CHAPTER 2

MEASUREMENTS

IMPORTANT POINTS

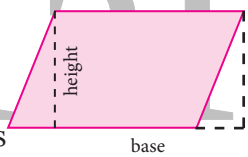
- SI unit of Distance is metre.
- SI unit of Weight is gram.
- SI unit of Time is second.
- International system of units were introduced in the year1971.
- Perimeter is the distance around.
- Area is the region occupied by the closed shape.

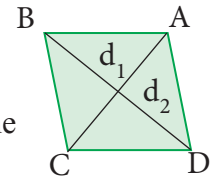
PARALLELOGRAM :

- A parallelogram is a four sided closed shape in which opposite sides are both parallel and equal.
- Area of the parallelogram = $b \times h$ sq. units, where b = base; h = height.
- The perimeter of a parallelogram is the sum of the lengths of the four sides.

RHOMBUS :

- In a parallelogram if all the sides are equal then it is called a rhombus.
- In a rhombus (i) all the sides are equal
  (ii) opposite sides are parallel
  (iii) diagonals divide the rhombus into 4 right angles triangles of equal area.
  (iv) the diagonals bisect each other at right angles.

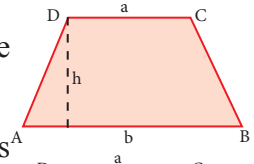


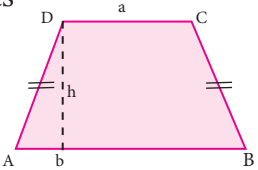


- Area of the rhombus = (base × height) sq. units
- Area of the rhombus = $\frac{1}{2}(d_1 \times d_2)$ sq. units. Where d_1 and d_2 are the diagonals.

TRAPEZIUM :

- A parallelogram with one pair of non-parallel sides is known as a Trapezium.
- Area of the Trapezium = $\frac{1}{2} \times h(a+b)$ sq. units. Where a and b are lengths of parallel sides.
- If the non-parallel sides of Trapezium are equal then it is known as an isosceles Trapezium.





PARALLELOGRAM

TRY THESE

(Text book Page No. 33)

1. Find the missing values for the following:

S.No.	Length	Breadth	Area	Perimeter	
(i)	12 m	8 m			**Hint :** The perimeter of a rectangle = 2 ($l + b$) units. Area of a rectangle = $l \times b$ sq. units l – length b – breadth of a rectangle.
(ii)	15 cm		90 sq. cm		
(iii)		50 mm		300 mm	
(iv)	12 cm			44 cm	

Sol : (i) Given Length $l = 12$ m ; Breadth $b = 8$ cm

$\therefore$ Area of rectangle = $l \times b$ sq. units $= 12 \times 8$ m^2 $= 96$ m^2

Perimeter of the rectangle = $2 \times (l + b)$ units = $2 \times (12 + 8)$ m = $2 \times 20 = 40$ m

(ii) Given Length $l = 15$ cm ; Area of the rectangle = 90 sq. cm

$l \times b = 90$; $15 \times b = 90$; $b = \frac{90}{15} = 6$ cm

Perimeter of the rectangle = $2 \times (l + b)$ units = $2 \times (15 + 6)$ cm = 2×21 cm = 42 cm

(iii) Given Breadth of rectangle = 50 mm ; Perimeter of the rectangle = 300 mm

$$2 \times (l + b) = 300$$
$$2 \times (l + 50) = 300$$
$$l + 50 = \frac{300}{2} = 150$$
$$l = 150 - 50$$
$$l = 100 \text{ mm}$$

Area = $l \times b$ sq. units = 100×50 mm^2 $= 5000$ mm^2

(iv) Length of the rectangle = 12 cm ; Perimeter = 44 cm

$2(l + b) = 44$

$2(12 + b) = 44$

$12 + b = \frac{44}{2}$

$12 + b = 22$; $b = 22 - 12$; $b = 10$ cm

Area $= l \times b$ sq. units

$= 12 \times 10$ cm^2 $= 120$ cm^2

S.No.	Length	Breadth	Area	Perimeter
(i)	12 m	8 m	96 m^2	40 m
(ii)	15 cm	6 cm	90 sq. cm	42 cm
(iii)	100 mm	50 mm	5000sq.mm	300 mm
(iv)	12 cm	10 cm	120 cm^2	44 cm

2.

S.No.	Side	Area	Perimeter	
(i)	60 m			**Hint :**
(ii)		64 sq. m		Perimeter of a square = $4 \times a$ units.
(iii)			100 mm	Area of a square = $a \times a$ sq. units
				a – is the side of square.

Sol : (i) Given side $a = 60$ cm

Area of the square = $a \times a$ sq.units = 60×60 cm^2 = 3600 cm^2

Perimeter of the square = $4 \times a$ units = 4×60 cm = 240 cm

(ii) Given area of a square = 64 sq. m

$a \times a = 64$

$a \times a = 8 \times 8$

$a = 8$ m

Perimeter = $4 \times a$

$= 4 \times 8$

$= 32$ m

(iii) Given perimeter of the square = 100 mm

$4 \times a = 100$

$a = \frac{100}{4}$ mm

$a = 25$ mm

Area = $a \times a$ sq. units

$= 25 \times 25$ mm^2

$= 625$ mm^2

S.No.	Side	Area	Perimeter
(i)	60 cm	3600 cm^2	240 cm
(ii)	8 m	64 sq. m	32 m
(iii)	25 mm	625 mm^2	100 mm

3.

S.No.	Base	Height	Area	
(i)	13 m	5 m		**Hint :**
(ii)	16 cm		240 sq. cm	Area of the right angled triangle = $\frac{1}{2}(b \times h)$ sq. unit
(iii)		6 mm	84 sq. mm	(b – base; h – height)

Sol : (i) Given base of the right angled triangle = 13 m ; height = 5 m

Area = $\frac{1}{2} \times (b \times h)$ sq. units = $\frac{1}{2} \times (13 \times 5)$ m^2 = $\frac{65}{2}$ m^2 = 32.5 m^2

(ii) Base = 16 cm ; Area = 240 sq. cm ; $\frac{1}{2} \times b \times h = 240$

$\frac{1}{\cancel{2}} \times \cancel{16}^{8} \times h = 240$; $h = \frac{240}{8}$; $h = 30$ cm

(iii) Given height $h = 6$ mm ; Area = 84 sq. mm

$\frac{1}{2} \times b \times h = 84$; $\frac{1}{2} \times b \times 6 = 84$

$b = \frac{84^{28} \times 2}{6_{3}}$; $b = 28$ mm

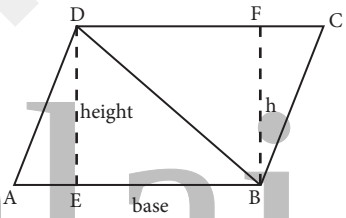
S.No.	Base	Height	Area
(i)	13 m	5 m	32.5 m^2
(ii)	16 cm	30 cm	240 sq. cm
(iii)	28 mm	6 mm	84 sq. mm

Think

(Text book Page No. 35)

1. Explain the area of the parallelogram as sum of the areas of the two triangles.

Sol : ABCD is a parallelogram. It can be divided into two triangles of equal area by drawing the diagonal BD.



