

MASTERMIND

Mathematics

Based on NCERT 2025

Class

8

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Key Features

- Key Points to Remember
- Key Words for Better Understanding
- NCERT Questions, Activities and Projects
- Exam Oriented Additional Questions with Answers
- AI Integrated
- NCF Compliant
- Competency Based Questions



All of NCERT Questions

1. Rational Numbers

Exercise 1.1

- Name the property under multiplication used in each of the following.
(a) $\frac{-4}{5} \times 1 = 1 \times \frac{-4}{5} = -\frac{4}{5}$ (b) $-\frac{13}{17} \times \frac{-2}{7} = \frac{-2}{7} \times \frac{-13}{17}$ (c) $\frac{-19}{29} \times \frac{29}{-19} = 1$
- Tell what property allows you to compute $\frac{1}{3} \times \left(6 \times \frac{4}{3}\right)$ as $\left(\frac{1}{3} \times 6\right) \times \frac{4}{3}$.
- The product of two rational numbers is always a _____.

2. Linear Equations in One Variable

Exercise 2.1

Solve the following equations and check your results.

- $3x = 2x + 18$
- $5t - 3 = 3t - 5$
- $5x + 9 = 5 + 3x$
- $4z + 3 = 6 + 2z$
- $2x - 1 = 14 - x$
- $8x + 4 = 3(x - 1) + 7$
- $x = \frac{4}{5}(x + 10)$
- $\frac{2x}{3} + 1 = \frac{7x}{15} + 3$
- $2y + \frac{5}{3} = \frac{26}{3} - y$
- $3m = 5m - \frac{8}{5}$

Exercise 2.2

Solve the following linear equations.

- $\frac{x}{2} - \frac{1}{5} = \frac{x}{3} + \frac{1}{4}$
- $\frac{n}{2} - \frac{3n}{4} + \frac{5n}{6} = 21$
- $x + 7 - \frac{8x}{3} = \frac{17}{6} - \frac{5x}{2}$
- $\frac{x-5}{3} = \frac{x-3}{5}$
- $\frac{3t-2}{4} - \frac{2t+3}{3} = \frac{2}{3} - t$
- $m - \frac{m-1}{2} = 1 - \frac{m-2}{3}$

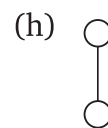
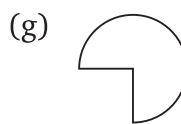
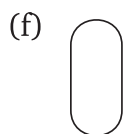
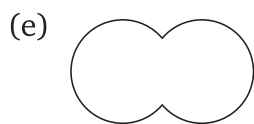
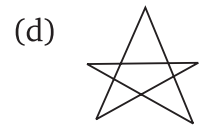
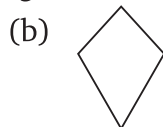
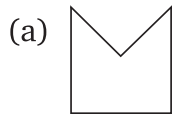
Simplify and solve the following linear equations.

- $3(t - 3) = 5(2t + 1)$
- $15(y - 4) - 2(y - 9) + 5(y + 6) = 0$
- $3(5z - 7) - 2(9z - 11) = 4(8z - 13) - 17$
- $0.25(4f - 3) = 0.05(10f - 9)$

3. Understanding Quadrilaterals

Exercise 3.1

- Given here are some figures.



Classify each of them on the basis of the following :

- (i) Simple curve
- (ii) Simple closed curve
- (iii) Polygon
- (iv) Convex polygon
- (v) Concave polygon

2. What is a regular polygon?

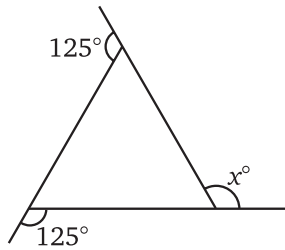
State the name of a regular polygon of :

- (a) 3 sides
- (b) 4 sides
- (c) 6 sides

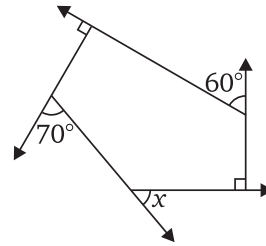
Exercise 3.2

1. Find x in the following figures :

(a)



(b)



2. Find the measure of each exterior angle of a regular polygon of :

- (a) 9 sides
- (b) 15 sides

3. How many sides does a regular polygon have, if the measure of an exterior angle is 24° ?

4. How many sides does a regular polygon have, if each of its interior angles is 165° ?

5. (a) Is it possible to have a regular polygon with measure of each exterior angle as 22° ?

(b) Can it be an interior angle of a regular polygon? Why?

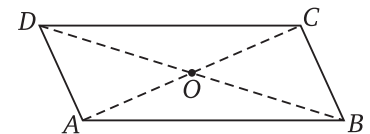
6. (a) What is the minimum interior angle possible for a regular polygon? Why?

(b) What is the maximum exterior angle possible for a regular polygon?

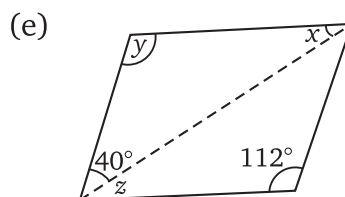
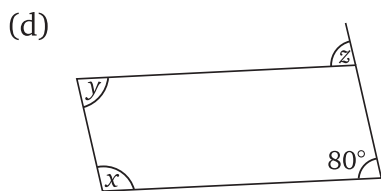
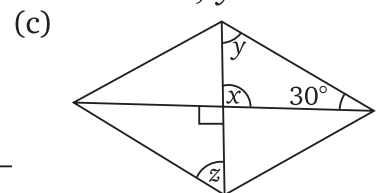
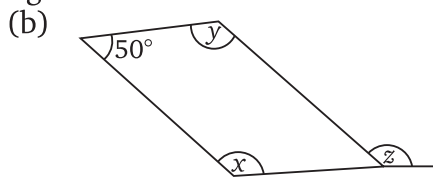
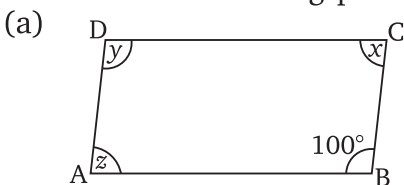
Exercise 3.3

1. Given a parallelogram $ABCD$. Complete each statement along with the definition or property used.

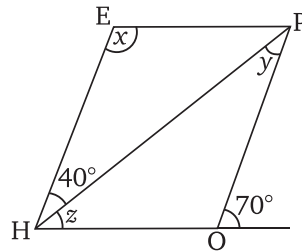
- (a) $AD =$ _____
- (b) $\angle DCB =$ _____
- (c) $OC =$ _____
- (d) $m\angle DAB + m\angle CDA =$ _____



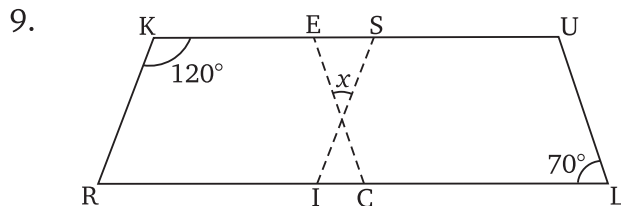
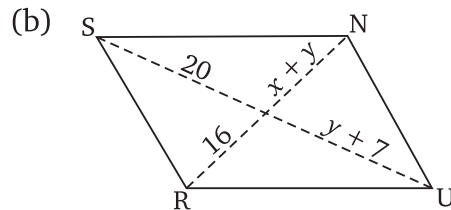
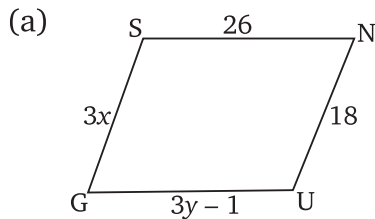
2. Consider the following parallelograms. Find the values of the unknowns x , y and z .



