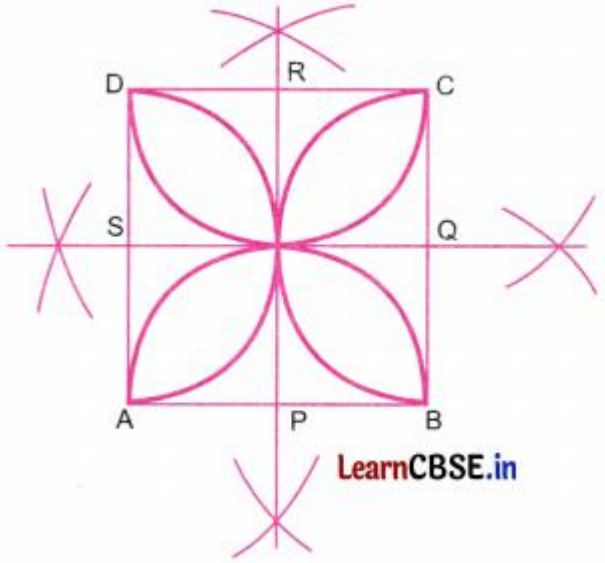


Let PQ be the perpendicular bisector of XY.
Let R be any point on PQ.
Join RX and RY.
ΔROX and ΔROY are congruent, because OX = OY, ∠ROX = ∠ROY, and OR is common.
∴ RX = RY
∴ For any point R on the perpendicular bisector, we have RX = RY.
∴ Every point on the perpendicular bisector is equidistant from X and Y.
Since AX ≠ 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-



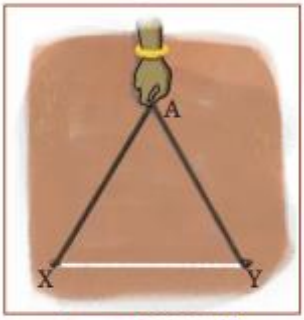
Solution:
Let ABCD be a square. We draw perpendicular bisectors of the sides AB and BC as shown in the figure.

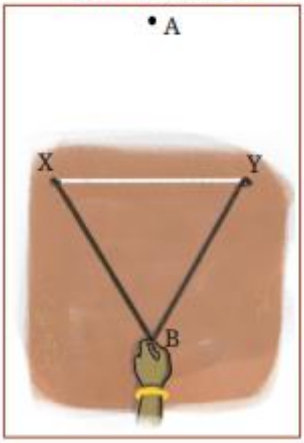


Let the perpendicular bisectors intersect the square at the points P, Q, R, and S. With centres at P, Q, R, and S, draw semicircles in the square with radius equal to AP.

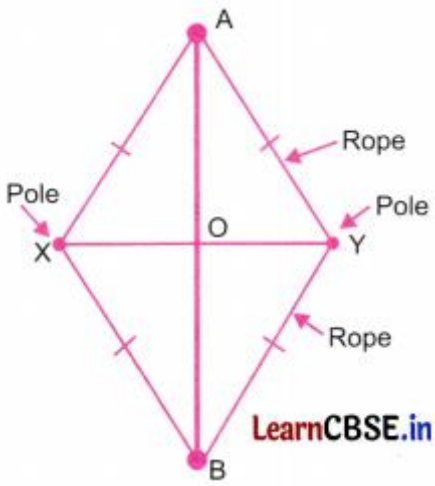
Colour the boundary of the design using a coloured pencil.
This will make the design stand out from the supporting lines and curve.

Question 5.
Justify why AB in the figure given below is the perpendicular bisector of the line XY.





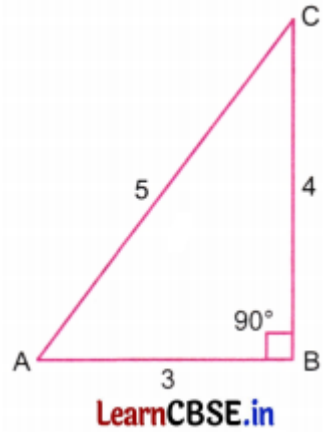
Solution:



In the above figure, XAY and XBY are two positions of the rope.
Points A and B are at the midpoint of the rope.
∴ We have AX = AY = BX = BY.

ΔAXB and ΔAYB are congruent, because AX = AY, BX = BY, and AB is common.
∴ ∠XAO = ∠YAO
ΔAXO and ΔAYO are congruent, because AX = AY, ∠XAO = ∠YAO, and AO is common.
∴ OX = OY and ∠XOA = ∠YOA.
Also, ∠XOA + ∠YOA = 180°
∴ 2∠XOA = 180° or ∠XOA = 90°
∴ OX = OY and ∠XOA = ∠YOA = 90°
∴ 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°.

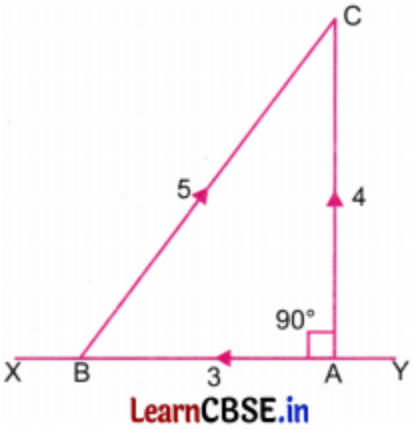


Construction:
Draw a line XY and take any point A on it.
We shall construct a 90° angle at point A, using a rope.

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 ΔABC, the sides are 3 units, 4 units, and 5 units.
The angle opposite to the longest side is ∠A.
∴ By the 3-4-5 principle, ∠A is equal to 90°.
∴ 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:

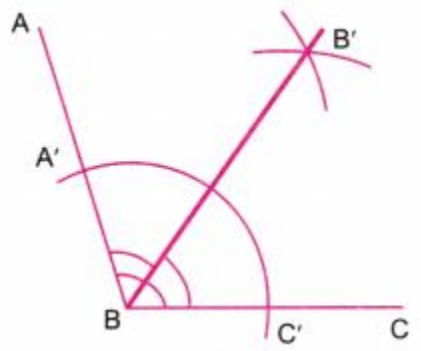
1. Construct a right angle (90°).
2. Draw its angle bisector.
3. The bisector divides 90° into two equal parts.

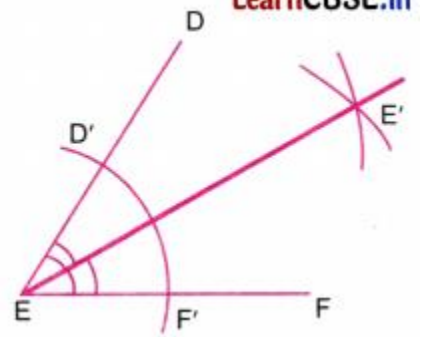
$$90^\circ \div 2 = 45^\circ$$

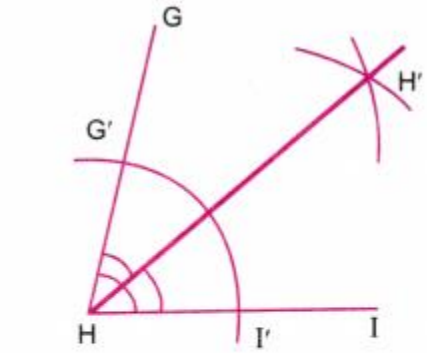
Therefore, the required angle is **45°**.