Area of the parallelogram ABCD = base × height

$= AB \times DE$

But area of the triangle ABD $= \frac{1}{2} \times$ base × height

$= \frac{1}{2} \times AB \times DE$

Area of triangle CDB $= \frac{1}{2} \times DC \times BF$ [$\because AB = DC, DE = BF$]

$= \frac{1}{2} \times AB \times DE$

Area of parallelogram ABCD $= \frac{1}{2} \times AB \times DE + \frac{1}{2} \times AB \times DE$

= Area of ΔABD + Area of ΔCDB

2. A rectangle is a parallelogram but a parallelogram is not a rectangle. Why?

Sol : For both rectangle and parallelogram

(i) opposite sides are equal and parallel.

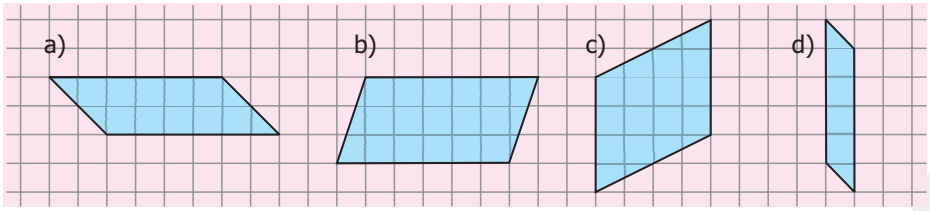
(ii) For rectangle all angles equal to 90°. But for parallelogram opposite angles are equal.

$\therefore$ All rectangles are parallelograms. But all parallelograms are not rectangles as their angles need not be equal to 90°.

TRY THESE

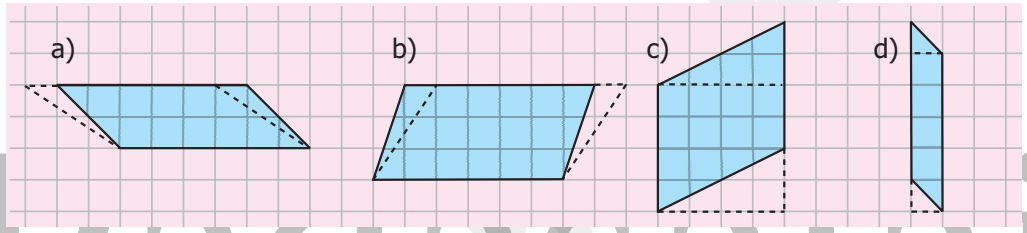
(Text book Page No. 36)

1. Count the squares and find the area of the following parallelograms by converting those into rectangles of the same area. (Without changing the base and height).



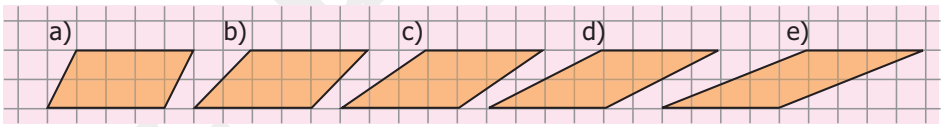
(a) _____ sq. units (b) _____ sq. units
(c) _____ sq. units (d) _____ sq. units

Sol : Converting the given parallelograms into rectangles we get.



(a) 10 sq. units (b) 18 sq. units
(c) 16 sq. units (d) 5 sq. units

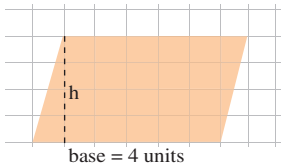
2. Draw the heights for the given parallelograms and mark the measure of their bases and find the area. Analyse your result.



Sol : (a) Area of the parallelogram = $b \times h$ sq. units

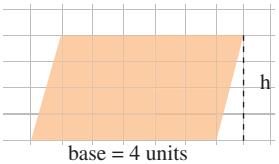
$= 4 \times 2$ sq. units

$= 8$ sq. units



By counting the small squares also we get number of full squares + number of square more than half = 6 + 2 = 8 sq. units.

(b) Area of the parallelogram = base × height = 4 × 2 = 8 sq. units

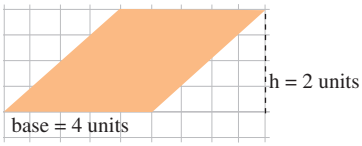


Also area = Number of full squares + $\frac{1}{2}$ [Number of half squares]

$= 6 + \frac{1}{2}(4) = 6 + 2 = 8$ sq. units

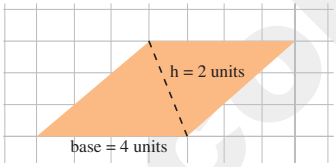
Measurements

(c) Area of the parallelogram = base × height = 4 × 2 = 8 sq. units

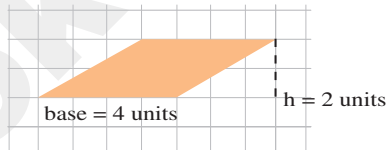


Also area = Number of full squares + Number of squares more than half + $\frac{1}{2}$ Number of half squares = 4 + 4 = 8 sq. units

(d) Area of the parallelogram = (base × height) sq. units
= 4 × 2 sq. units = 8 sq. units
Also area of the parallelogram
= Number of full squares + $\frac{1}{2}$ [Number of half squares] + Number of squares more than half = 4 + 0 + 4 = 8 sq. units

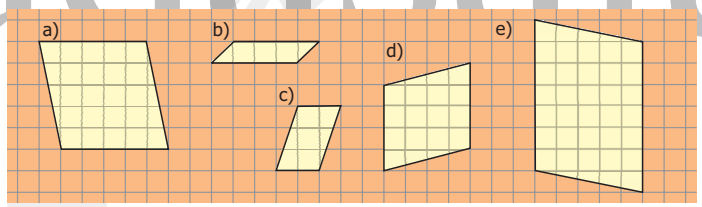


(e) Area of the parallelogram = (base × height) sq. units
= 4 × 2 = 8 sq. units
Also area of the parallelogram = Number of full squares + Number of squares more than half + $\frac{1}{2}$ [Number of half squares] = 2 + 6 = 8 sq. units



Unit 2

3. Find the area of the following parallelograms by measuring their base and height, using formula.



(a) ____ sq. units (b) ____ sq. units (c) ____ sq. units
(d) ____ sq. units (e) ____ sq. units

Sol : (a) Area of the rectangle = (base × height) sq. units
base = 5 units
height = 5 units
∴ Area = (5 × 5) sq. units = 25 sq. units

(b) Area of the rectangle = (base × height) sq. units
base = 4 units
height = 1 unit
∴ Area = 4 × 1 sq. units = 4 sq. units

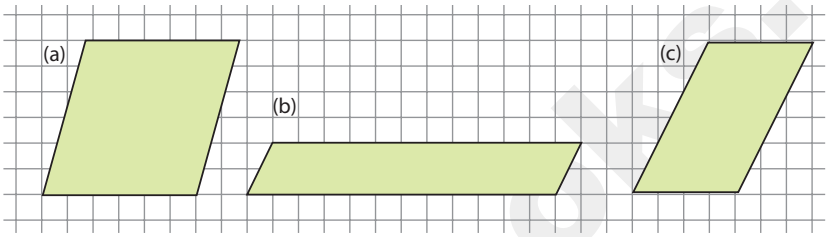
(c) Area of the rectangle = (base × height) sq. units
base = 2 units
height = 3 units
∴ Area = 2 × 3 sq. units = 6 sq. units