- Can a quadrilateral $ABCD$ be a parallelogram, if :
 - $\angle D + \angle B = 180^\circ$?
 - $AB = DC = 8$ cm, $AD = 4$ cm and $BC = 4.4$ cm?
 - $\angle A = 70^\circ$ and $\angle C = 65^\circ$?
- Draw a rough figure of a quadrilateral that is not a parallelogram but has exactly two opposite angles of equal measure.
- The measures of two adjacent angles of a parallelogram are in the ratio 3:2. Find the measure of each of the angles of the parallelogram.
- Two adjacent angles of a parallelogram have equal measure. Find the measure of each of the angles of the parallelogram.
- The adjacent figure HOPE is a parallelogram. Find the angle measures x , y and z . State the properties you use to find them.

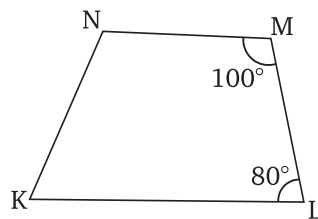


- The following figures GUNS and RUNS are parallelograms. Find x and y . (Lengths are in cm)

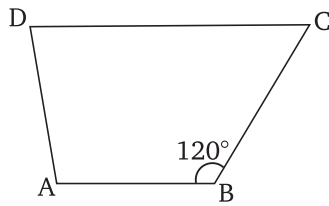


In the above figure both RISK and CLUE are parallelograms. Find the value of x .

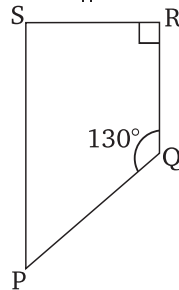
- Explain how the figure given below is a trapezium. Which of its two sides are parallel?



- Find $m\angle C$ in the figure given below. If $\overline{AB} \parallel \overline{DC}$.



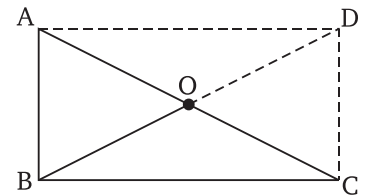
12. Find the measure of $\angle P$ and $\angle S$, if $\overline{SP} \parallel \overline{RQ}$ in the figure given below.



(If you find $m\angle R$, is there more than one method to find $m\angle P$?)

Exercise 3.4

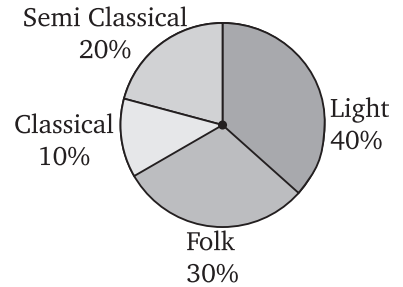
- State whether True or False :
 - All rectangles are squares.
 - All rhombuses are parallelograms.
 - All squares are rhombuses and also rectangles.
 - All squares are not parallelograms.
 - All kites are rhombuses.
 - All rhombuses are kites.
 - All parallelograms are trapeziums.
 - All squares are trapeziums.
- Identify all the quadrilaterals that have :
 - four sides of equal length
 - four right angles
- Explain how a square is :
 - a quadrilateral
 - a parallelogram
 - a rhombus
 - a rectangle
- Name the quadrilaterals whose diagonals :
 - bisect each other
 - are perpendicular bisectors of each other
 - are equal
- Explain why a rectangle is a convex quadrilateral.
- $\triangle ABC$ is a right-angled triangle and O is the mid point of the side opposite to the right angle. Explain why O is equidistant from A , B and C .
(The dotted lines are drawn additionally to help you).



4. Data Handling




Exercise 4.1

1. A survey was made to find the type of music that a certain group of young people liked in a city. Adjoining pie chart shows the findings of this survey.



From this pie chart answer the following :

- (a) If 20 people liked classical music, how many young people were surveyed?
 (b) Which type of music is liked by the maximum number of people?
 (c) If a cassette company were to make 1000 CD's, how many of each type would they make?
2. A group of 360 people were asked to vote for their favourite season from the three seasons; rainy, winter and summer.

Seasons	No. of votes
Summer 	90
Rainy 	120
Winter 	150

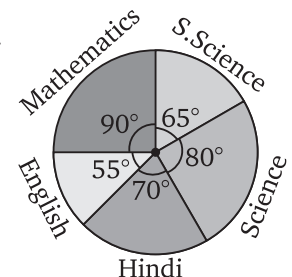
- (a) Which season got the most votes? (b) Find the central angle of each sector.
 (c) Draw a pie chart to show this information.
3. Draw a pie chart showing the following information. The table shows the colours preferred by a group of people.

Colours	Number of people
Blue	18
Green	9
Red	6
Yellow	3
Total	36

Hint : Find the proportion of each sector. For example,

Blue is $\frac{18}{36} = \frac{1}{2}$; Green is $\frac{9}{36} = \frac{1}{4}$ and so on. Use this to find the corresponding angles.

4. The adjoining pie chart gives the marks scored in an examination by a student in Hindi, English, Mathematics, Social Science and Science. If the total marks obtained by the students were 540, answer the following questions :



- (a) In which subject did the student score 105 marks?
(Hint : for 540 marks, the central angle = 360°. So, for 105 marks, what is the central angle?)

- (b) How many more marks were obtained by the student in Mathematics than in Hindi?
 (c) Examine whether the sum of the marks obtained in Social Science and Mathematics is more than that in Science and Hindi.
(Hint : Just study the central angles).

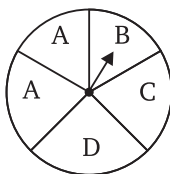
5. The number of students in a hostel, speaking different languages is given below. Display the data in a pie chart.

Language	Hindi	English	Marathi	Tamil	Bengali	Total
Number of students	40	12	9	7	4	72

Exercise 4.2

1. List the outcomes you can see in these experiments.

(a) Spinning a wheel



(b) Tossing two coins together

2. When a die is thrown, list the outcomes of an event of getting :

(a) (i) a prime number.

(ii) not a prime number.

(b) (i) a number greater than 5.

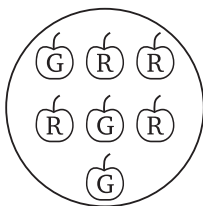
(ii) a number not greater than 5.

3. Find the :

(a) Probability of the pointer stopping on D in (Question 1-(a))?

(b) Probability of getting an ace from a well shuffled deck of 52 playing cards?

(c) Probability of getting a red apple. (See figure below)



4. Numbers 1 to 10 are written on ten separate slips (one number on one slip), kept in a box and mixed well. One slip is chosen from the box without looking into it. What is the probability of :

(a) getting a number 6?

(b) getting a number less than 6?

(c) getting a number greater than 6?

(d) getting a 1-digit number?

5. If you have a spinning wheel with 3 green sectors, 1 blue sector and 1 red sector. What is the probability of getting a green sector? What is the probability of getting a non blue sector?