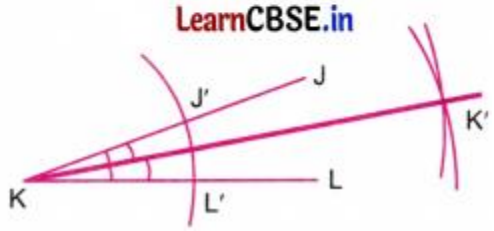
Figure It Out

Question 1.
Construct at least 4 different angles. Draw their bisectors.
Solution:
We draw 4 different angles, ∠ABC, ∠DEF, ∠GHI, and ∠JKL, as shown below:



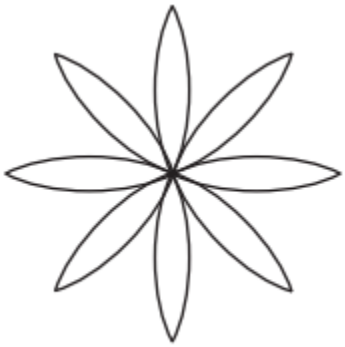




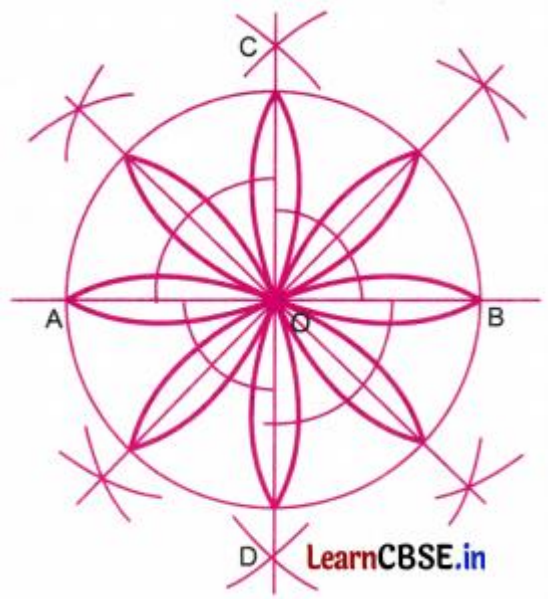


We shall draw the bisectors of the above angles.
With centres at B, E, H, and K, draw arcs intersecting the arms of the angles.
With centres at A', C', D', F', G', I', J', and L', draw arcs of the same radius so that the arcs intersect at points B', E', H', and K'.
Join BB', EE', HH', and KK'.
In the above figure:
BB' is the bisector of ∠ABC
EE' is the bisector of ∠DEF
HH' is the bisector of ∠GHI
KK' is the bisector of ∠JKL.

Question 2.
Construct the 8-petaled figure shown below.



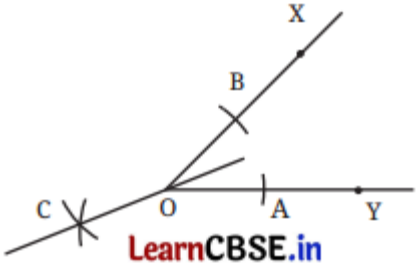
Solution:
Draw a line AB.
With centres at A and B, draw arcs of equal radius above and below the line AB.
Let the arcs intersect at the points C and D.
Join C and D.
Let AB and CD intersect at O.
Draw the bisectors of ∠BOC, ∠COA, ∠AOD, and ∠DOB as shown in the figure.



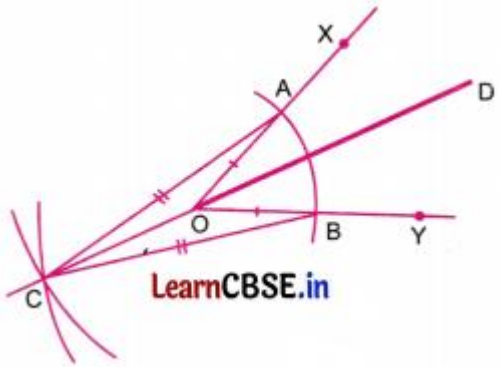
Draw a circle with centre at O and radius equal to the length of a petal in the given figure.
Draw dots at the points of intersection of the circle with the lines.
Using the dots and the centre of the circle, draw the petals as shown in the given figure.
In the next step, we erase the extra lines and 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 ∠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.

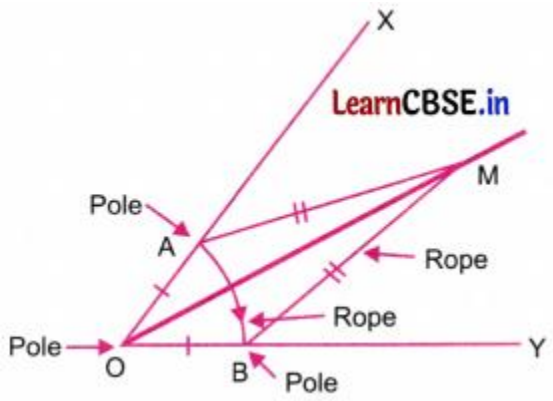


Join AC, BC, and OC. Extend CO to CD.
We have OA = OB and AC = BC.
In ΔOAC and ΔOBC, we have OA = OB, AC = BC, and OC is common.
∴ ΔOAC ≅ ΔOBC (Using SSS rule)
∴ ∠AOC = ∠BOC
∴ 180° – ∠AOC = 180° – ∠BOC

∴ ∠AOD = ∠BOD
∴ Line OD is the bisector of the angle ∠XOY.
∴ Line OC is the bisector of the angle ∠XOY.

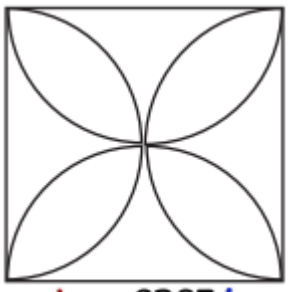
Question 4.
What are the other angles that can be constructed using angle bisection? Can you construct a 65.5° angle?
Solution:
By using the angle bisector method, we can bisect any given angle.
Using a ruler and compass, we know the method of making a 90° angle on a line.
We have = 45° and = 22.5°.
∴ By using an angle bisector, we can make angles of 45° and 22.5°.
Also, 90° + 45° = 135°, 90° + 22.5° = 112.5°, 45° + 22.5° = 67.5°.
∴ We can also construct angles 135°, 112.5°, and 67.5° using the angle bisector.
∴ 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 ∠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.

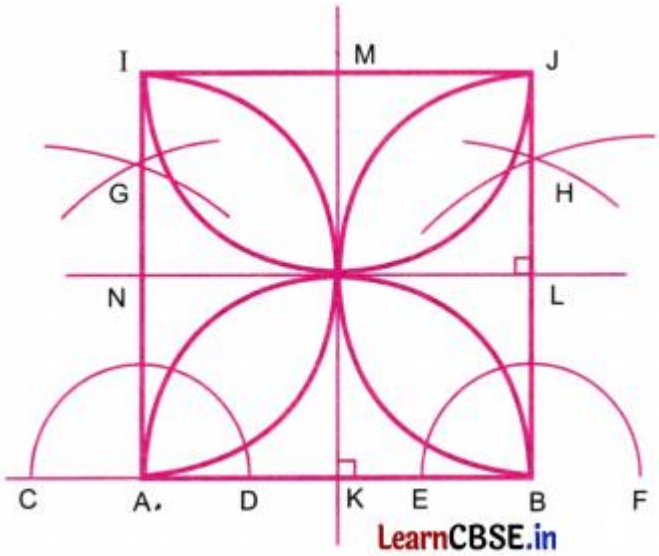


We have OA = OB and AM = BM.
In ΔOAM and ΔOBM, we have OA = OB, AM = BM, and OM is common.
∴ ΔOAM = ΔOBM (Using SSS-rule)
∴ ∠AOM = ∠BOM
∴ ∠XOM = ∠YOM
∴ OM is the bisector of the given angle ∠XOY.

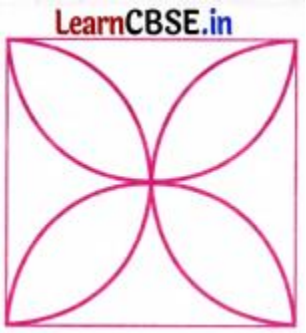
Question 6.
Construct the following figure:



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.