(d) Area of the rectangle = (base × height) sq. units
base = 4 units
height = 4 units
∴ Area = 4 × 4 sq. units = 16 sq. units

(e) Area of the parallelogram = (base × height) sq. units
base = 7 units
height = 5 units
∴ Area = 7 × 5 sq. units = 35 sq. units

4. Draw as many parallelograms as possible in a grid sheet with the area 20 square units each.

Sol :

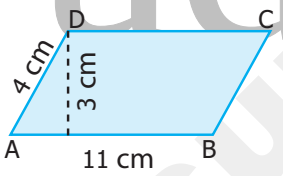


Area of the parallelogram (a), (b) or (c) = 20 sq. units

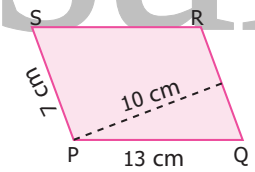
EXERCISE 2.1

1. Find the area and perimeter of the following parallelograms.

(i)



(ii)



Sol : (i) Given base b = 11 cm ; height h = 3 cm

Area of the parallelogram = $b \times h$ sq. units = 11×3 cm^2
= 33 cm^2

Also perimeter of a parallelogram = Sum of 4 sides
= 11 cm + 4 cm + 11 cm + 4 cm = 30 cm

Area = 33 cm^2; Perimeter = 30 cm.

(ii) Given base b = 7 cm [∵ PS = PQ]
height h = 10 cm
Area of the parallelogram = $b \times h$ sq. units
= 7×10 cm^2 = 70 cm^2
Perimeter = Sum of four sides
= 13 cm + 7 cm + 13 cm + 7 cm
= 40 cm

Area = 70 cm^2, Perimeter = 40 cm

2. Find the missing values.

S.No.	Base	Height	Area
(i)	18 cm	5 cm	
(ii)	8 m		56 sq. m
(iii)		17 mm	221 sq. mm

Sol : (i) Given Base $b = 18$ cm ; Height $h = 5$ cm

$\therefore$ Area of the parallelogram $= b \times h$ sq. units

$= 18 \times 5$ cm^2

$= 90$ cm^2

(ii) Base $b = 8$ m ; Area of the parallelogram = 56 sq. m

$b \times h = 56$

$8 \times h = 56$

$h = \frac{56}{8}$

$h = 7$ m

(iii) Given Height h = 17 mm

Area of the parallelogram = 221 sq. mm

$b \times h = 221$

$b \times 17 = 221$

$b = \frac{221}{17}$

$b = 13$ m

Tabulating the results, we get

S.No.	Base	Height	Area
(i)	18 cm	5 cm	90 sq. cm
(ii)	8 m	7 m	56 sq. m
(iii)	13 mm	17 mm	221 sq. mm

3. Suresh on a parallelogram shaped trophy in a state level chess tournament. He knows that the area of the trophy is 735 sq. cm and its base is 21 cm. What is the height of that trophy?

Sol : Given base $b = 21$ cm

Area of parallelogram = 735 sq. cm

$b \times h = 735$

$21 \times h = 735$

$h = \frac{735}{21}$

$h = 35$ cm

$\therefore$ Height of the trophy = 35 cm

4. **Janaki has a piece of fabric in the shape of a parallelogram. Its height is 12 m and its base is 18 m. She cuts the fabric into four equal parallelograms by cutting the parallel sides through its mid-points. Find the area of each new parallelogram.**

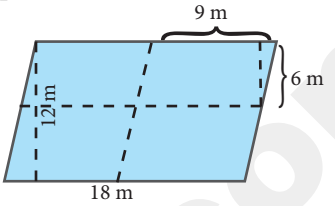
Sol : Area of a parallelogram = (base × height) sq. units

$$\text{Base length} = \frac{18}{2} = 9 \text{ m}$$

$$\text{Height} = \frac{12}{2} = 6 \text{ m}$$

$$\text{Area} = 9 \times 6 = 54 \text{ m}^2$$

Area of each parallelogram = 54 m^2

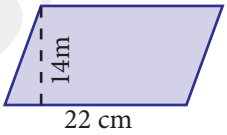


5. **A ground is in the shape of parallelogram. The height of the parallelogram is 14 metres and the corresponding base is 8 metres longer than its height. Find the cost of levelling the ground at the rate of ₹ 15 per sq. m.**

Sol : Height of the parallelogram h = 14 m

Base = 8 m longer than height

= (14 + 8) m = 22 m



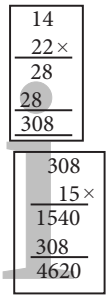
Area of the parallelogram = (base × height) sq. units

= (22 × 14)m^2 = 308 m^2

Cost of levelling 1 m^2 = ₹ 15

Cost of levelling 308 m^2 = 308 × 15 = ₹ 4,620

Cost of levelling the ground = ₹ 4,620



Objective Type Questions

6. **The perimeter of a parallelogram whose adjacent sides are 6 cm and 5 cm is**

(i) 12 cm (ii) 10 cm (iii) 24 cm (iv) 22 cm **[Ans : (iv) 22 cm]**

Hint : = 2(6 + 5) = 2 × 11 = 22 cm

7. **The area of parallelogram whose base 10 m and height 7 m is**

(i) 70 sq. m (ii) 35 sq. m (iii) 7 sq. m (iv) 10 sq. m **[Ans : (i) 70 sq. m]**

Hint : = base × height = 10m × 7m = 70 sq.m

8. **The base of the parallelogram with area is 52 sq. cm and height 4 cm is**

(i) 48 cm (ii) 104 cm (iii) 13 cm (iv) 26 cm **[Ans : (iii) 13 Cm]**

Hint : $\text{base} = \frac{\text{area}}{\text{height}} = \frac{52\text{sq.cm}}{4\text{cm}} = 13\text{cm}$

9. **What happens to the area of the parallelogram if the base is increased 2 times and the height is halved?**

(i) Decreases to half (ii) Remains the same

(iii) Increase by two times (iv) None **[Ans : (ii) Remains the same]**

Hint : Area = $b \times h$ sq. units

New base = 2 × old base

New height = $\frac{1}{2}$ × old height

$\therefore$ New Area = New base × New height = $(2 \times b)\frac{1}{2} \times h = bh$, = old Area

10. In a parallelogram the base is three times its height. If the height is 8 cm then the area is

(i) 64 sq. cm (ii) 192 sq. cm (iii) 32 sq. cm (iv) 72 sq. cm

[Ans : (ii) 192 sq. cm]

Hint : Given $b = 3 \times h$; $h = 8$ cm

Area = $b \times h = 3h \times 8 = 3 \times 8 \times 8 = 192$ cm^2

Additional Questions

1. In the following figure, PQRS is a parallelogram find x and y.

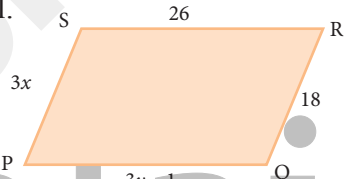
Sol : We know that in a parallelogram opposite sides are equal.