6. Find the probabilities of the events given in Question 2.



5. Squares and Square Roots

Exercise 5.1

- What will be the unit digit of the squares of the following numbers?
(a) 81 (b) 272 (c) 799 (d) 3853 (e) 1234
(f) 26387 (g) 52698 (h) 99880 (i) 12796 (j) 55555
- The following numbers are obviously not perfect squares. Give reason.
(a) 1057 (b) 23453 (c) 7928 (d) 222222
(e) 64000 (f) 89722 (g) 222000 (h) 505050
- The squares of which of the following would be odd numbers?
(a) 431 (b) 2826
(c) 7779 (d) 82004
- Observe the following pattern and find the missing digits.

$$\begin{aligned}11^2 &= 121 \\101^2 &= 10201 \\1001^2 &= 1002001 \\100001^2 &= 1 \quad \underline{\hspace{2cm}} \quad 2 \quad \underline{\hspace{2cm}} \quad 1 \\10000001^2 &= \underline{\hspace{4cm}}\end{aligned}$$

- Observe the following pattern and find the missing numbers.

$$\begin{aligned}11^2 &= 1 \ 2 \ 1 \\101^2 &= 1 \ 0 \ 2 \ 0 \ 1 \\10101^2 &= 102030201 \\1010101^2 &= \underline{\hspace{4cm}} \\ \underline{\hspace{4cm}}^2 &= 10203040504030201\end{aligned}$$

- Using the given pattern, find the missing numbers.

$$\begin{aligned}1^2 + 2^2 + 2^2 &= 3^2 \\2^2 + 3^2 + 6^2 &= 7^2 \\3^2 + 4^2 + 12^2 &= 13^2 \\4^2 + 5^2 + \underline{\hspace{1cm}} &= 21^2 \\5^2 + \underline{\hspace{1cm}}^2 + 30^2 &= 31^2 \\6^2 + 7^2 + \underline{\hspace{1cm}}^2 &= \underline{\hspace{1cm}}^2\end{aligned}$$

To find pattern

Third number is related to first and second number. How?

Fourth number is related to third number. How?

- Without adding, find the sum.

- $1 + 3 + 5 + 7 + 9$
- $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19$
- $1 + 3 + 5 + 7 + 9 + 11 + 13 + 15 + 17 + 19 + 21 + 23$

3. Find the smallest number by which each of the following numbers must be divided to obtain a perfect cube.

(a) 81	(b) 128	(c) 135
(d) 192	(e) 704	
4. Parikshit makes a cuboid of plasticine of sides 5 cm, 2 cm and 5 cm. How many such cuboids will he need to form a cube?

Exercise 6.2

1. Find the cube root of each of the following numbers by prime factorisation method.

(a) 64	(b) 512	(c) 10648	(d) 27000
(e) 15625	(f) 13824	(g) 110592	(h) 46656
(i) 175616	(j) 91125		
2. State true or false :
 - (a) Cube of any odd number is even.
 - (b) A perfect cube does not end with two zeros.
 - (c) If square of a number ends with 5, then its cube ends with 25.
 - (d) There is no perfect cube which ends with 8.
 - (e) The cube of a two digit number may be a three digit number.
 - (f) The cube of a two digit number may have seven or more digits.
 - (g) The cube of a single digit number may be a single digit number.



7. Comparing Quantities

Exercise 7.1

1. Find the ratio of the following :
 - (a) Speed of a cycle 15 km per hour to the speed of a scooter 30 km per hour.
 - (b) 5 m to 10 km
 - (c) 50 paise to ₹ 5
2. Convert the following ratios to percentages.
 - (a) 3:4
 - (b) 2:3
3. 72% of 25 students are good in mathematics. How many students are not good in mathematics?
4. A football team won 10 matches out of the total number of matches they played. If their win percentage was 40, then how many matches did they play in all?
5. If Chameli had ₹ 600 left after spending 75% of her money, how much did she have in the beginning?
6. If 60% people in a city like cricket, 30% like football and the remaining like other games, then what per cent of the people like other games? If the total number of people are 50 lakh, find the exact number who like each type of game.

Exercise 7.2

1. During a sale, a shop offered a discount of 10% on the marked prices of all the items. What would a customer have to pay for a pair of jeans marked at ₹ 1450 and two shirts marked at ₹ 850 each?
2. The price of a TV is ₹ 13,000. The sales tax charged on it is at the rate of 12%. Find the amount that Vinod will have to pay, if he buys it.
3. Arun bought a pair of skates at a sale where the discount given was 20%. If the amount he pays is ₹ 1,600. Find the marked price.
4. I purchased a hair-dryer for ₹ 5,400 including 8% VAT. Find the price before VAT was added.
5. An article was purchased for ₹ 1239 including GST of 18%. Find the price of the article before GST was added?

Exercise 7.3

1. The population of a place increased to 54,000 in 2003 at a rate of 5% per annum.
(a) Find the population in 2001.
(b) What would be its population in 2005?
2. In a Laboratory, the count of bacteria in a certain experiment was increasing at the rate of 2.5% per hour. Find the bacteria at the end of 2 hours, if the count was initially 5,06,000.
3. A scooter was bought at ₹ 42,000. Its value depreciated at the rate of 8% per annum. Find its value after one year.



8. Algebraic Expressions and Identities

Exercise 8.1

1. Add the following :
(a) $ab - bc, bc - ca, ca - ab$
(b) $a - b + ab, b - c + bc, c - a + ac$
(c) $2p^2q^2 - 3pq + 4, 5 + 7pq - 3p^2q^2$
(d) $l^2 + m^2, m^2 + n^2, n^2 + l^2, 2lm + 2mn + 2nl$
2. (a) Subtract $4a - 7ab + 3b + 12$ from $12a - 9ab + 5b - 3$.
(b) Subtract $3xy + 5yz - 7zx$ from $5xy - 2yz - 2zx + 10xyz$.
(c) Subtract $4p^2q - 3pq + 5pq^2 - 8p + 7q - 10$ from $18 - 3p - 11q + 5pq - 2pq^2 + 5p^2q$.

Exercise 8.2

1. Find the product of the following pairs of monomials.
(a) $4, 7p$ (b) $-4p, 7p$ (c) $-4p, 7pq$
(d) $4p^3, -3p$ (e) $4p, 0$
2. Find the areas of rectangles with the following pairs of monomials as their lengths and breadths respectively.
 $(p, q); (10m, 5n); (20x^2, 5y^2); (4x, 3x^2); (3mn, 4np)$

3. Complete the table of products.

First monomial → Second monomial ↓	$2x$	$-5y$	$3x^2$	$-4xy$	$7x^2y$	$-9x^2y^2$
$2x$	$4x^2$					
$-5y$			$-15x^2y$			
$3x^2$						
$-4xy$						
$7x^2y$						
$-9x^2y^2$						

4. Obtain the volume of rectangular boxes with the following length, breadth and height respectively.

(a) $5a, 3a^2, 7a^4$

(b) $2p, 4q, 8r$

(c) $xy, 2x^2y, 2xy^2$

(d) $a, 2b, 3c$

5. Obtain the product of :

(a) xy, yz, zx

(b) $a, -a^2, a^3$

(c) $2, 4y, 8y^2, 16y^3$

(d) $a, 2b, 3c, 6abc$

(e) $m, -mn, mnp$

Exercise 8.3

1. Carry out the multiplication of the expressions in each of the following pairs :

(a) $4p, q+r$

(b) $ab, a-b$

(c) $a+b, 7a^2b^2$

(d) $a^2-9, 4a$

(e) $pq+qr+rp, 0$

2. Complete the table.

S.No.	First expression	Second expression	Product
(a)	a	$b+c+d$	
(b)	$x+y-5$	$5xy$	
(c)	p	$6p^2-7p+5$	
(d)	$4p^2q^2$	p^2-q^2	
(e)	$a+b+c$	abc	

3. Find the product.

(a) $(a^2) \times (2a^{22}) \times (4a^{26})$

(b) $\left(\frac{2}{3}xy\right) \times \left(\frac{-9}{10}x^2y^2\right)$

(c) $\left(-\frac{10}{3}pq^3\right) \times \left(\frac{6}{5}p^3q\right)$

(d) $x \times x^2 \times x^3 \times x^4$

4. (a) Simplify : $3x(4x - 5) + 3$ and find its value for : (i) $x = 3$, (ii) $x = \frac{1}{2}$.

