ST. LAWRENCE HIGH SCHOOL

A JESUIT CHRISTIAN MINORITY INSTITUTION

CLASS 8

SUBJECT : Algebra & Geometry

Study Material 4

Area of Rectilinear Figures

Date:7.5.2020

AREA OF RECTILINEAR FIGURES

Synopsis

- **Perimeter:** The length of the boundary of a plane figure is called its perimeter.
- **Area:** The amount of surface enclosed by a plane figure is called its area.
- **Rectangle:** Given a rectangle of length 'l' units and breadth 'b' units,
  - (i) Perimeter of the rectangle = $2(l + b)$ units
  - (ii) Diagonal of the rectangle, $d = \sqrt{l^2 + b^2}$ units
  - (iii) Area of the rectangle = $(l \times b)$ sq. units
  - (iv) Length = $\left(\frac{\text{area}}{\text{breadth}}\right)$ units
  - (v) Breadth = $\left(\frac{\text{area}}{\text{length}}\right)$ units
- **Area of four walls of room:** Let there be a room with length 'l' units, breadth 'b' units and height 'h' units.

  Then (i) Area of four walls = $2(l + b) \times h$ sq. units

  (ii) Diagonal of room = $\sqrt{l^2 + b^2 + h^2}$ units
- **Perimeter and area of a square:** Let each side of a square be 'a' units. Then
  - (i) Perimeter of the square = $(4a)$ units
  - (ii) Diagonal of the square $= \sqrt{a^2 + a^2} = \sqrt{2a^2} = a\sqrt{2}$ units
  - (iii) Area of the square = a^2 sq. units
  - (iv) Area of the square $= \frac{1}{2} \times (\text{diagonal})^2$ sq. units
  - (v) Side of the square $= \sqrt{\text{Area}}$ units
- **Perimeter and area of a triangle:**
  - (i) Let 'a', 'b' and 'c' be the lengths of sides of a triangle. Then, perimeter of the triangle is given by $(a + b + c)$ units.

    $s = \frac{1}{2}(a + b + c)$ is called semi-perimeter of the triangle.

(ii) Area of the triangle $= \sqrt{s(s-a)(s-b)(s-c)}$ sq. units

(iii) Let the base of a triangle be 'b' units and its corresponding height (or altitude) be 'h' units.

Then the area of the triangle $= \left(\frac{1}{2} \times b \times h\right)$ sq. units

> ***Note:*** **We may consider any side of the triangle as its base.**
> **Then the corresponding height would be the length of the perpendicular to this side from the opposite vertex.**

(iv) Area of an equilateral triangle with each side 'a' units $= \left(\frac{\sqrt{3}}{4} \times a^2\right)$ sq. units

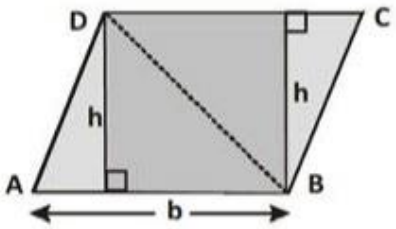
(v) Height of an equilateral triangle of side 'a' units $= \left(\frac{\sqrt{3}a}{2}\right)$ units

(vi) Area of a right triangle $= \frac{1}{2} \times$ (product of legs) sq. units

> ***Note:*** **The sides containing the right angle are known as legs of a right triangle.**

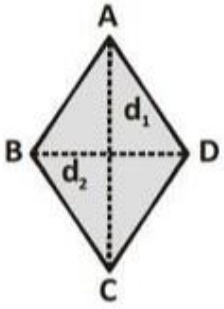
- **Area of a parallelogram:** Let ABCD be a parallelogram with base 'b' units and height 'h' units.

  Then area of parallelogram = (base × height) sq. units



- **Area of a rhombus:** Let ABCD be a rhombus in which diagonal AC = d_1 units and diagonal BD = d_2 units.

  Then area of rhombus ABCD $= \left(\frac{1}{2} \times d_1 \times d_2\right)$ sq. units.

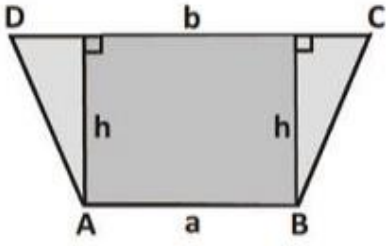


- **Area of a trapezium:** Let ABCD be a trapezium in which AB || DC. Let AB be 'a' units and DC be 'b' units.