$\therefore 3x = 18$ and $3y - 1 = 26$

$x = \frac{18}{3}$ $3y = 26 + 1 = 27$

$x = 6$ $y = \frac{27}{3}$

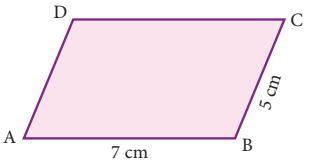
$y = 9$



2. Two adjacent sides of a parallelogram are 5 cm and 7 cm respectively. Find its perimeter.

Sol : Perimeter = AB + BC + CD + AD [$\because$ AB = DC & AD = BC]

= 7 cm + 5 cm + 7 cm + 5 cm = 24 cm

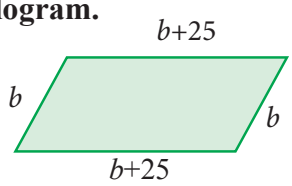


3. The perimeter of a parallelogram is 150 cm. One of its sides is greater than the other by 25 cm. Find the length of the sides of the parallelogram.

Sol : Given perimeter = 150 cm

Let one side of the parallelogram be 'b' cm

Then the other side = $b + 25$ cm



$b + (b + 25) + b + (b + 25) = 150$

$b + b + 25 + b + b + 25 = 150$

$4b + 50 = 150$ $= 4b = 100$

$b = \frac{\cancel{100}^{25}}{\cancel{4}} = 25$

$\therefore$ One side $b = 25$ cm

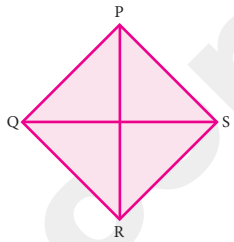
Other side $b + 25 = 50$ cm

RHOMBUS

TRY THESE

(Text book Page No. 41)

1. Observe the figure and answer the following questions.



(i) Name two pairs of opposite sides.

(ii) Name two pairs of adjacent sides.

(iii) Name the two diagonals.

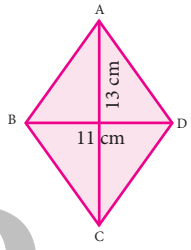
Sol : (i) (a) PQ and RS (b) QR and PS

(ii) (a) PQ and QR (b) PS and RS

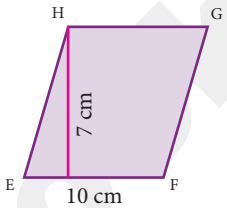
(iii) (a) PR and QS are diagonals.

2. Find the area of the rhombus given in (i) and (ii).

(i)



(ii)



Sol :

(i) Area of the rhombus $= \frac{1}{2}(d_1 + d_2)$ $= \frac{1}{2}(11+13)$ sq. units $= \frac{1}{2} \times (24)$ cm^2

$= 12\ cm^2$

(ii) Base = 10 cm ; Height = 7 cm

Area of the rhombus = $b \times h$ sq. units = $10 \times 7\ cm^2 = 70\ cm^2$

Think

(Text book Page No. 41)

1. Can you find the perimeter of the rhombus?

Sol : If we know the length of one side we can find the perimeter using 4 × side units.

2. Can diagonals of a rhombus be of the same length?

Sol : When the diagonals of a rhombus become equal it become a square.

3. A square is a rhombus but a rhombus is not a square. Why?

Sol : In a square (i) all sides are equal.
(ii) opposite sides are parallel
(iii) diagonals divides the square into 4 right angled triangles of equal area
(iv) the diagonals bisect each other at right angles.

So it become a rhombus also.

But in a rhombus (i) each angle need not equal to 90°.
(ii) the length of the diagonals need not be equal.

Therefore it does not become a square.

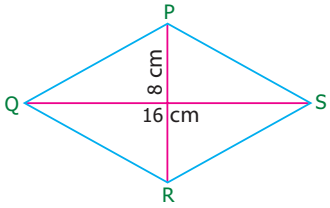
4. Can you draw a rhombus in such a way that the side is equal to the diagonal.

Sol : Yes, we can draw a rhombus with one of its diagonals equal to its side length. In such case the diagonal will divide the rhombus into two congruent equilateral triangles.

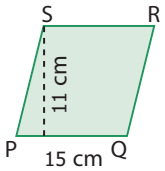
Exercise 2.2

1. Find the area of rhombus PQRS shown in the following figures.

(i)



(ii)



Sol : (i) Given the diagonals $d_1 = 16$ cm ; $d_2 = 8$ cm

Area of the rhombus $= \frac{1}{2}(d_1 \times d_2)$ sq. units

$= \frac{1}{\cancel{2}} \times 16 \times \cancel{8}^{4}$ cm^2 $= 64$ cm^2

Area of the rhombus $= 64$ cm^2

(ii) Given base $b = 15$ cm ; Height $h = 11$ cm

Area of the rhombus = (base × height) sq. units

$= 15 \times 11$ cm^2 $= 165$ cm^2

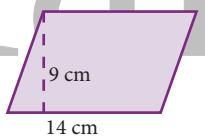
Area of the rhombus $= 165$ cm^2

2. Find the area of a rhombus whose base is 14 cm and height is 9 cm.

Sol : Given base $b = 14$ cm ; Height $h = 9$ cm

Area of the rhombus $= b \times h$ sq. units

$= 14 \times 9$ cm^2 $= 126$ cm^2



3. Find the missing value.

S.No.	Diagonal (d_1)	Diagonal (d_2)	Area
(i)	19 cm	16 cm	
(ii)	26 m		468 sq. m
(iii)		12 mm	180 sq. mm

Sol : (i) Given diagonal $d_1 = 19$ cm ; $d_2 = 16$ cm

Area of the rhombus $= \frac{1}{2}(d_1 \times d_2)$ sq. units $= \frac{1}{\cancel{2}_1} \times 19 \times \cancel{16}^{8}$

$= 152$ cm^2

(ii) Given diagonal $d_1 = 26$ m ; Area of the rhombus = 468 sq. m

$\frac{1}{2} \times (d_1 \times d_2) = 468$; $(26 \times d_2) = 468 \times 2$

$d_2 = \frac{\overset{36}{\cancel{468} \times \cancel{2}}}{\cancel{26}_{13}}$ $= d_2 = 36$ m

(iii) Given the diagonal $d_2 = 12$ mm ; Area of the rhombus = 180 sq. mm

$$\frac{1}{2} \times (d_1 \times d_2) = 180$$

$$\frac{1}{2}(d_1 \times 12) = 180$$

$$d_1 \times 12 = 180 \times 2$$

$$d_1 = \frac{\overset{15}{\cancel{180}} \times 2}{\cancel{12}}$$

$$d_1 = 30 \text{ mm}$$

Diagonal $d_1 = 30$ mm

Tabulating the results we have

S.No.	Diagonal (d_1)	Diagonal (d_2)	Area
(i)	19 cm	16 cm	152 sq. cm
(ii)	26 m	36 m	468 sq. m
(iii)	30 mm	12 mm	180 sq. mm

4. The area of a rhombus is 100 sq. cm and length of one of its diagonals is 8 cm. Find the length of the other diagonal.