(b) Simplify : $a(a^2 + a + 1) + 5$ and find its value for : (i) $a = 0$, (ii) $a = 1$, (iii) $a = -1$.

5. (a) Add : $p(p - q)$, $q(q - r)$ and $r(r - p)$

(b) Add : $2x(z - x - y)$ and $2y(z - y - x)$

(c) Subtract : $3l(l - 4m + 5n)$ from $4l(10n - 3m + 2l)$

(d) Subtract : $3a(a + b + c) - 2b(a - b + c)$ from $4c(-a + b + c)$

Exercise 8.4

1. Multiply the binomials.

(a) $(2x + 5)$ and $(4x - 3)$

(b) $(y - 8)$ and $(3y - 4)$

(c) $(2.5l - 0.5m)$ and $(2.5l + 0.5m)$

(d) $(a + 3b)$ and $(x + 5)$

(e) $(2pq + 3q^2)$ and $(3pq - 2q^2)$

(f) $\left(\frac{3}{4}a^2 + 3b^2\right)$ and $4\left(a^2 - \frac{2}{3}b^2\right)$

2. Find the product :

(a) $(5 - 2x)(3 + x)$

(b) $(x + 7y)(7x - y)$

(c) $(a^2 + b)(a + b^2)$

(d) $(p^2 - q^2)(2p + q)$

3. Simplify :

(a) $(x^2 - 5)(x + 5) + 25$

(b) $(a^2 + 5)(b^3 + 3) + 5$

(c) $(t + s^2)(t^2 - s)$

(d) $(a + b)(c - d) + (a - b)(c + d) + 2(ac + bd)$

(e) $(x + y)(2x + y) + (x + 2y)(x - y)$

(f) $(x + y)(x^2 - xy + y^2)$

(g) $(1.5x - 4y)(1.5x + 4y + 3) - 4.5x + 12y$

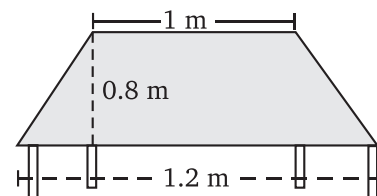
(h) $(a + b + c)(a + b - c)$

9. Mensuration

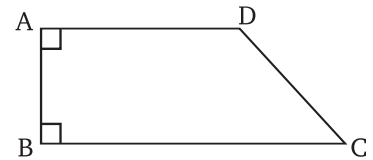
Exercise 9.1

1. The shape of the top surface of a table is a trapezium. Find its area, if its parallel sides are 1 m and 1.2 m and perpendicular distance between them is 0.8 m.

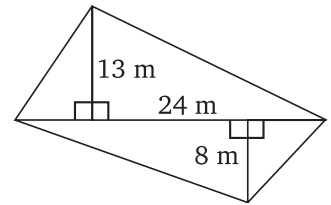
2. The area of a trapezium is 34 cm^2 and the length of one of the parallel sides is 10 cm and its height is 4 cm. Find the length of the other parallel side.



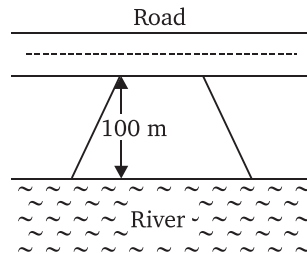
3. Length of the fence of a trapezium shaped field $ABCD$ is 120 m. If $BC = 48$ m, $CD = 17$ m and $AD = 40$ m, find the area of this field. Side AB is perpendicular to the parallel sides AD and BC .



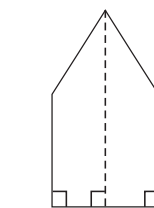
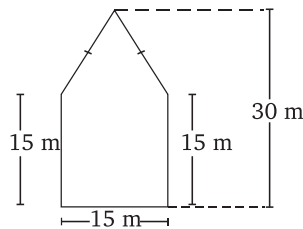
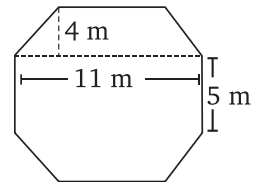
4. The diagonal of a quadrilateral shaped field is 24 m and the perpendiculars dropped on it from the remaining opposite vertices are 8 m and 13 m. Find the area of the field.



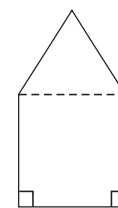
5. The diagonals of a rhombus are 7.5 cm and 12 cm. Find its area.
6. Find the area of a rhombus whose side is 5 cm and whose altitude is 4.8 cm. If one of its diagonals is 8 cm long, find the length of the other diagonal.
7. The floor of a building consists of 3000 tiles which are rhombus shaped and each of its diagonals are 45 cm and 30 cm in length. Find the total cost of polishing the floor, if the cost per m^2 is ₹ 4.
8. Mohan wants to buy a trapezium shaped field. Its side along the river is parallel to and twice the side along the road. If the area of this field is $10500 m^2$ and the perpendicular distance between the two parallel sides is 100 m. Find the length of the side along the river.



9. Top surface of a raised platform is in the shape of a regular octagon as shown in the figure. Find the area of the octagonal surface.
10. There is a pentagonal shaped park as shown in the figure. For finding its area Jyoti and Kavita divided it in two different ways.



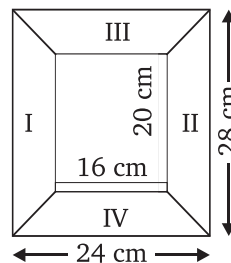
Jyoti's diagram



Kavita's diagram

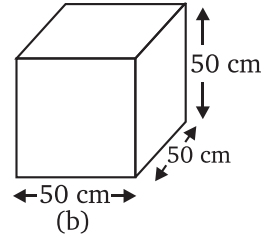
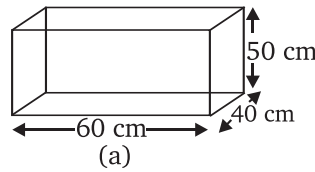
Find the area of this park using both ways. Can you suggest some other way of finding its area?

11. Diagram of the adjacent picture frame has outer dimensions = $24 \text{ cm} \times 28 \text{ cm}$ and inner dimensions = $16 \text{ cm} \times 20 \text{ cm}$. Find the area of each section of the frame, if the width of each section is same.

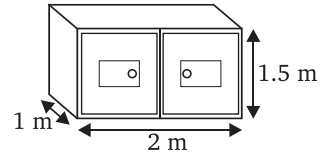


Exercise 9.2

- There are two cuboidal boxes as shown in the adjoining figure. Which box requires the lesser amount of material to make?
- A suitcase with measures $80\text{ cm} \times 48\text{ cm} \times 24\text{ cm}$ is to be covered with a tarpaulin cloth. How many metres of tarpaulin of width 96 cm is required to cover 100 such suitcases?