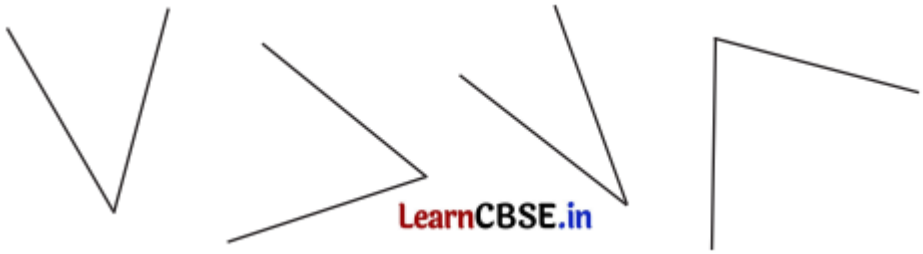
Here ABJI is a square.
Using a ruler and a compass, find perpendicular bisectors of the sides AB and BJ.
With centres at K, L, M, and N, draw semicircles in the square with radius equal to AK.
Now, we erase the extra lines and arcs.
The above figure looks as given below:



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.

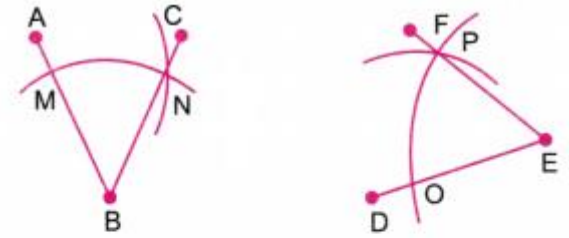
Figure It Out

Question 1.
Construct at least 4 different angles in different orientations without taking any measurements. Make a copy of all these angles.

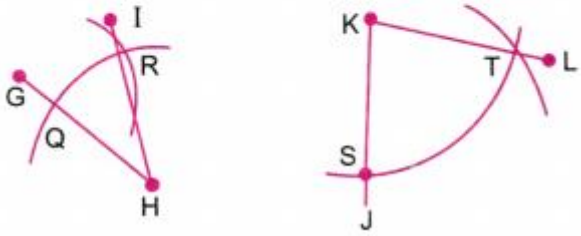


Solution:

The following are the given angles:



(*i*) (*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.

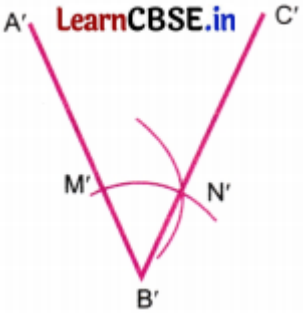
Let the arc intersect AB and BC at M and N, respectively.

Let the arc intersect A'B' at M.

Measure MN using a compass.

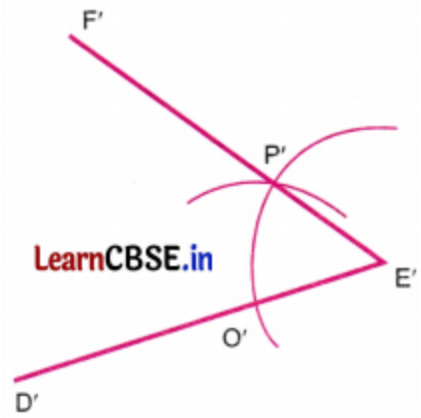
Transfer this length on the arc from M' to get M'N' = MN.

Join B' and N'.



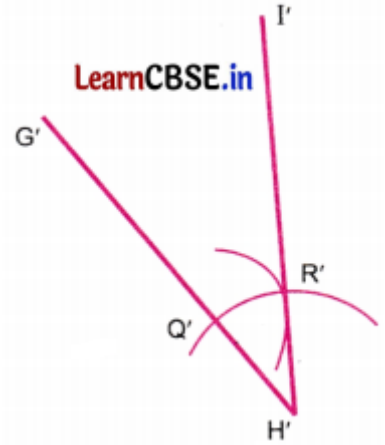
∠A'B'C' is the required angle.

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'.



∠D'E'F' is the required angle.

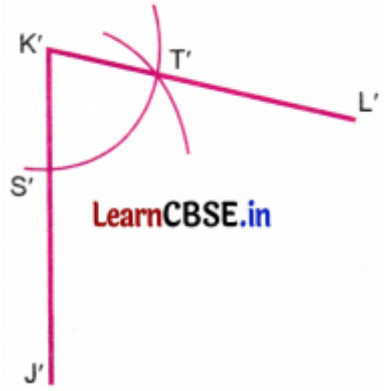
Angie (iii): Draw a line G'H' along the direction of the line GH.
With centres at H and H', draw arcs of equal radius.
Let the arc intersect GH and HI at Q and R, respectively.



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'.
∠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'.

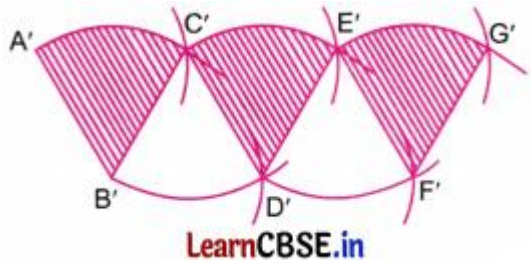
Measure ST using a compass.
Transfer this length on the arc from S' to get S'T' = ST.



Join K' and T.
∠J'K'L' is the required angle.

Question 2.
Construct the following figure:

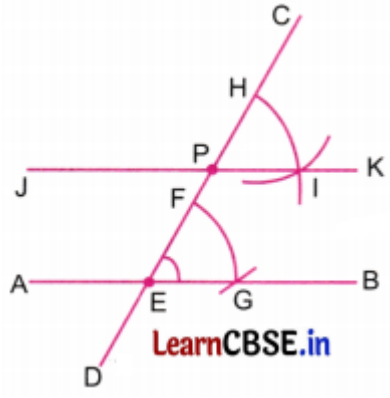
Solution:
We name the vertices of the given figure as A, B, C, D, E, F, G.
Draw a line A'B' equal to AB and along the direction of the line AB.
With centre at B'. draw an arc of radius A'B'.
Measure AC using a compass.
Transfer this length on the arc from A' to get A'C' = AC.
Join B' and C'. Shade this 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'.

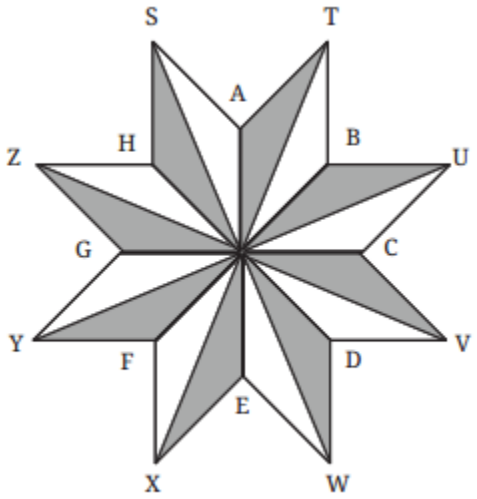
Measure CE using a compass.
Transfer this length on the arc from C' to get C'E' = CE.
Join D' and E'. Shade this sector as shown in the given figure.
With centre at E', draw an arc of radius D'E'.
Measure DF using a compass.
Transfer this length on the arc from D' to get D'F' = DF.
Join E' and F'.
With 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 ∠PEB and ∠CPK are equal.
∴ 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 = 45°, 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 ∠CAD.

With centres at C and E, draw arcs of equal radius.

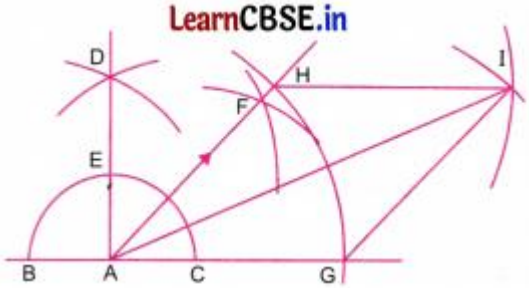
Let the arcs intersect at point F. Join AF.