Sol : Given the length of one diagonal $d_1 = 8$ cm ; Area of the rhombus = 100 sq. cm

$$\frac{1}{2}(d_1 \times d_2) = 100$$

$$\frac{1}{2} \times 8 \times d_2 = 100$$

$$8 \times d_2 = 100 \times 2$$

$$d_2 = \frac{\overset{25}{\cancel{100}} \times \cancel{2}}{\cancel{8}_4} = 25 \text{ cm}$$

Length of the other diagonal $d_2 = 25$ cm

5. A sweet is in the shape of rhombus whose diagonals are given as 4 cm and 5 cm. The surface of the sweet should be covered by an aluminum foil. Find the cost of aluminum foil used for 400 such sweets at the rate of ₹ 7 per 100 sq. cm.

Sol : Diagonals $d_1 = 4$ cm and $d_2 = 5$ cm

Area of one rhombus shaped sweet $= \frac{1}{2} \times (d_1 \times d_2)$ sq. units $= \frac{1}{\cancel{2}} \times \overset{2}{\cancel{4}} \times 5$ cm^2 $= 10$ cm^2

Aluminum foil used to cover 1 sweet = 10 cm^2

$\therefore$ Aluminum foil used to cover 400 sweets $= 400 \times 10 = 4000$ cm^2

Cost of aluminum foil for 100 cm^2 = ₹ 7

$\therefore$ Cost of aluminum foil for 4000 cm^2 $= \frac{\cancel{4000}}{\cancel{100}} \times 7 =$ ₹ 280

$\therefore$ Cost of aluminum foil used = ₹ 280.

Objective Type Questions

6. **The area of the rhombus with side 4 cm and height 3 cm is**

(i) 7 sq. cm (ii) 24 sq. cm (iii) 12 sq. cm (iv) 10 sq. cm

[Ans : (iii) 12 sq. cm]

Hint : Area = Base × Height = $4 \times 3 = 12$ cm^2

7. **The area of the rhombus when both diagonals measuring 8 cm is**

(i) 64 sq. cm (ii) 32 sq. cm (iii) 30 sq. cm (iv) 16 sq. cm

[Ans : (ii) 32 sq. cm]

Hint : Area $= \frac{1}{2} \times (d_1 \times d_2) = \frac{1}{2} \times 8 \times 8 = 32$

8. **The area of the rhombus is 128 sq. cm. and the length of one diagonal is 32 cm. The length of the other diagonal is**

(i) 12 cm (ii) 8 cm (iii) 4 cm (iv) 20 cm

[Ans : (ii) 8 cm]

Hint : $\frac{1}{2} \times d_1 \times d_2 = 128 \Rightarrow d_2 = \frac{\cancel{128} \times 2}{\cancel{32}} = 8$ cm

9. **The height of the rhombus whose area 96 sq. m and side 24 m is**

(i) 8 m (ii) 10 m (iii) 2 m (iv) 4 m **[Ans : (iv) 4 m]**

Hint : Area = Base × height = $96 \Rightarrow$ height $= \frac{96}{24} = 4$

10. **The angle between the diagonals of a rhombus is**

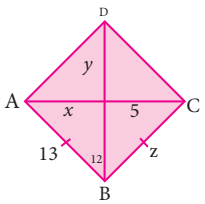
(i) 120° (ii) 180° (iii) 90° (iv) 100° **[Ans : (iii) 90°]**

Hint : Angles of a rhombus bisect at right angles.

Unit 2

Additional Questions

1. **ABCD is a rhombus. Find *x*, *y*, and *z*.**



Sol : We know that all sides of rhombus are equal and its diagonals bisect each other.

$\therefore x = 5, y = 12$ and $z = 13$.

2. **Find the altitude of the rhombus whose area is 315 cm^2 and its perimeter is 180 cm.**

Sol : Given perimeter of the rhombus = 180 cm

$\therefore$ One side of the rhombus $= \frac{180}{4} = 45$ cm

Given area of the rhombus = 315 cm^2

$b \times h = 315$

$45 \times h = 315 = \frac{315}{45}$

$h = 7$cm

Altitude of the rhombus = 7 cm

3. The floor of a building consists of 2000 tiles which are rhombus shaped and each of its diagonals are 40 cm and 25 cm. Find the total cost of polishing the floor, if the cost per m^2 = ₹ 5.

Sol : Area of each tile = $\frac{1}{2} \times d_1 \times d_2$ sq. units

$= \frac{1}{\cancel{2}} \times \cancel{40}^{20} \times 25 \text{ cm}^2 = 500 \text{ cm}^2$

$\therefore$ Area of 2000 tiles = $500 \times 2000 = 10{,}00{,}000 \text{ cm}^2 = 100 \text{ m}^2$

Cost of polishing 1 m^2 = ₹ 5

$\therefore$ Cost of polishing 100 $m^2 = 5 \times 100$ = ₹ 500

Think

(Text book Page No. 46)

1. Can you find the perimeter of the trapezium? Discuss.

Sol : If all sides are given, then by adding all the four lengths we can find the perimeter of a trapezium.

2. In which case a trapezium can be divided into two equal triangles?

Sol : If two parallel sides are equal in length. Then it can be divided into two equal triangles.

3. Mention any three life situations where the isosceles trapeziums are used?

Sol : (i) Glass of a car windows.
(ii) Eye glass (glass in spectacles)
(iii) Some bridge supports.
(iv) Sides of handbags.

Exercise 2.3

1. Find the missing values.

S.No.	Height '*h*'	Parallel side '*a*'	Parallel side '*b*'	Area
(i)	10 m	12 m	20 m	
(ii)		13 cm	28 cm	492 sq. cm
(iii)	19 m		16 m	323 sq. m
(iv)	16 cm	15 cm		360 sq. cm

Solution :

(i) Given Height $h = 10$ m ; Parallel sides $a = 12$ m ; $b = 20$ m

Area of the Trapezium = $\frac{1}{2} h(a+b)$ sq. units = $\frac{1}{\cancel{2}} \times \cancel{10}^{5} \times (12+20) \text{m}^2$

$= (5 \times 32) \text{ m}^2 = 160 \text{ m}^2$

(ii) Given the parallel sides $a = 13$ cm ; $b = 28$ cm

Area of the trapezium = 492 sq. cm

$$\frac{1}{2} \times h(a+b) = 492$$

$$\frac{1}{2} \times h \times (13+28) = 492$$

Measurements

$$h \times 41 = 492 \times 2$$

$$h = \frac{\cancel{492}^{12} \times 2}{\cancel{41}_{1}}$$

$$h = 24 \text{ cm}$$

(iii) Given height 'h' = 19 m ; Parallel sides b = 16 m

Area of the trapezium = 323 sq. m

$$\frac{1}{2} \times h \times (a+b) = 323$$

$$\frac{1}{2} \times 19 \times (a+16) = 323$$

$$a + 16 = \frac{\cancel{323}^{17} \times 2}{\cancel{19}^{1}} = 34$$

$$a = 34 - 16 = 18 \text{ m}$$

$$a = 18 \text{ m}$$

(iv) Given the height h = 16 cm ; Parallel sides a = 15 cm

Area of the trapezium = 360 sq. cm

$$\frac{1}{2} \times h \times (a+b) = 360$$

$$\frac{1}{\cancel{2}} \times \cancel{16}^{8} \times (15+b) = 360$$

$$15 + b = \frac{\overset{45}{\cancel{360}}}{8} = 45$$

$$b = 45 - 15 = 30$$

$$b = 30 \text{ cm}$$

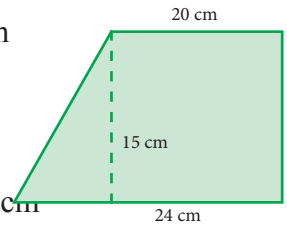
Tabulating the results we get

S.No.	Height 'h'	Parallel side 'a'	Parallel side 'b'	Area
(i)	10 cm	12 m	20 m	160 m^2
(ii)	24 cm	13 cm	28 cm	492 sq. cm
(iii)	19 m	18 m	16 m	323 sq. m
(iv)	16 cm	15 cm	30 cm	360 sq. cm