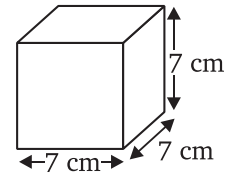
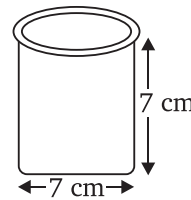


- Find the side of a cube, whose surface area is 600 cm^2 .
- Rukhsar painted the outside of the cabinet of measure $1\text{ m} \times 2\text{ m} \times 1.5\text{ m}$. How much surface area did she cover, if she painted all except the bottom of the cabinet.
- Daniel is painting the walls and ceiling of a cuboidal hall with length, breadth and height of 15 m , 10 m and 7 m respectively. From each can of paint 100 m^2 of area is painted.

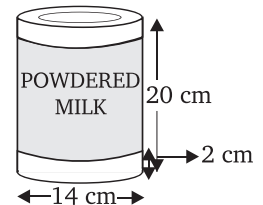


How many cans of paint will she need to paint the room?

- Describe how the two figures at the right are alike and how they are different. Which box has larger lateral surface area?
- A closed cylindrical tank of radius 7 m and height 3 m is made from a sheet of metal. How much sheet of metal is required?

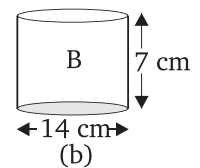
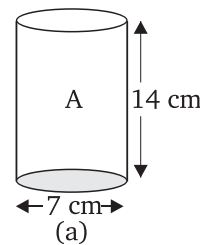


- The lateral surface area of a hollow cylinder is 4224 cm^2 . It is cut along its height and formed a rectangular sheet of width 33 cm . Find the perimeter of rectangular sheet?
- A road roller takes 750 complete revolutions to move once over to level a road. Find the area of the road, if the diameter of a road roller is 84 cm and length is 1 m .
- A company packages its milk powder in cylindrical container, whose base has a diameter of 14 cm and height 20 cm . Company places a label around the surface of the container (as shown in the figure). If the label is placed 2 cm from top and bottom, what is the area of the label.

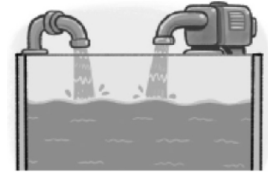


Exercise 9.3

- Given a cylindrical tank, in which situation will you find surface area and in which situation volume.
 - To find how much it can hold.
 - Number of cement bags required to plaster it.
 - To find the number of smaller tanks that can be filled with water from it.
- Diameter of cylinder A is 7 cm , and the height is 14 cm . Diameter of cylinder B is 14 cm and height is 7 cm . Without doing any calculations can you suggest, whose volume is greater? Verify it by finding the volume of both the cylinders. Check whether the cylinder with greater volume also has greater surface area?



- Find the height of a cuboid, whose base area is 180 cm^2 and volume is 900 cm^3 ?
- A cuboid is of dimensions $60 \text{ cm} \times 54 \text{ cm} \times 30 \text{ cm}$. How many small cubes with side 6 cm can be placed in the given cuboid?
- Find the height of the cylinder whose volume is 1.54 m^3 and diameter of the base is 140 cm ?
- A milk tank is in the form of cylinder whose radius is 1.5 m and length is 7 m . Find the quantity of milk in litres that can be stored in the tank?
- If each edge of a cube is doubled :
 - How many times will its surface area increase?
 - How many times will its volume increase?
- Water is pouring into a cuboidal reservoir at the rate of $60 \text{ litres per minute}$. If the volume of reservoir is 108 m^3 . Find the number of hours it will take to fill the reservoir.



10. Exponents and Powers

Exercise 10.1

- Evaluate :
 - 3^{-2}
 - $(-4)^{-2}$
 - $\left(\frac{1}{2}\right)^{-5}$
- Simplify and express the result in power notation with positive exponent.
 - $(-4)^5 \div (-4)^8$
 - $\left(\frac{1}{2^3}\right)^2$
 - $(-3)^4 \times \left(\frac{5}{3}\right)^4$
 - $(3^{-7} \div 3^{-10}) \times 3^{-5}$
 - $2^{-3} \times (-7)^{-3}$
- Find the value of :
 - $(3^0 + 4^{-1}) \times 2^2$
 - $(2^{-1} \times 4^{-1}) \div 2^{-2}$
 - $\left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{4}\right)^{-2}$
 - $(3^{-1} + 4^{-1} + 5^{-1})^0$
 - $\left\{\left(\frac{-2}{3}\right)^{-2}\right\}^2$
- Evaluate : (a) $\frac{8^{-1} \times 5^3}{2^{-4}}$ (b) $(5^{-1} \times 2^{-1}) \times 6^{-1}$
- Find the value of m for which : $5^m \div 5^{-3} = 5^5$.
- Evaluate : (a) $\left\{\left(\frac{1}{3}\right)^{-1} - \left(\frac{1}{4}\right)^{-1}\right\}^{-1}$ (b) $\left(\frac{5}{8}\right)^{-7} \times \left(\frac{8}{5}\right)^{-4}$
- Simplify : (a) $\frac{25 \times t^{-4}}{5^{-3} \times 10 \times t^{-8}}$ ($t \neq 0$) (b) $\frac{3^{-5} \times 10^{-5} \times 125}{5^{-7} \times 6^{-5}}$

Exercise 10.2

- Express the following numbers in standard form.

(a) 0.00000000000085	(b) 0.00000000000942	(c) 6020000000000000
(d) 0.00000000837	(e) 31860000000	
- Express the following numbers in usual form.

(a) 3.02×10^{-6}	(b) 4.5×10^4	(c) 3×10^{-8}
(d) 1.0001×10^9	(e) 5.8×10^{12}	(f) 3.61492×10^6
- Express the number appearing in the following statements in standard form :
 - 1 micron is equal to $\frac{1}{1000000}$ m.
 - Charge of an electron is 0.000,000,000,000,000,000,16 coulomb.
 - Size of a bacteria is 0.0000005 m.
 - Size of a plant cell is 0.00001275 m.
 - Thickness of a thick paper is 0.07 mm.
- In a stack, there are 5 books each of thickness 20 mm and 5 paper sheets each of thickness 0.016 mm. What is the total thickness of the stack.



11. Direct and Inverse Properties

Exercise 11.1

- Following are the car parking charges near a railway station upto :

4 hours	=	₹ 60
8 hours	=	₹ 100
12 hours	=	₹ 140
24 hours	=	₹ 180

Check, if the parking charges are in direct proportion to the parking time.

- A mixture of paint is prepared by mixing 1 part of red pigments with 8 parts of base. In the following table, find the parts of base that need to be added.

Parts of red pigments	1	4	7	12	20
Parts of base	8

- In Question 2 above, if 1 part of a red pigment requires 75 mL of base, how much red pigment should we mix with 1800 mL of base?
- A machine in a soft drink factory fills 840 bottles in six hours. How many bottles will it fill in five hours?
- A photograph of a bacteria enlarged 50,000 times attains a length of 5 cm as shown in the diagram. What is the actual length of the bacteria? If the photograph is enlarged 20,000 times only, what would be its enlarged length?