With centre at A, draw an arc intersecting AC and AF at G and H respectively.

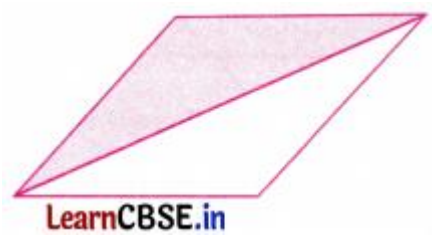
With centres at G and H, draw arcs of equal radius equal to AG.

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° ÷ 5 = 72°).
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.

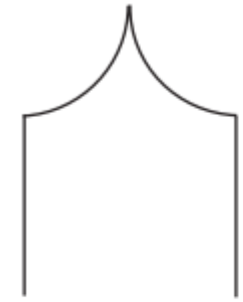
Properties:

- 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.

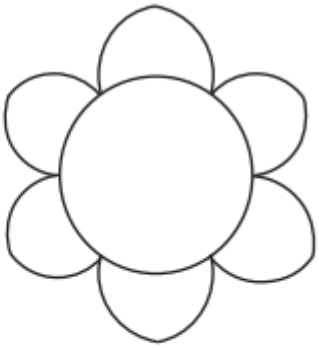
Figure It Out

Question 1.
Construct the following figures:



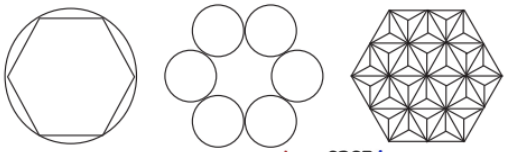
(a)

An Inflexed Arc



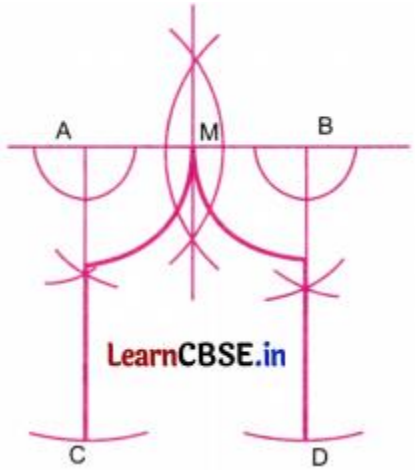
(b)

The fun part about this figure is that it can also be constructed using only a compass! Can you do it?



(c) (d) (e)

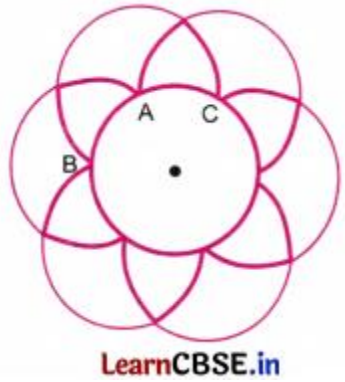
Solution:
(a) Draw a line and take points A and B on it.
Draw perpendiculars at A and B below the line using a ruler and a compass as shown in the figure.



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.

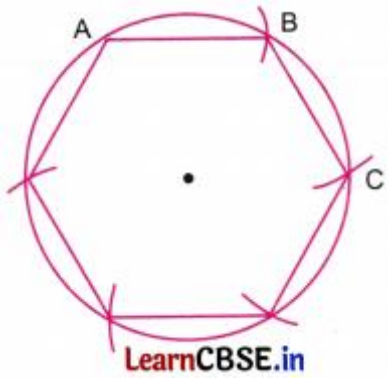
(b) This figure is called the 'Flower of Life'.
Draw a circle. This is called the central circle of the required figure.
Take any point A on the circumference and draw an arc of the same radius as that of the circle outside the circle and touching its circumference at B and C.
With centre at B, draw 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.

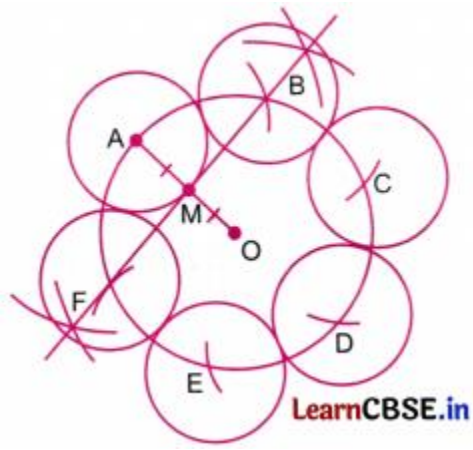
(c) Draw a circle. Take any point A on the circumference and draw an arc with centre at A and radius that to the circle's and intersecting the circle at B.



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.

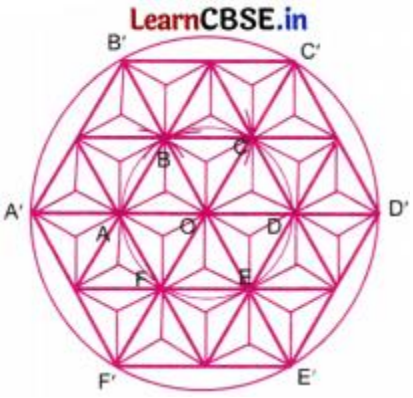
(d) Draw a circle. Take any point A on the circle and draw an arc of the same radius as that of the circle intersecting the circle at B.
With B as centre, draw an arc of the same radius intersecting the circle at C.



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.

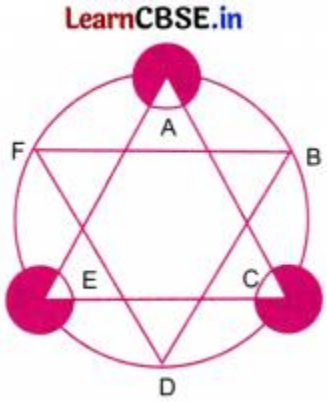


Repeat this process and get points of intersection D, E, and F.
Draw a circle with centre O and radius twice OA.
Join OA and extend it to intersect the outer circle at A'.
Similarly, draw other extended lines. Join the lines as shown in the figure.

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.

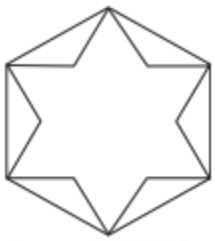


With the centre at B and the same radius, draw an arc intersecting the circle at C.
Repeat this process to get points of intersection D, E, and F.
Join AC, CE, EA, BD, DF, and FB.
Draw three equal circles with wedges removed at A, C, and E as shown above.

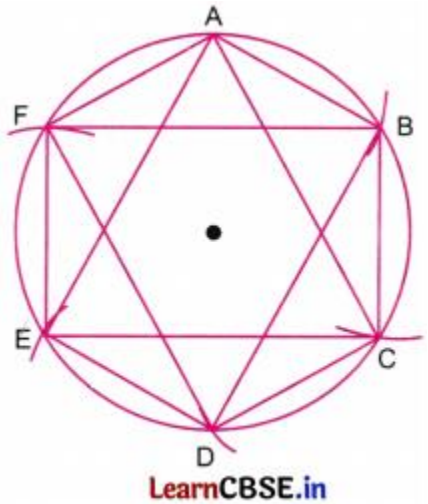
Erase the extra arcs, circle, and letters to get the required figure as shown above.
The above figure is called the Kanizsa triangle.
The three circles with wedges removed and three V-shaped angles are arranged

in such a way that the brain perceives a white equilateral triangle pointing upward-even though no such triangle is actually drawn.

Question 3.
Construct this figure.



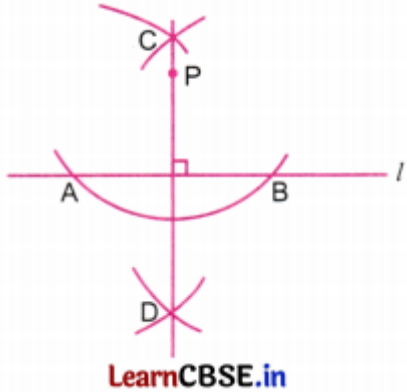
[Hint: Find the angles in this figure.]
Solution:
Draw a circle. Take any point A on the top of the circle and draw an arc with centre at A and radius as that of the circle and intersecting the circle at B.