2. Find the area of a trapezium whose parallel sides are 24 cm and 20 cm and the distance between them is 15 cm.

Sol : Given the parallel sides a = 24 cm; b = 20 cm

Distance between a and b is 'h' = 15 cm



$$\text{Area of the trapezium} = \frac{1}{2} \times h \times (a+b)$$

$$= \frac{1}{2} \times 15 \times (24+20) \text{ cm}$$

$$= \frac{1}{\cancel{2}_{1}} \times 15 \times \cancel{44}^{22} = 330 \text{ cm}^2$$

Area of the trapezium = 330 cm^2

3. The area of a trapezium is 1586 sq. cm. The distance between its parallel sides is 26 cm. If one of the parallel sides is 84 cm then find the other side.

Sol : Given one parallel side = 84 cm. Let the other parallel side be 'b' cm.

Distance between a and b is h = 26 cm.

Area of the trapezium = 1586 sq. cm.

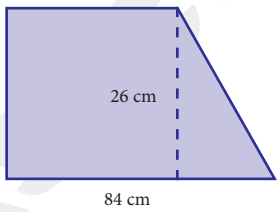
$$\frac{1}{2}\times h\times(a+b) = 1586$$

$$\frac{1}{\cancel{2}}\times \cancel{26}^{13}\times(84+b) = 1586$$

$$84 + b = \frac{\cancel{1586}^{122}}{\cancel{13}_{1}}$$

$$84 + b = 122$$

$$b = 122 - 84 = 38 \text{ cm}$$



$\therefore$ The other parallel side = 38 cm.

4. The area of a trapezium is 1080 sq. cm. If the lengths of its parallel sides are 55.6 cm and 34.4 cm. Find the distance between them.

Sol : Length of the parallel sides a = 55.6 cm ; b = 34.4 cm

Area of the trapezium = 1080 sq. cm

$$\frac{1}{2}\times h\times(a+b) = 1080$$

$$\frac{1}{2}\times h\times(55.6+34.4) = 1080$$

$$\frac{1}{\cancel{2}}\times h\times \cancel{90.0}^{45} = 1080$$

$$h = \frac{\cancel{1080}^{24}}{\cancel{45}} = 24 \text{ cm}$$

Distance between parallel sides = 24 cm.

5. The area of a trapezium is 180 sq. cm and its height is 9 cm. If one of the parallel sides is longer than the other by 6 cm. Find the length of the parallel sides.

Sol : Let one of the parallel side be 'a' cm. Given one parallel sides is longer than the other by 6 cm.

i.e. $b = a + 6$ cm

Also given height 'h' = 9 cm

Area of the trapezium = 180 sq. cm

$$\frac{1}{2}\times h\times(a+b) = 180 \text{ cm}^2$$

$$\frac{1}{2}\times 9\times(a+a+6) = 180$$

$$\frac{1}{2}\times 9\times(2a+6) = 180$$

Measurements

$$2a + 6 = \frac{\overset{20}{\cancel{180} \times 2}}{\cancel{9}} = 20 \times 2$$

$$2a + 6 = 40$$

$$2a = 40 - 6 = 34$$

$$a = \frac{34}{2} = 17 \text{ cm}$$

$$b = a + 6 = 17 + 6 = 23 \text{ cm}$$

$\therefore$ The parallel sides are $a = 17$ cm and $b = 23$ cm

6. The sunshade of a window is in the form of isoceles trapezium whose parallel sides are 81 cm and 64 cm and the distance between them is 6 cm. Find the cost of painting the surface at the rate of ₹ 2 per sq. cm.

Sol : Given the parallel sides $a = 81$ cm ; $b = 64$ cm

Distance between 'a' and 'b' is height $h = 6$ cm

$$\text{Area of the trapezium} = \frac{1}{2} \times h(a+b) \text{ sq. units}$$

$$= \frac{1}{\cancel{2}} \times \cancel{6}^{3} \times (81+64) = 3 \times 145 \text{ cm}^2 = 435 \text{ cm}^2$$

Cost of painting 1 cm^2 = ₹ 2

Cost of painting 435 cm^2 = ₹ 435×2 = ₹ 870

$\therefore$ Cost of painting = ₹ 870

7. A window is in the form of trapezium whose parallel sides are 105 cm and 50 cm respectively and the distance between the parallel sides is 60 cm. Find the cost of the glass used to cover the window at the rate of ₹ 15 per 100 sq. cm.

Sol : Given the parallel sides $a = 105$ cm ; $b = 50$ cm ; Height = 60 cm

$$\text{Area of the trapezium} = \frac{1}{2} \times h \times (a+b) \text{ sq. units} = \frac{1}{\cancel{2}} \times \overset{30}{\cancel{60}} \times (105+50) \text{ cm}^2$$

$$= 30 \times 155 \text{ cm}^2 = 4650 \text{ cm}^2$$

For 100 cm^2 cost of glass used = ₹ 15

$\therefore$ For 4650 cm^2 cost of glass = ₹ $\frac{4650}{100} \times 15$ = ₹ 697.50

Cost of the glass used = ₹ 697.50

Objective Type Questions

8. The area of the trapezium, if the parallel sides are measuring 8 cm and 10 cm and the height 5 cm is

(i) 45 sq. cm (ii) 40 sq. cm (iii) 18 sq. cm (iv) 50 sq. cm

[Ans: (i) 45 sq. cm]

Hint : $\frac{1}{2} \times h \times (a+b) = \frac{1}{2} \times 5 \times (10+8) = 45$

9. **In a trapezium if the sum of the parallel sides is 10 m and the area is 140 sq.m, then the height is**

(i) 7 cm (ii) 40 cm (iii) 14 cm (iv) 28 cm

[Ans: (iv) 28 cm]

Hint : Area $= \frac{1}{2} \times h \times (a + b) \Rightarrow 140 = \frac{1}{2} \times h \times 10 \Rightarrow h = 28$

10. **When the non-parallel sides of a trapezium are equal then it is known as**

(i) a square (ii) a rectangle

(iii) an isoceles trapezium (iv) a parallelogram

[Ans: (iii) an isoceles trapezium]

Exercise 2.4

Miscellaneous Practice Problems

1. **The base of the parallelogram is 16 cm and the height is 7 cm less than its base. Find the area of the parallelogram.**

Sol : In a parallelogram

Given base $b = 16$ cm ; height h = base – 7 cm = 16 – 7 = 9 cm

Area of the parallelogram = (base × height) sq. units

$= 16 \times 9 \text{ cm}^2 = 144 \text{ cm}^2$

Area of the parallelogram = 144 cm^2

2. **An agricultural field is in the form of a parallelogram, whose area is 68.75 sq. hm. The distance between the parallel sides is 6.25 cm. Find the length of the base.**

Sol : Height of the parallelogram = 6.25 hm

Area of the parallelogram = 68.75 sq. hm

$b \times h = 68.75$

$b \times 6.25 = 68.75$

$b = \frac{68.75}{6.25} = \frac{6875}{625} = 11$ km

$\frac{6875^{275^{11}}}{625_{25_1}}$

Length of the base = 11 km.