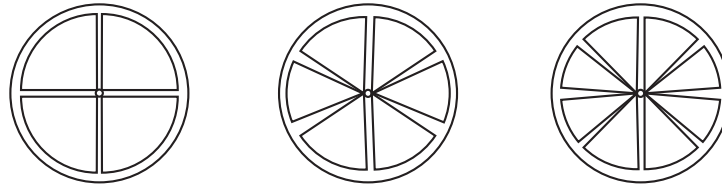
- In a model of a ship, the mast is 9 cm high, while the mast of the actual ship is 12 m high. If the length of the ship is 28 m, how long is the model ship?
- Suppose 2 kg of sugar contains 9×10^6 crystals. How many sugar crystals are there in :
(a) 5 kg of sugar? (b) 1.2 kg of sugar?
- Rashmi has a road map with a scale of 1 cm representing 18 km. She drives on a road for 72 km. What would be her distance covered in the map?
- A 5 m 60 cm high vertical pole casts a shadow 3 m 20 cm long. Find at the same time :
(a) the length of the shadow cast by another pole 10 m 50 cm high.
(b) the height of a pole which casts a shadow 5 m long.
- A loaded truck travels 14 km in 25 minutes. If the speed remains the same, how far can it travel in 5 hours?

Exercise 11.2

- Which of the following are in inverse proportion?
(a) The number of workers on a job and the time to complete the job.
(b) The time taken for a journey and the distance travelled in a uniform speed.
(c) Area of cultivated land and the crop harvested.
(d) The time taken for a fixed journey and the speed of the vehicle.
(e) The population of a country and the area of land per person.
- In a Television game show, the prize money of ₹ 1,00,000 is to be divided equally amongst the winners. Complete the following table and find whether the prize money given to an individual winner is directly or inversely proportional to the number of winners?

Number of winners	1	2	4	5	8	10	20
Prize for each winner (in ₹)	1,00,000	50,000

- Rehman is making a wheel using spokes. He wants to fix equal spokes in such a way that the angles between any pair of consecutive spokes are equal. Help him by completing the following table.



Number of spokes	4	6	8	10	12
Angle between a pair of consecutive spokes	90°	60°

- Are the number of spokes and the angles formed between the pairs of consecutive spokes in inverse proportion?
 - Calculate the angle between a pair of consecutive spokes on a wheel with 15 spokes.
 - How many spokes would be needed, if the angle between a pair of consecutive spokes is 40° ?
- If a box of sweets is divided among 24 children, they will get 5 sweets each. How many would each get, if the number of the children is reduced by 4?
 - A farmer has enough food to feed 20 animals in his cattle for 6 days. How long would the food last, if there were 10 more animals in his cattle?

6. A contractor estimates that 3 persons could rewire Jasminder's house in 4 days. If, he uses 4 persons instead of three, how long should they take to complete the job?
7. A batch of bottles were packed in 25 boxes with 12 bottles in each box. If the same batch is packed using 20 bottles in each box, how many boxes would be filled?
8. A factory requires 42 machines to produce a given number of articles in 63 days. How many machines would be required to produce the same number of articles in 54 days?
9. A car takes 2 hours to reach a destination by travelling at the speed of 60 km/h. How long will it take, when the car travels at the speed of 80 km/h?
10. Two persons could fit new windows in a house in 3 days :
 - (a) One of the persons fell ill before the work started. How long would the job take now?
 - (b) How many persons would be needed to fit the windows in one day?
11. A school has 8 periods a day each of 45 minutes duration. How long would each period be, if the school has 9 periods a day, assuming the number of school hours to be the same?



12. Factorisation

Exercise 12.1

1. Find the common factors of the given terms.

(a) $12x, 36$	(b) $2y, 22xy$	(c) $14pq, 28p^2q^2$
(d) $2x, 3x^2, 4$	(e) $6abc, 24ab^2, 12a^2b$	(f) $16x^3, -4x^2, 32x$
(g) $10pq, 20qr, 30rp$	(h) $3x^2y^3, 10x^3y^2, 6x^2y^2z$	
2. Factorise the following expressions.

(a) $7x - 42$	(b) $6p - 12q$	(c) $7a^2 + 14a$
(d) $-16z + 20z^3$	(e) $20l^2m + 30alm$	(f) $5x^2y - 15xy^2$
(g) $10a^2 - 15b^2 + 20c^2$	(h) $-4a^2 + 4ab - 4ca$	(i) $x^2yz + xy^2z + xyz^2$
(j) $ax^2y + bxy^2 + cxyz$		
3. Factorise :

(a) $x^2 + xy + 8x + 8y$	(b) $15xy - 6x + 5y - 2$	(c) $ax + bx - ay - by$
(d) $15pq + 15 + 9q + 25p$	(e) $z - 7 + 7xy - xyz$	

Exercise 12.2

1. Factorise the following expressions.

(a) $a^2 + 8a + 16$	(b) $p^2 - 10p + 25$	(c) $25m^2 + 30m + 9$
(d) $49y^2 + 84yz + 36z^2$	(e) $4x^2 - 8x + 4$	(f) $121b^2 - 88bc + 16c^2$
(g) $(l + m)^2 - 4lm$	(Hint : Expand $(l + m)^2$ first)	
(h) $a^4 + 2a^2b^2 + b^4$		
2. Factorise :

(a) $4p^2 - 9q^2$	(b) $63a^2 - 112b^2$	(c) $49x^2 - 36$
(d) $16x^5 - 144x^3$	(e) $(l + m)^2 - (l - m)^2$	(f) $9x^2y^2 - 16$
(g) $(x^2 - 2xy + y^2) - z^2$	(h) $25a^2 - 4b^2 + 28bc - 49c^2$	
3. Factorise the expressions.

(a) $ax^2 + bx$	(b) $7p^2 + 21q^2$	(c) $2x^3 + 2xy^2 + 2xz^2$
-----------------	--------------------	----------------------------

(d) $am^2 + bm^2 + bn^2 + an^2$ (e) $(lm + l) + m + 1$ (f) $y(y + z) + 9(y + z)$
 (g) $5y^2 - 20y - 8z + 2yz$ (h) $10ab + 4a + 5b + 2$ (i) $6xy - 4y + 6 - 9x$

4. Factorise :

(a) $a^4 - b^4$ (b) $p^4 - 81$ (c) $x^4 - (y + z)^4$
 (d) $x^4 - (x - z)^4$ (e) $a^4 - 2a^2b^2 + b^4$

5. Factorise the following expressions :

(a) $p^2 + 6p + 8$ (b) $q^2 - 10q + 21$ (c) $p^2 + 6p - 16$

Exercise 12.3

1. Carry out the following divisions.

(a) $28x^4 \div 56x$ (b) $-36y^3 \div 9y^2$ (c) $66pq^2r^3 \div 11qr^2$
 (d) $34x^3y^3z^3 \div 51xy^2z^3$ (e) $12a^8b^8 \div (-6a^6b^4)$

2. Divide the given polynomial by the given monomial.

(a) $(5x^2 - 6x) \div 3x$ (b) $(3y^8 - 4y^6 + 5y^4) \div y^4$
 (c) $8(x^3y^2z^2 + x^2y^3z^2 + x^2y^2z^3) \div 4x^2y^2z^2$
 (d) $(x^3 + 2x^2 + 3x) \div 2x$ (e) $(p^3q^6 - p^6q^3) \div p^3q^3$

3. Work out the following divisions :

(a) $(10x - 25) \div 5$ (b) $(10x - 25) \div (2x - 5)$
 (c) $10y(6y + 21) \div 5(2y + 7)$ (d) $9x^2y^2(3z - 24) \div 27xy(z - 8)$
 (e) $96abc(3a - 12)(5b - 30) \div 144(a - 4)(b - 6)$