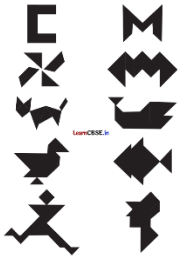
With the centre at B and the same radius, draw an arc intersecting the circle at C.
Repeat this process to get points of intersection D, E, and F.
Join the lines as shown in the figure.

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.

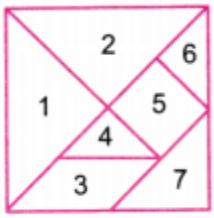


Question 5.
How can the tangram pieces be rearranged to form each of the following figures?

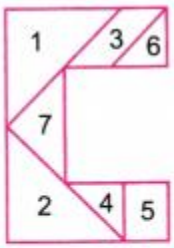


Solution:

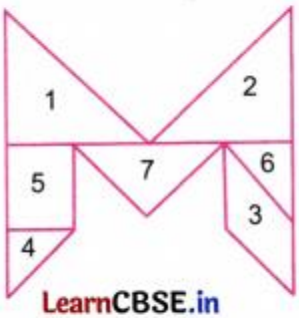
To solve this problem, we prepare 10 sets of 7 tans obtained from a tangram-based shape given below:



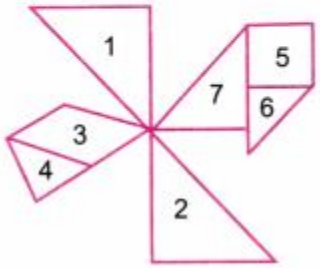
(i)



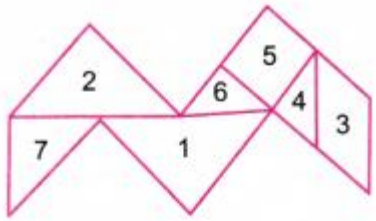
(ii)



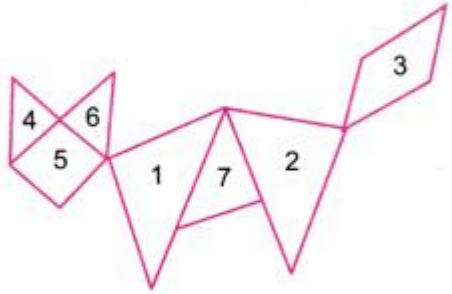
(iii)



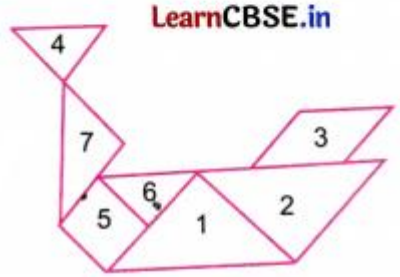
(iv)



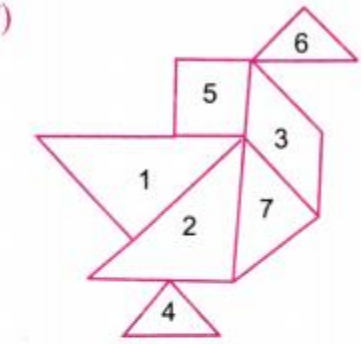
(v)



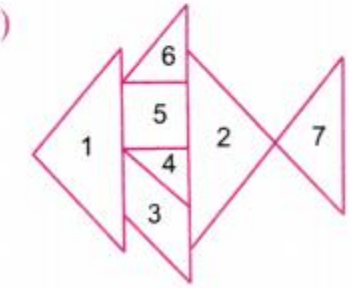
(vi)



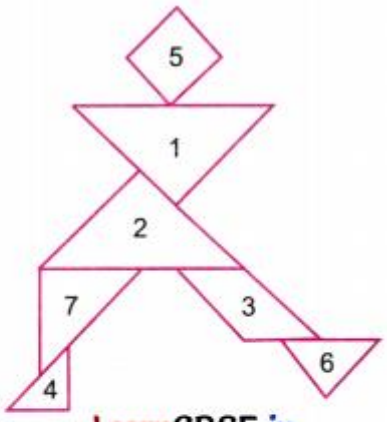
(vii)



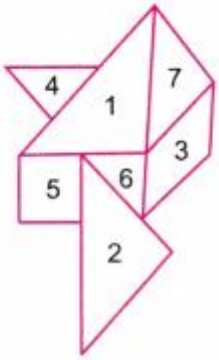
(viii)



(ix)

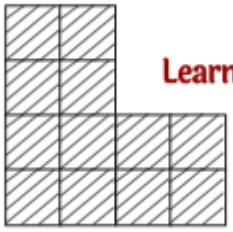


(x)



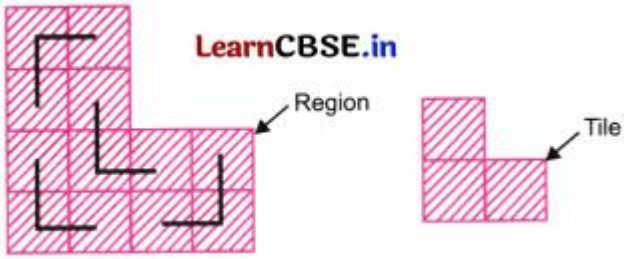
Question 6.
Is the following tiling possible?

Region to be tiled

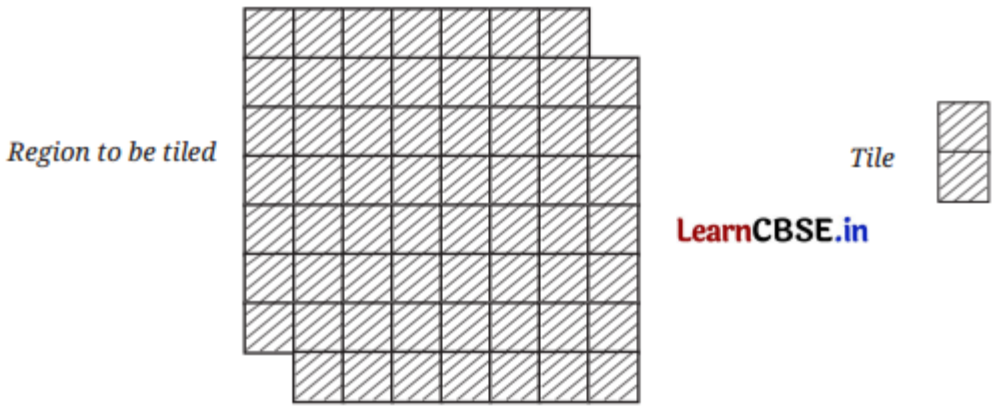


Tile

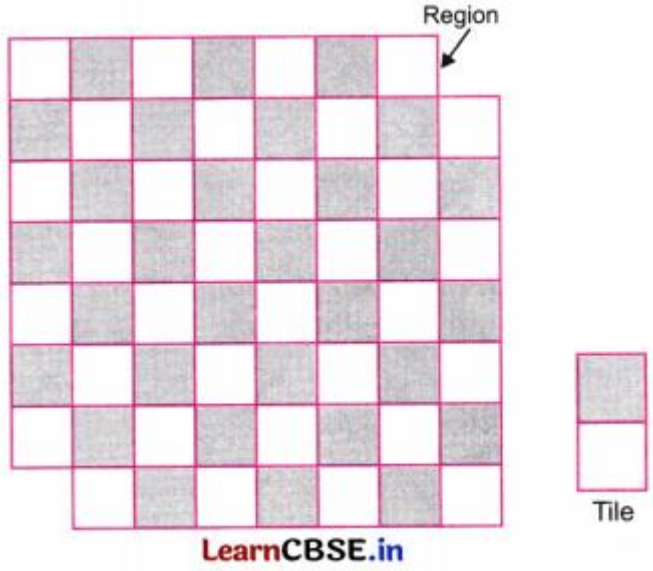
Solution:
The given tiles can be used for tiling the region.
The tiling shall use 4 tiles of the given shape.