3. **A square and a parallelogram have the same area. If the side of the square is 48m and the height of the parallelogram is 18 m. Find the length of the base of the parallelogram.**

Sol : Given side of the square is 48 m

Area of the square = (side × side) sq. unit $= 48 \times 48 \text{ m}^2$

Height of the parallelogram = 18 m

Area of the parallelogram = 'bh' sq. units = $b \times 18 \text{ m}^2$

Also area of the parallelogram = Area of the square

$b \times 18 = 48 \times 48$

$b = \frac{48^{24^{8}} \times 48^{16}}{18_{9_{3}}} = 8 \times 16 = 128$ m

Base of the parallelogram = 128 m

Measurements

4. The height of the parallelogram is one fourth of its base. If the area of the parallelogram is 676 sq. cm, find the height and the base.

Sol : Let the base of the parallelogram be 'b' cm

4	676
13	169
	13

Given height = $\frac{1}{4}\times$ base ; Area of the parallelogram = 676 sq. cm

$$b \times h = 676$$
$$b \times \frac{1}{4}b = 676$$
$$b \times b = 676 \times 4$$
$$b \times b = 13 \times 13 \times 4 \times 4$$
$$b = 13 \times 4 \text{ cm} = 52 \text{ cm}$$
$$\text{Height} = \frac{1}{4}\times 52 \text{ cm} = 13 \text{ cm}$$

Height = 13 cm, Base = 52 cm

5. The area of the rhombus is 576 sq. cm and the length of one of its diagonal is half of the length of the other diagonal then find the length of the diagonal.

Sol : Let one diagonal of the rhombus = d_1 cm

The other diagonal $d_2 = \frac{1}{2}\times d_1$ cm

Area of the rhombus = 576 sq. cm

$$\frac{1}{2}\times(d_1 \times d_2) = 576$$
$$\frac{1}{2}\times(d_1 \times \frac{1}{2}d_1) = 576$$
$$d_1 \times d_1 = 576 \times 2 \times 2 = 6 \times 6 \times 4 \times 4 \times 2 \times 2$$
$$d_1 \times d_1 = \underline{6 \times 4 \times 2} \times \underline{6 \times 4 \times 2}$$
$$d_1 = 6 \times 4 \times 2$$
$$d_1 = 48 \text{ cm}$$
$$d_2 = \frac{1}{2}\times 48 = 24 \text{ cm}$$

$\therefore$ Length of the diagonals $d_1 = 48$ cm and $d_2 = 24$ cm.

6. A ground is in the form of isoceles trapezium with parallel sides measuring 42 m and 36 m long. The distance between the parallel sides is 30 m. Find the cost of levelling it at the rate of ₹ 135 per sq. m.

Sol : Parallel sides of the trapezium $a = 42$ m ; $b = 36$ m

Also height $h = 30$ m

$$\text{Area of the trapezium} = \frac{1}{2}\times h \times (a+b) \text{ sq. unit}$$
$$= \frac{1}{2}\times 30 \times (42+36) \text{ m}^2$$

$$= \frac{1}{\cancel{2}_1} \times 30 \times \cancel{78}^{39} \text{ m}^2$$

1170
135
5850
3510
1170
1,57,950

Area = 1,170 m^2

Cost of levelling 1 m^2 = ₹ 135

∴ Cost of levelling 1170 m^2 = ₹ 1170 × 135 = ₹ 1,57,950

Cost of levelling the ground = ₹ 1,57,950

Challenge Problems

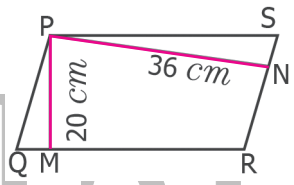
7. In a parallelogram PQRS (See the diagram) PM and PN are the heights corresponding to the sides QR and RS respectively. If the area of the parallelogram is 900 sq. cm and the length of PM and PN are 20 cm and 36 cm respectively, find the length of the sides QR and SR.

Sol : Considering QR as base of the parallelogram height h_1 = 20 cm

Area of the parallelogram = 900 cm^2

$b_1 \times h_1 = 900$; $b_1 \times 20 = 900$

$$b_1 = \frac{\cancel{900}^{45}}{\cancel{20}} = 45 \text{ cm}$$



Again considering SR as base

height = 36 cm ; Area = 900 cm^2

$b_2 \times h_2 = 900$; $b_2 \times 36 = 900$

$$b_2 = \frac{900}{36}$$

b_2 = 25 cm

SR = 25 cm ; QR = 45 cm ; SR = 25 cm

8. If the base and height of a parallelogram are in the ratio 7:3 and the height is 45 cm, then fixed the area of the parallelogram.

Sol :

Given base ; height = 7:3

Let base = 7x cm

height = 3x cm

also given height = 45 cm

3x = 45 cm

$$x = \frac{45}{3} = 15$$

Now base = 7x cm = 7 × 15 cm = 105 cm

Area of the parallelogram = $b \times h$ sq. unit

= 105 × 45 = 4725 cm^2

Area of the parallelogram = 4725 cm^2

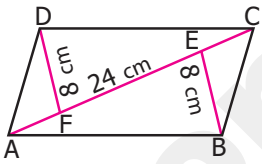
9. Find the area of the parallelogram ABCD if AC is 24 cm and BE = DF = 8 cm.

Sol : Area of the parallelogram ABCD = Area of the triangle ABC + Area of the triangle ADC

Area of the triangle $= \frac{1}{2} \times$ (base × height) sq. units

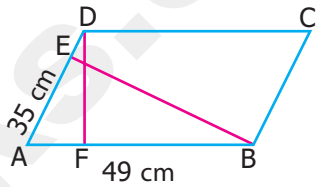
Area of $\Delta ABC = \frac{1}{\cancel{2}} \times \overset{12}{\cancel{24}} \times 8\ cm^2 = 96\ cm^2$

Area of $\Delta ADC = \frac{1}{\cancel{2}} \times \overset{12}{\cancel{24}} \times 8\ cm^2 = 96\ cm^2$



Area of the parallelogram ABCD = 96 + 96 = 192 cm^2

10. The area of the parallelogram ABCD is 1470 sq. cm. If AB = 49 cm and AD = 35 cm then, find the height, DF and BE.



Sol : Area of the parallelogram = 1470 sq. cm

Considering AB = base = 49 cm

height = DF

Area = base × height

$49 \times DF = 1470$

$DF = \frac{1470}{49}$

$\frac{\cancel{1470}^{\overset{30}{\cancel{210}}}}{\cancel{49}_{\cancel{7}_1}}$

DF = 30 cm

Now considering AD as base

Base = AD = 35 cm ; height = BE

Base × Height = 1470

$35 \times BE = 1470$; $BE = \frac{1470}{35}$

$\frac{\cancel{1476}^{\overset{42}{\cancel{210}}}}{\cancel{35}_{\cancel{5}_1}}$

BE = 42 cm ; DF = 30 cm ; BE = 42 cm

11. One of the diagonals of a rhombus is thrice as the other. If the sum of the length of the diagonals is 24 cm, then find the area of the rhombus.