4. Divide as directed :

(a) $5(2x + 1)(3x + 5) \div (2x + 1)$ (b) $26xy(x + 5)(y - 4) \div 13x(y - 4)$
 (c) $52pqr(p + q)(q + r)(r + p) \div 104pq(q + r)(r + p)$
 (d) $20(y + 4)(y^2 + 5y + 3) \div 5(y + 4)$ (e) $x(x + 1)(x + 2)(x + 3) \div x(x + 1)$

5. Factorise the expressions and divide them as directed.

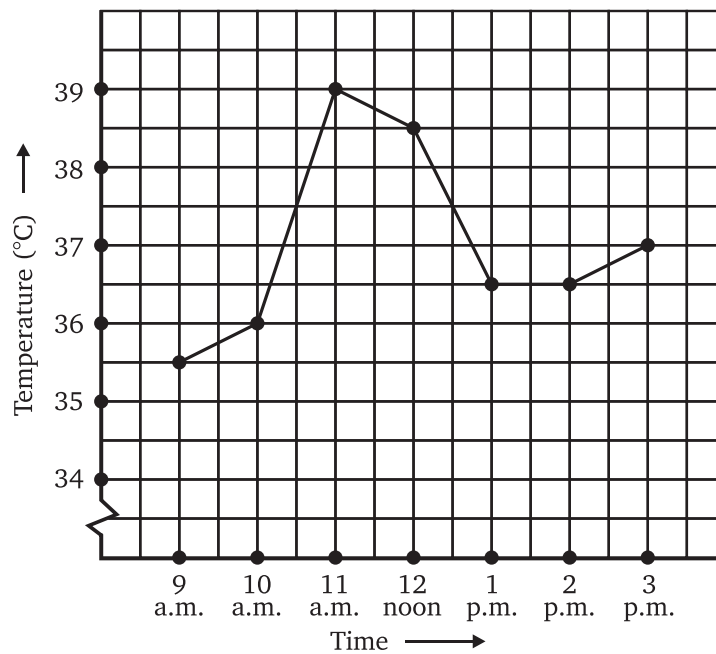
(a) $(y^2 + 7y + 10) \div (y + 5)$ (b) $(m^2 - 14m - 32) \div (m + 2)$
 (c) $(5p^2 - 25p + 20) \div (p - 1)$ (d) $4yz(z^2 + 6z - 16) \div 2y(z + 8)$
 (e) $5pq(p^2 - q^2) \div 2p(p + q)$ (f) $12xy(9x^2 - 16y^2) \div 4xy(3x + 4y)$
 (g) $39y^3(50y^2 - 98) \div 26y^2(5y + 7)$

13. Introduction to Graphs

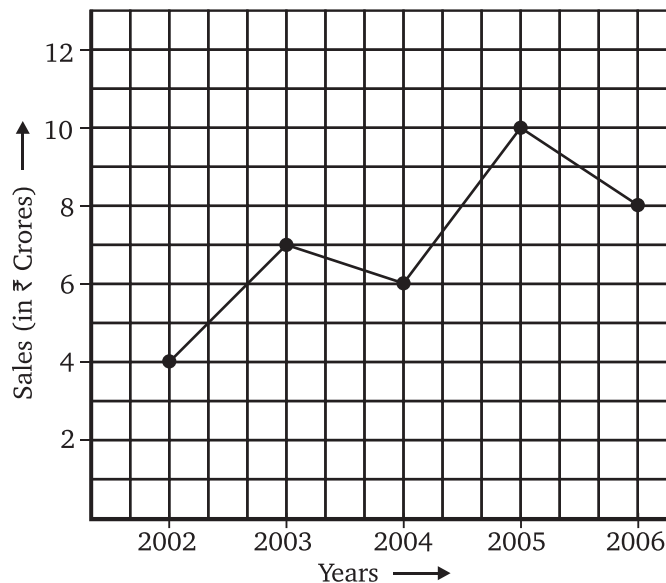
Exercise 13.1

1. The following graph shows the temperature of a patient in a hospital, recorded every hour.

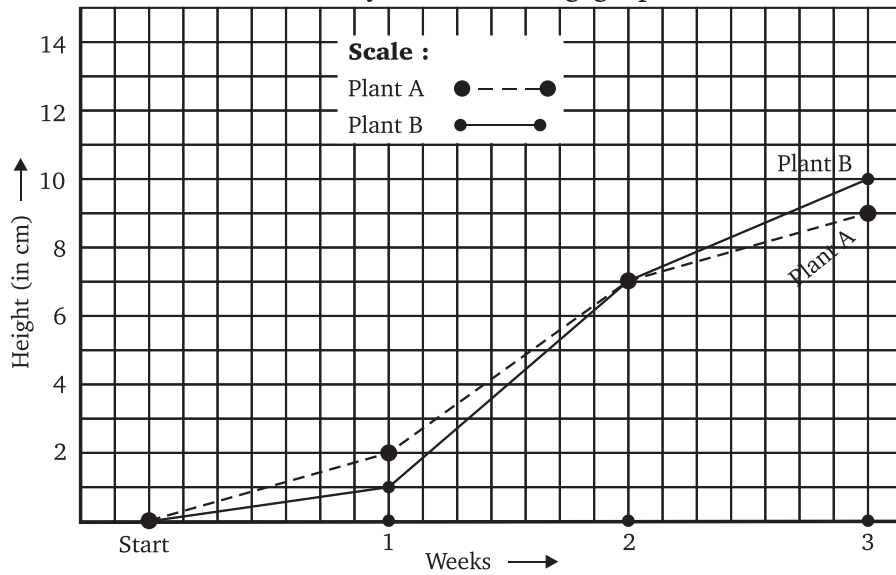
- (a) What was the patient's temperature at 1 p.m.?
 (b) When was the patient's temperature 38.5°C ?



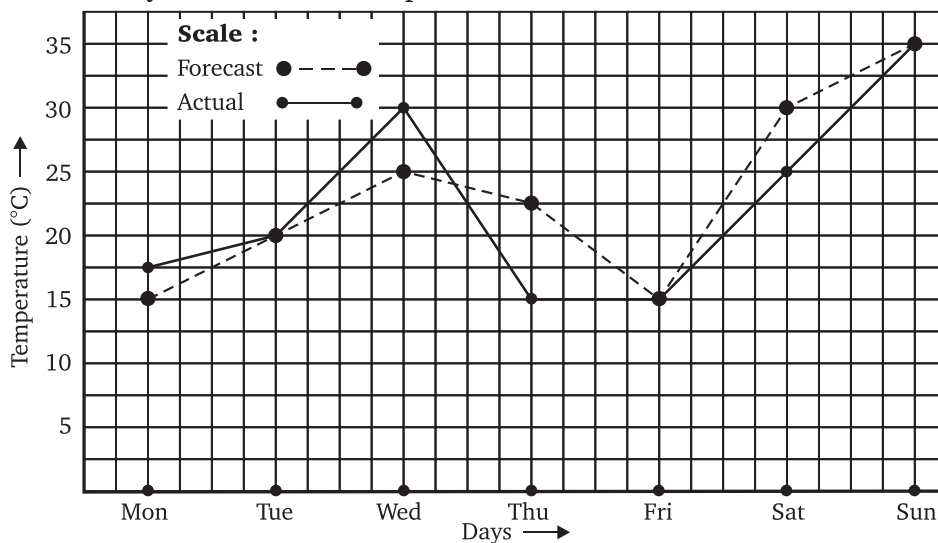
- (c) The patient's temperature was the same two times during the period given. What were these two times?
- (d) What was the temperature at 1:30 p.m.? How did you arrive at your answer?
- (e) During which periods did the patient's temperature showed an upward trend?
2. The following line graph shows the yearly sales figures for a manufacturing company.
- (a) What were the sales in :
- (i) 2002 ? (ii) 2006 ?
- (b) What were the sales in :
- (i) 2003 ? (ii) 2005 ?
- (c) Compute the difference between the sales in 2002 and 2006.
- (d) In which year was there the greatest difference between the sales as compared to its previous year?