  Then area of trapezium ABCD

  $= \frac{1}{2} \times$ (sum of parallel sides) × distance between them

  $= \frac{1}{2} \times (a + b) \times h$ sq. units



> ***Note:*** **Distance between the parallel sides = height**

Multiple Choice Questions

A B C D

1 The area of a rhombus is 28 cm^2 and one of its diagonals is 4 cm. Find its perimeter.

(A) $4\sqrt{53}$ cm (B) 36 cm
(C) $2\sqrt{53}$ cm (D) 44 cm

2 The area of a trapezium is 28 cm^2 and one of its parallel sides is 6 cm. If its altitude is 4 cm, find its other parallel side.

(A) 4 cm (B) 8 cm
(C) 6 cm (D) 10 cm

3 The perimeter of a trapezium is 52 cm and its non-parallel sides are each equal to 10 cm. If its altitude is 8 cm, what is its area?

(A) 128 cm^2 (B) 112 cm^2
(C) 118 cm^2 (D) 124 cm^2

4 A man bought a rectangular field of length 144 m and width 64 m. In exchange for this field he wanted to buy a square field of the same area. What would the side of the square field be?

(A) 104 m (B) 208 m
(C) 96 m (D) 416 m

5 The area of a parallelogram is 120 cm^2 and its altitude is 10 cm. Find the length of the base.

(A) 24 cm (B) 12 cm
(C) 8 cm (D) 4 cm

6 What is the area of an isosceles triangle having base 'x' cm and one side 'y' cm?

(A) $\frac{x}{2}\sqrt{y^2+\frac{x^2}{4}}$ cm^2 (B) $\frac{x}{2}\sqrt{\frac{4y^2-x^2}{4}}$ cm^2

(C) $\frac{x^2-y^2}{4}$ cm^2 (D) $\frac{x^2+y^2}{4}$ cm^2

7 What is the length of the diagonal of a square whose area is 16900 m^2 ?

(A) 130 m (B) $130\sqrt{2}$ m
(C) 169 m (D) 144 m

8 The sides of a triangle are 3 cm, 5 cm and 4 cm. What is its area?

(A) 6 cm^2 (B) 7.5 cm^2
(C) $5\sqrt{2}$ cm^2 (D) 10 cm^2

9 The base of an isosceles right triangle is 30 cm. Find its area.

(A) 225 cm^2 (B) $225\sqrt{3}$ cm^2
(C) $5\sqrt{2}$ cm^2 (D) $6\sqrt{3}$ cm^2

10 The sides of a triangle are 16 cm, 30 cm and 34 cm. What is its area ?

(A) 120 cm^2 (B) 260 cm^2
(C) 240 cm^2 (D) 272 cm^2

11 The adjacent sides of a parallelogram are 8 cm and 9 cm. The diagonal joining the ends of these sides is 13 cm. Calculate the area of the parallelogram.

(A) 72 cm^2 (B) $12\sqrt{35}$ cm^2
(C) $24\sqrt{35}$ cm^2 (D) 150 cm^2

12 The sides of a triangle are 11 cm, 15 cm and 16 cm. What is the measure of the altitude to the largest side ?

(A) $30\sqrt{7}$ cm (B) 30 cm

(C) $\frac{15\sqrt{7}}{4}$ cm (D) $\frac{15\sqrt{7}}{2}$ cm

13 The perimeter of a triangular field is 144 m and the ratio of its sides is 3 : 4 : 5. What is the area of the field?

(A) 864 m^2 (B) 468 m^2
(C) 824 m^2 (D) 486 m^2

14 A rectangular field has its length and breadth in the ratio 5 : 3. Its area is 3.75 hectares. Find the cost of fencing it at ₹5 per metre.

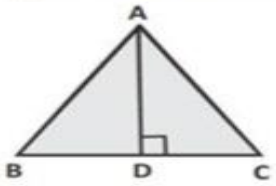
(A) ₹400 (B) ₹4000
(C) ₹1000 (D) ₹500

ANSWERS

Multiple Choice Questions

1. (A) 2. (B) 3. (A) 4. (C) 5. (B)

6. (B) Consider the isosceles triangle as shown in the figure. Drop a perpendicular AD to base BC.