Sol : Let one of the diagonals of rhombus be 'd_1' cm and the other be d_2 cm.

Give $d_1 = 3 \times d_2$

Also $d_1 + d_2 = 24$ cm

$\Rightarrow 3d_2 + d_2 = 24$

$4d_2 = 24$

$\frac{\overset{6}{\cancel{24}}}{\cancel{4}}$

$d_2 = 6$ cm

$d_1 = 3 \times d_2 = 3 \times 6$

$d_1 = 18$ cm

$\therefore$ Area of the rhombus $= \frac{1}{2} \times d_1 \times d_2$ sq. units

$= \frac{1}{2} \times 18 \times 6\ cm^2 = 54\ cm^2$

Area of the rhombus $= 54\ cm^2$

12. A man has to build a rhombus shaped swimming pool. One of the diagonal is 13 m and the other is twice the first one. Then find the area of the swimming pool and also find the cost of cementing the floor at the rate of ₹ 15 per sq. cm.

Sol :

Let the first diagonal d_1 = 13 m

d_2 = 2 × 13 m = 26 m

Area of the rhombus = $\frac{1}{2} \times d_1 \times d_2$ sq. units

= $\frac{1}{\cancel{2}} \times 13 \times \cancel{26}^{13}$ m^2 = 169 m^2

Cost of cementing 1 m^2 = ₹15

Cost of cementing 169 m^2 = ₹ 169 × 15 = ₹ 2,535

Cost of cementing = ₹ 2,535

13. Find the height of the parallelogram whose base is four times the height and whose area is 576 sq. cm.

Sol : Let the height be 'h' and base be 'b' units

Given b = $4 \times h$

Area of the parallelogram = 576 sq. cm

$b \times h$ = 576

$4h \times h$ = 576

$h \times h$ = $\frac{576}{4}$ = 144

$h \times h$ = 12×12

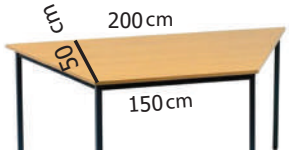
h = 12 cm

$\cancel{576}^{144}$ / $\cancel{4}1_1$

Height = 12 cm; base = 4 × 12 = 48 cm

14. The table top is in the shape of a trapezium with measurements given in the figure. Find the cost of the glass used to cover the table at the rate of ₹ 6 per 10 sq. cm.

Sol :



Length of the parallel sides a = 200 cm

b = 150 cm

Height h = 50 cm

Area of the trapezium = $\frac{1}{2} \times h\,(a + b)$ sq. units

= $\frac{1}{2} \times 50\ (200 + 150)$ cm^2

= $\frac{1}{2} \times 50 \times 350$ cm^2 = 8750 cm^2

Cost for 10 sq. cm glass = ₹ 68

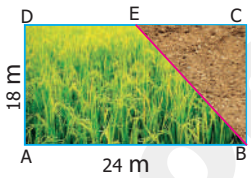
∴ Cost of 8750 cm^2 glass = $\frac{8750}{10} \times 6$

= ₹ 5250

Cost of glass used = ₹ 5,250

15. Arivu has a land ABCD with the measurements given in the figure. If a portion ABED is used for cultivation (where E is the midpoint of DC). Find the cultivated area.

Sol : From the figure given ABED is a trapazium with height



h = 18 m

One of the parallel side a = 24 m

Since E is the midpoint of D.

Other parallel side b = $\frac{24}{2}$ = 12 m

$\therefore$ Area of the cultivated ADEB = $\frac{1}{2} \times h(a+b)\ m^2$ = $\frac{1}{\cancel{2}} \times \overset{9}{\cancel{18}}(24+12)$

= $9 \times 36\ m^2 = 324\ m^2$

Area of cultivation = $324\ m^2$

Unit Test

Time: 1 hrs **Section A** **Max Marks : 25**

I. Choose the best answer from the options given below. **5 × 1 = 5**

1. The height of the parallelogram whose area is 246 cm^2 and base 20 cm.
   (a) 1.23 cm (b) 13.2 cm (c) 12.3 cm (d) 1.32 cm

2. Area of the trapezium with height 10 cm, top 4 cm and bottom 6 cm is
   (a) 40 cm^2 (b) 50 cm^2 (c) 35 cm^2 (d) 20 cm^2

3. If the parallel sides of a parallelogram are 2 cm apart and their sum is 10 cm, then its area is
   (a) 20 cm^2 (b) 5 cm^2 (c) 10 cm^2 (d) none

4. If length = 4 cm and height is 3 cm area of the parallelogram is
   (a) 14 cm^2 (b) 7 cm^2 (c) 10 cm^2 (d) 12 cm^2

5. Find the height if area of the parallelogram is 564 cm^2 and its base is 30 cm.
   (a) 56.4 cm^2 (b) 94 cm^2 (c) 18.8 cm^2 (d) 188 cm^2

II. Fill in the blanks. **5 × 1 = 5**

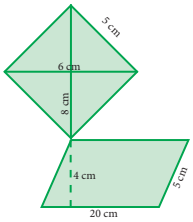
6. A parallelogram with one pair of _____ is known as a trapezium.
7. The distance between the parallel sides is _____ of the trapezium.
8. If the non parallel sides are equal then it is an _____ trapezium.
9. The diagonals of the rhombus divide it into four _____ of equal area.
10. In rhombus the diagonal bisect each other at _____.

III. Answer the following question **5 × 2 = 10**

11. The area of a trapezium is 960 cm^2. If the parallel sides are 34 cm and 46 cm find the distance between them.
12. Find the area of trapezium whose parallel sides are 10 cm and 15 cm and are at a distance of 6 cm from each other.
13. Find the sum of the lengths of the bases of a trapezium whose area is 4.2 m^2 and whose height is 280 cm.
14. Given the base is 15 cm, height is 8 cm, other parallel side is 9 cm. Find the area.
15. Find the area of the trapezium, whose parallel sides are 16 cm, and 22 cm and height is 12 cm.

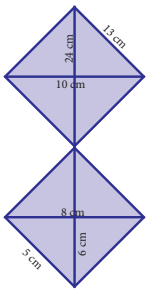
IV. Answer the following question **1 × 5 = 5**

16. (a) Find the area and perimeter of the following.



(or)

(b) Find the area and perimeter of the following.



Unit 2

ANSWERS

1. (a) 12.3 cm
2. (b) 50 cm^2
3. (c) 10 cm^2
4. (d) 12 cm^2
5. (c) 18.8 cm^2

II.
6. non parallel sides
7. height
8. isoceles
9. right angled triangles
10. right angle

III.
11. 24 cm
12. 75 cm^2
13. 3 m
14. 96 cm^2
15. 2.28 cm

IV.
16. (a) 10.4 cm^2, 70 cm
(b) 144 cm^2, 72 cm