3. For an experiment in Botany, two different plants, plant A and plant B were grown under similar laboratory conditions. Their heights were measured at the end of each week for 3 weeks. The results are shown by the following graph.



- How high was Plant A after : (i) 2 weeks, (ii) 3 weeks?
 - How high was Plant B after : (i) 2 weeks, (ii) 3 weeks?
 - How much did Plant A grow during the 3rd week?
 - How much did Plant B grow from the end of the 2nd week to the end of the 3rd week?
 - During which week did Plant A grow most?
 - During which week did Plant B grow least?
 - Were the two plants of the same height during any week shown here? Specify.
4. The following graph shows the temperature forecast and the actual temperature for each day of a week.
- On which days was the forecast temperature the same as the actual temperature?
 - What was the maximum forecast temperature during the week?
 - What was the minimum actual temperature during the week?
 - On which day did the actual temperature differ the most from the forecast temperature?



5. Use the tables below to draw linear graphs :

(a) The number of days a hill side city received snow in different years.

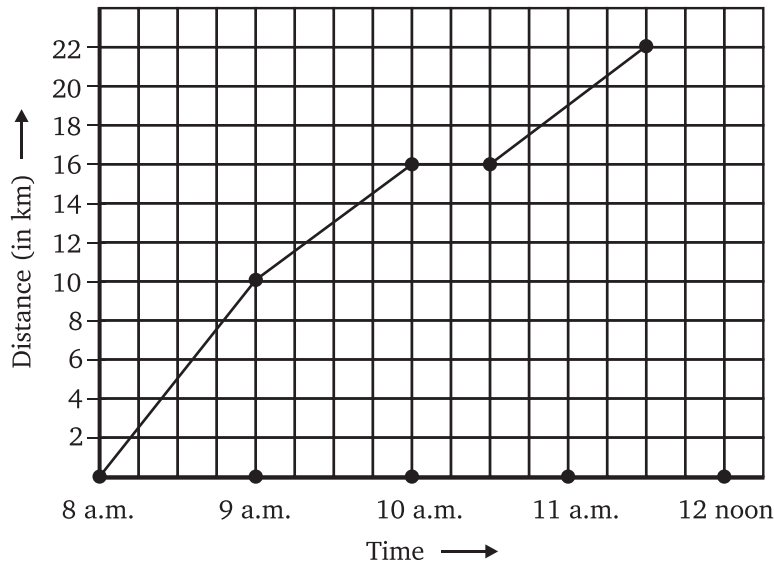
Year	2003	2004	2005	2006
Days	8	10	5	12

(b) Population (in thousands) of men and women in a village in different years.

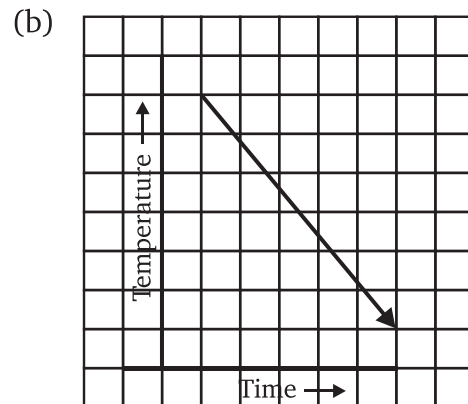
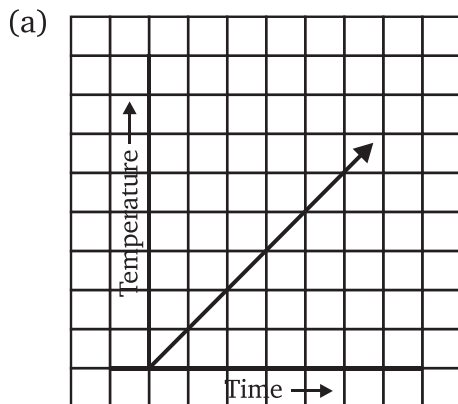
Year	2003	2004	2005	2006	2007
Number of Men	12	12.5	13	13.2	13.5
Number of Women	11.3	11.9	13	13.6	12.8

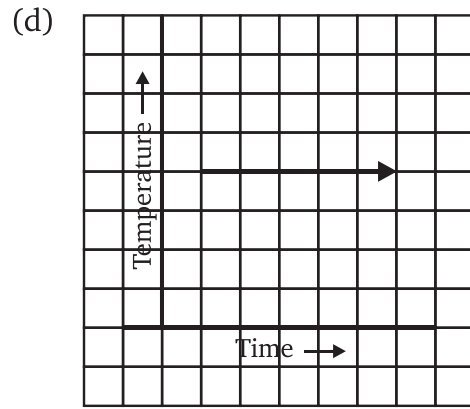
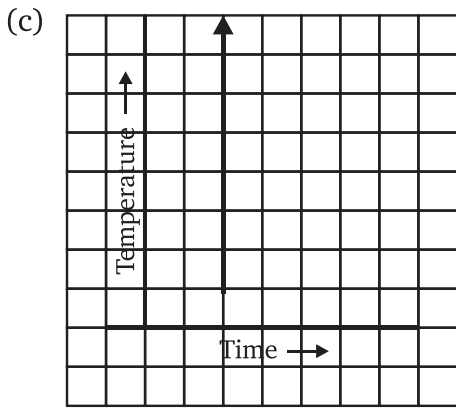
6. A courier-person cycles from a town to a neighbouring suburban area to deliver a parcel to a merchant. His distance from the town at different times is shown by the following graph.

- What is the scale taken for the time axis?
- How much time did the person take for the travel?
- How far is the place of the merchant from the town?
- Did the person stop on his way? Explain.
- During which period did he ride fastest?



7. Can there be a time-temperature graph as follows? Justify your answer.





Exercise 13.2

1. Draw the graphs for the following tables of values, with suitable scales on the axes.

- (a) Cost of apples.

Number of apples	1	2	3	4	5
Cost (in ₹)	5	10	15	20	25

- (b) Distance travelled by a car.

Time (in hours)	6 a.m.	7 a.m.	8 a.m.	9 a.m.
Distances (in km)	40	80	120	160

- (i) How much distance did the car cover during the period 7:30 a.m. to 8 a.m?
 (ii) What was the time when the car had covered a distance of 100 km since it's start?

- (c) Interest on deposits for a year.

Deposit (in ₹)	1000	2000	3000	4000	5000
Simple Interest (in ₹)	80	160	240	320	400

- (i) Does the graph pass through the origin?
 (ii) Use the graph to find the interest on ₹ 2500 for a year.
 (iii) To get an interest of ₹ 280 per year, how much money should be deposited?

2. Draw a graph for the following :

- (a)

Side of square (in cm)	2	3	3.5	5	6
Perimeter (in cm)	8	12	14	20	24

Is it a linear graph?

- (b)

Side of square (in cm)	2	3	4	5	6
Area (in cm²)	4	9	16	25	36

Is it a linear graph?