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, ∠QPB = 90°.

---

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:
$120° \div 2 = 60°$

$60° \div 2 = 30°$

$30° \div 2 = 15°$

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:

$90° \div 2 = 45°$

$45° \div 2 = 22.5°$

$22.5° \div 2 = 11.25°$

These angles can be constructed exactly using ruler and compass.

---

5. Why does the rope method produce an angle equal to ∠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 ∠ABC.

Practice Time 6.4

1.

Each copied angle is equal to its original angle.

2.

The angle constructed at P is equal to ∠ABC.

3.

The angles at A and B are equal.

4.

The angle constructed at S is equal to ∠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?

$$360^\circ \div 8$$
$$= 45^\circ$$

Answer: 45°

---

2. A regular polygon has central angle 40°. How many sides does it have?

$$360^\circ \div 40^\circ$$
$$= 9$$

Answer: 9 sides

---

3. A regular polygon has central angle 30°. Find the number of sides.

$$360° \div 30°$$
$$= 12$$

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 ÷ 4 = 4

Answer: ● = 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 ÷ 4 = 6

Flower = 6

Each identical shape = 6 ÷ 3 = 2

Answer: Flower = 6, each top shape = 2

Fig. 3

Given: Diamond = 8

Balance shows:

Diamond = 2 cars

8 = 2 cars

Car = 8 ÷ 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 circles = 40

Circle = 40 ÷ 5 = 8

Then:

4 F-shapes = 40

F-shape = 40 ÷ 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

One sack = 10 + 2

Sack = 12

Answer: 12 units

Fig. 2

Two sacks = 10 + 4 + 2

Two sacks = 16

One sack = 16 ÷ 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

$3n + 1 = 200$

$3n = 199$

$n = 199/3$

$n = 66⅓$

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 ❌

Try x = 3

5(3) − 4 = 15 − 4 = 11 ❌

Try x = 2.2

5(2.2) − 4 = 11 − 4 = 7 ✅

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:

$3(15) - 10 = 45 - 10 = 35$ ✓

Answer: x = 15

(b) 5s = 3s

5s − 3s = 0

2s = 0

s = 0

Check:

5(0) = 3(0)

0 = 0 ✓

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 ✓

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 subacting 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
LHS = $3u - 7$
$= 3 \times 10 - 7$
$= 30 - 7$
$= 23$
RHS = $2u + 3$
$= 2 \times 10 + 3$
$= 20 + 3$
$= 23$
LHS = 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:
LHS = 4(m + 6) – 8
= 4(-10 + 6) – 8
= 4(-4) – 8
= -16 – 8
= -24
RHS = 2m – 4
= 2(-10) – 4
= -20 – 4
= -24
LHS = RHS
Hence checked.

(e) = 6
Multiply both sides by 15
× 15 = 6 × 15
⇒ u = 90
Check:
LHS =
= 6
RHS = 6
LHS = 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
⇒ 6 = 2, 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
⇒ 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

$x = x/2 + 1$

$x - x/2 = 1$

$x/2 = 1$

x = 2 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 × ___ − 8 = 37

5x = 45

x = 9

Blank = 9

(b) 37 − (33 − ___) = 35

37 − 33 + x = 35

4 + x = 35

x = 31

(c) −3 × (−11 + ___) = 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**

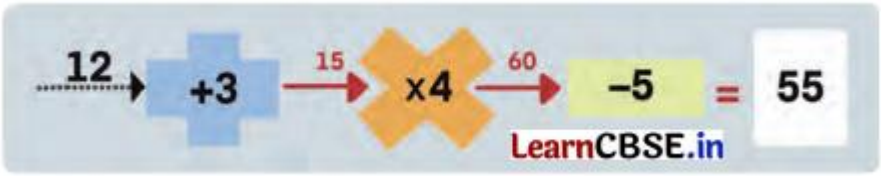
Question 11.
In the given picture, each black blob hides an equal number of blue dots. If there are 25 dots in total, how many dots are covered by one blob? Write an equation to describe this problem.

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
⇒ 3u = 25 – 4
⇒ 3u = 21
⇒ u = 7
Each black blob hides 7 blue dots.

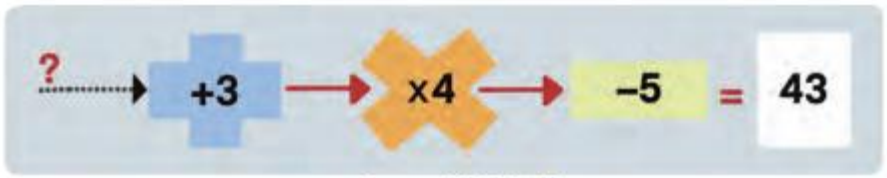
Question 12.
Here are machines that take an input, perform an operation on it, and send out

the result as an output.

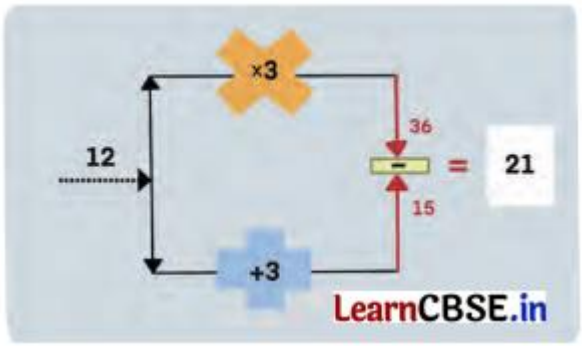
(a)



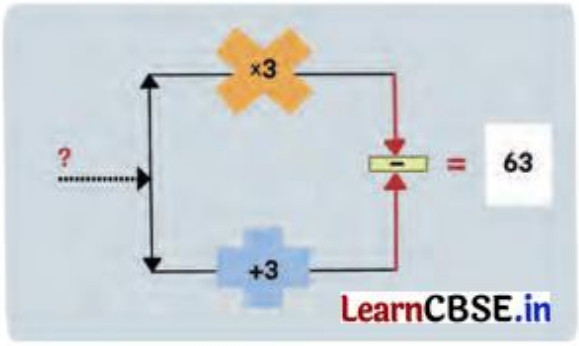
Find the inputs in the following cases:

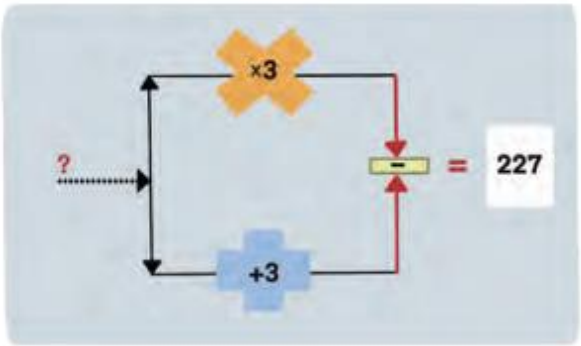


(b)



Find the inputs in the following cases:





Solution:

(a)

(i) $\xrightarrow{(9)} +3 \xrightarrow{(12)} \times 4 \xrightarrow{(48)} -5 = 43$

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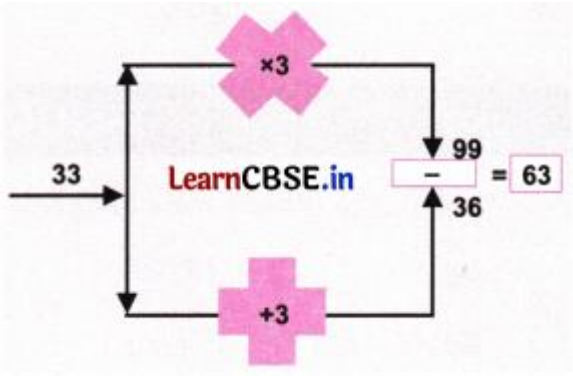
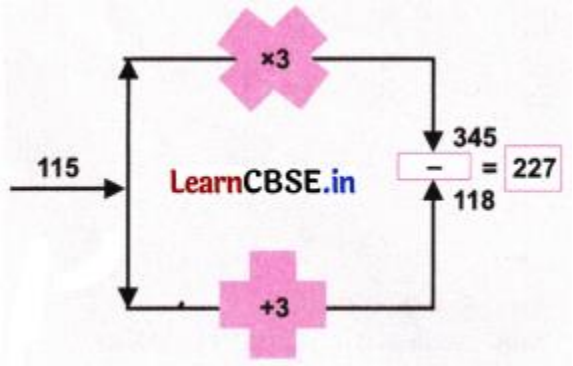
(ii) $\xrightarrow{17} +3 \xrightarrow{20} \times 4 \xrightarrow{80} -5 = 75$

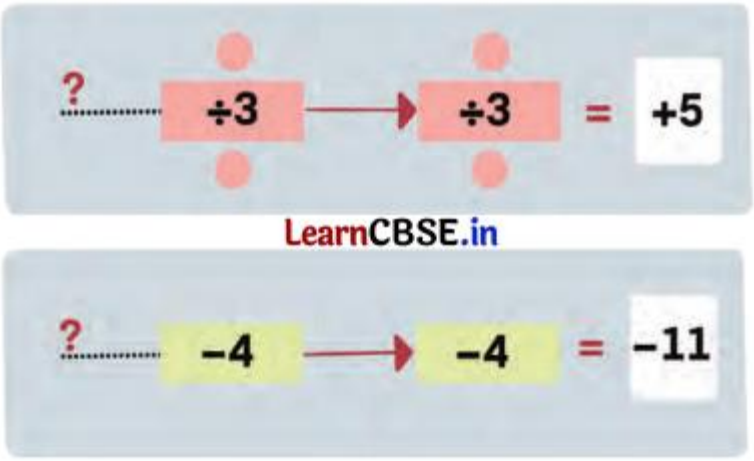
(b) (i) Let the unknown number be x.
$x \times 3 - (x + 3) = 63$
$\Rightarrow 3x - x - 3 = 63$
$\Rightarrow 2x - 3 = 63$
$\Rightarrow 2x = 66$
$\Rightarrow x = 33$



(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 ÷ 3) ÷ 3 = 5

⇒ a ÷ 3 = 5 × 3

⇒ a ÷ 3 = 15

⇒ a = 15 × 3

⇒ 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

⇒ b – 4 – 4 = -11

⇒ b – 8 = -11

⇒ b = -11 + 8

⇒ 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:

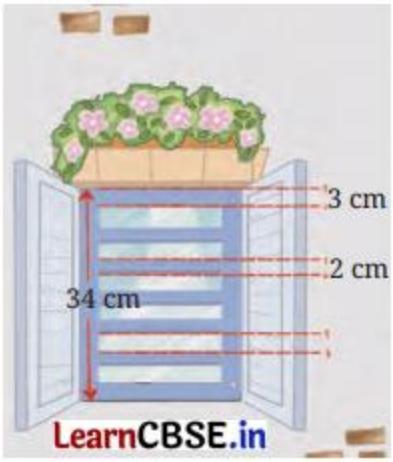
Fixed charges by Taxi driver = ₹ 800

Charge per kilometer = ₹ 20

Let the distance covered be x km.
According to the question
$x \times 20 + 800 = 2200$
$\Rightarrow 20x = 2200 - 800$
$\Rightarrow 20x = 1400$
$\Rightarrow x = 70$
Total distance covered is 70 km.

Question 15.
The sum of two numbers is 76. One number is three times the other number. What are the numbers?
Solution:
Let the two numbers be x and 3x.
According to the question
$x + 3x = 76$
$\Rightarrow 4x = 76$
$\Rightarrow x = 19$
The two numbers are 19 and 3×19, i.e., 19 and 57.

Question 16.
The figure shows the diagram for a window with a grill. What is the gap between the two rods in the grill?



Solution:
Total height of the window, including the frame = 34 cm
Total height of the window excluding the frame = 34 cm – 3 cm – 3 cm = 28 cm
Width of one rod of grill = 2 cm
No. of rods of the grill = 5
Total width of 5 rods = 5×2 cm = 10 cm
Let the height of 1 gap be x cm.
No. of gaps = 6

Total height of gaps = 6x
According to the question
10 + 6x = 28
⇒ 6x = 28 – 10
⇒ 6x = 18
⇒ 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
⇒ 4x – 60 + 7x = 600
⇒ 4x + 7x = 600 + 60
⇒ 11x = 660
⇒ 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: $\boxed{x = \frac{19}{2}}$

(b) $14y + 24 = 36$

Correct solution:

$$14y = 36 - 24$$
$$14y = 12$$
$$y = \frac{12}{14}$$
$$y = \frac{6}{7}$$

Answer: $\boxed{y = \frac{6}{7}}$

(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: $\boxed{x = -\frac{13}{5}}$

---

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 = $180°$

$$y + (y + 15) + (y + 15) = 180$$
$$3y + 30 = 180$$
$$3y = 150$$
$$y = 50°$$

Base angles:

$$50 + 15 = 65°$$

Angles = $\boxed{50°,\ 65°,\ 65°}$

(b)

Triangle angles:

$$x + (x - 10) + (x + 10) = 180$$
$$3x = 180$$
$$x = 60°$$

Therefore:

$$x - 10 = 50^\circ$$
$$x + 10 = 70^\circ$$

Angles = $\boxed{50^\circ,\ 60^\circ,\ 70^\circ}$

---

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 $\boxed{4}$**.**

---

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 → 1 square

2nd → 2 squares

3rd → 3 squares

Hence:

Number of squares in position $n = n$

(a)

Position 11:

$$11 \text{ squares}$$

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)

$$7 + 3(n - 1) = 85$$
$$3n + 4 = 85$$
$$3n = 81$$
$$n = 27$$

Answer: Yes, position 27.

(d)

$$7 + 3(n - 1) = 150$$
$$3n + 4 = 150$$
$$3n = 146$$
$$n = \frac{146}{3}$$

Not a whole number.

Answer: No.

---

25. A number increased by 36 is equal to ten times itself

Let number = x

$$x + 36 = 10x$$
$$36 = 9x$$
$$x = 4$$

Answer: 4

---

26. Solve

(a)

$$5(r + 2) = 10$$

$$r + 2 = 2$$
$$r = 0$$

(b) $\boldsymbol{-3(u+2) = 2(u-1)}$

$$-3u - 6 = 2u - 2$$
$$-6 = 5u - 2$$
$$-4 = 5u$$
$$u = -\frac{4}{5}$$

Answer: $\boxed{u = -\frac{4}{5}}$

(c) $\boldsymbol{2(7-2n) = -6}$

$$14 - 4n = -6$$
$$-4n = -20$$
$$n = 5$$

Answer: $\boxed{n = 5}$

(d) $\boldsymbol{2(x-4) = -16}$

$$2x - 8 = -16$$
$$2x = -8$$
$$x = -4$$

Answer: $\boxed{x = -4}$

(e) $\boldsymbol{6(x-1) = 2(x-1) - 4}$

$$6x - 6 = 2x - 2 - 4$$
$$6x - 6 = 2x - 6$$
$$4x = 0$$
$$x = 0$$

Answer: $\boxed{x = 0}$

(f) $\mathbf{3 - 7s = 7 - 3s}$

$$3 = 7 + 4s$$
$$-4 = 4s$$
$$s = -1$$

Answer: $\boxed{s = -1}$

(g) $\mathbf{2x + 1 = 6 - (2x - 3)}$

$$2x + 1 = 6 - 2x + 3$$
$$2x + 1 = 9 - 2x$$
$$4x = 8$$
$$x = 2$$

Answer: $\boxed{x = 2}$

(h) $\mathbf{10 - 5x = 3(x - 4) - 2(x - 7)}$

$$10 - 5x = 3x - 12 - 2x + 14$$
$$10 - 5x = x + 2$$
$$8 = 6x$$
$$x = \frac{4}{3}$$

Answer: $\boxed{x = \frac{4}{3}}$

---

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.)

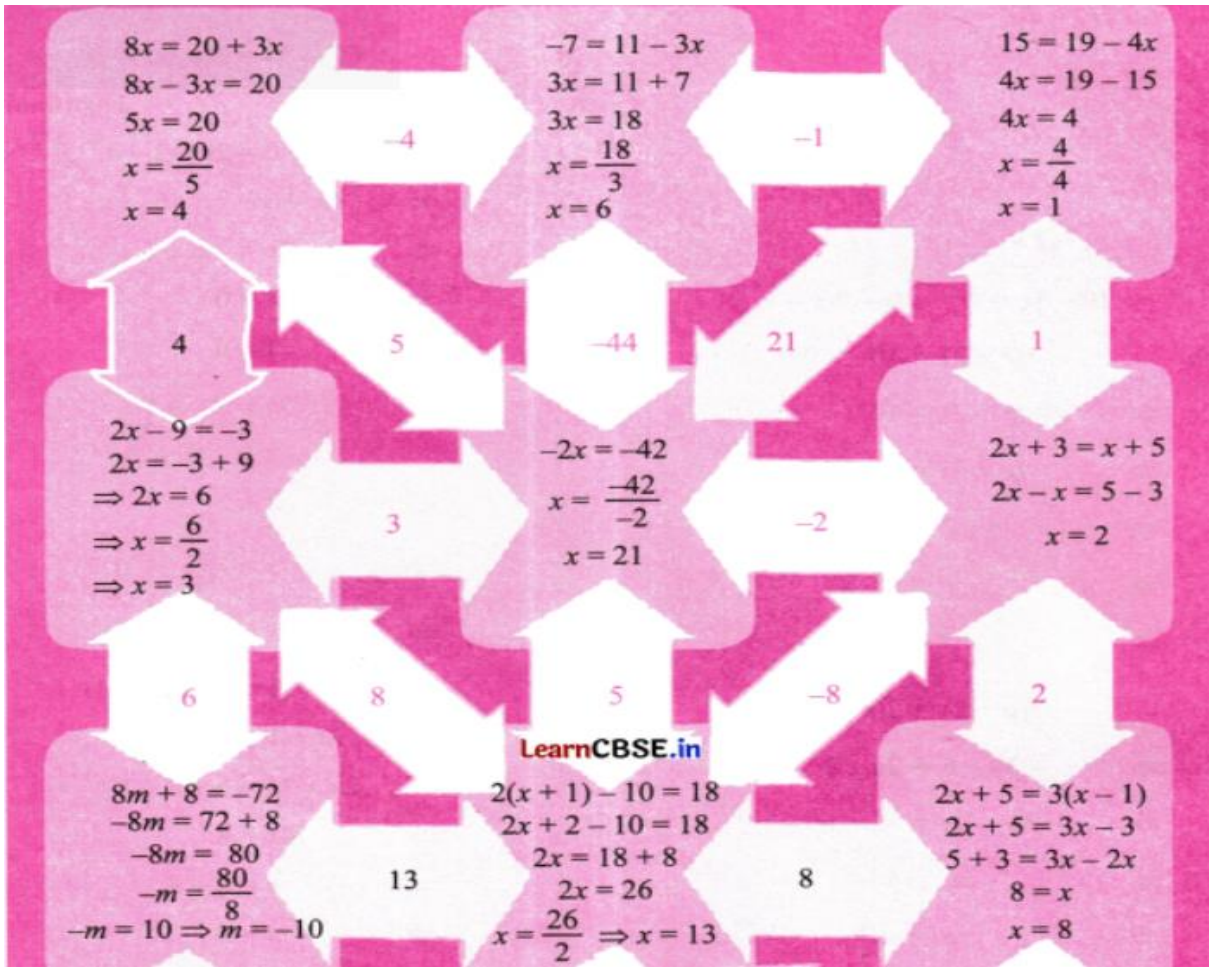
The correct path through the maze is:

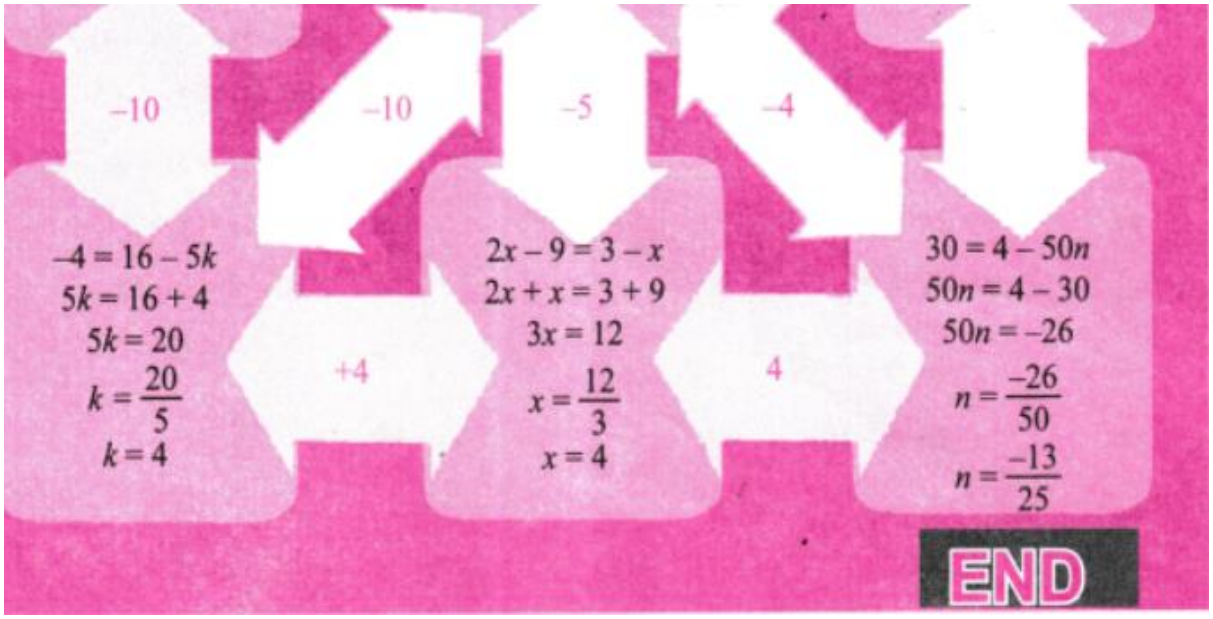
Start → -4 → 5 → 8 → 13 → -10 → +4 → 4 → End

•

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 ……(i)

Children have 2 feet, but donkeys have 4 feet.

According to the question

2x + 4y = 80

⇒ 2x + 4(28 – x) = 80 [From (i)]

⇒ 2x + 112 – 4x = 80

⇒ -2x + 112 = 80

⇒ -2x = 80 – 112

⇒ -2x = -32

⇒ 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

$$\frac{x}{4+3} = 11$$
$$\frac{x}{7} = 11$$
$$x = 11 \times 7$$
$$x = 77$$

Answer: x = 77

---

5. Solve 7(2 − m) = 21

$$2 - m = \frac{21}{7}$$
$$2 - m = 3$$
$$-m = 1$$
$$m = -1$$

Verification:

$$7(2 - (-1))$$
$$7(3) = 21$$

✓ 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 → 19 ✗

x = 5 → 22 ✗

x = 6 → 25 ✓

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 → 23 ✗

p = 5 → 28 ✗

p = 6 → 33 ✓

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:

$$7\left(3 \times \frac{13}{3} - 2\right)$$
$$= 7(13 - 2)$$
$$= 7 \times 11$$
$$= 77$$

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** ✔