It bisects the base. $\therefore$ $BD = \frac{x}{2}$

Now, by Pythagoras' theorem, we have $AD^2 = AB^2 - BD^2$

$$\Rightarrow y^2 - \frac{x^2}{4} = \frac{4y^2 - x^2}{4}$$

$$\Rightarrow AD = \sqrt{\frac{4y^2 - x^2}{4}}$$

Area of triangle

$$= \frac{1}{2} \times \text{base} \times \text{height}$$

$\therefore$ Area of ΔABC

$$= \frac{1}{2} \times x \times \sqrt{\frac{4y^2 - x^2}{4}} \text{ cm}^2$$

7. (B) 8. (A) 9. (A) 10. (C) 11. (B)

12. (C) By Heron's formula, we have area of triangle

$$= \sqrt{s(s-a)(s-b)(s-c)}.$$

Here,

$$s = \frac{11 + 15 + 16}{2} = \frac{42}{2} = 21 \text{ cm}$$

$\therefore$ Area $= \sqrt{21(10)(6)(5)}$

$$= 30\sqrt{7} \text{ sq. cm}$$

$$\therefore \text{ Height} = \frac{2 \text{ area}}{\text{base}} = \frac{2 \times 30\sqrt{7}}{16}$$

$$= \frac{15\sqrt{7}}{4} \text{ cm}$$

13. (A) 14. (B)

SOLVED PROBLEMS

Solved Examples

Ex 1. ***The diagonals of a rhombus are 24 cm and 10 cm. What is the perimeter of the rhombus ?***

Sol. Each side $= \sqrt{\left(\frac{24}{2}\right)^2 + \left(\frac{10}{2}\right)^2} = \sqrt{144+25} = \sqrt{169} = 13$ cm

$\therefore$ Perimeter $= 4 \times 13$ cm $= 52$ cm

Ex. 2. ***The area of a rhombus is 150 cm^2 . The length of one of its diagonals is 10 cm. What is the length of the other diagonal ?***

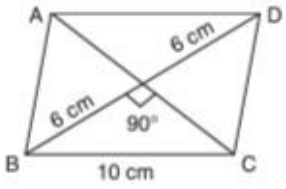
Sol. Let the length of second diagonal $= d_1$ cm

Then, $\frac{1}{2} \times (d_1 \times 10) = 150 \Rightarrow d_1 = \frac{150 \times 2}{10} = 30$ cm.

Ex. 3. ***The perimeter of a rhombus is 40 cm. If the length of one of its diagonals is 12 cm, what is the length of the other diagonal ?***

Sol. Each side of the rhombus $= \frac{40 \text{ cm}}{4} = 10$ cm

Let one of the diagonals $BD = 12$ cm. Then $BO = 6$ cm



$\therefore$ In right angled ΔBOC

$OC^2 = \sqrt{BC^2 - BO^2} = \sqrt{100-36} = \sqrt{64} = 8$ cm

$\therefore$ Diagonal $AC = 2 \times OC = 2 \times 8$ cm $= 16$ cm.

Ex. 4. ***The length of one side of a rhombus is 6.5 cm and its altitude is 10 cm. If the length of one of its diagonals is 26 cm, what will be the length of the other diagonal ?***

Sol. $\frac{1}{2} \times 26 \times$ other diagonal $= 6.5 \times 10$

$\Rightarrow$ Other diagonal $= \frac{6.5 \times 10 \times 2}{26} = 5$ cm.

Ex. 5. ***The area of a field in the shape of a trapezium measures 1440 m^2 . The perpendicular distance between its parallel sides is 24 m. If the ratio of the parallel sides is 5 : 3, what is the length of the longer parallel side ?***

Sol. Let the parallel sides be $5x$ and $3x$ respectively.

Then, $\frac{1}{2} \times 24 \times (5x + 3x) = 1440 \Rightarrow 8x = \frac{1440 \times 2}{24} \Rightarrow x = 15$ m

$\therefore$ The longer parallel side $= 5 \times 15$ m $= 75$ m.

Ex. 6. ***The difference between the two parallel sides of a trapezium is 8 m. The perpendicular distance between them is 24 m. If the area of the trapezium is 312 m², then what are the lengths of the two parallel sides ?***

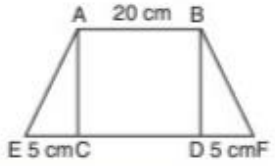
Sol. Let x and $x + 8$ be the two parallel sides of the trapezium. Then,

$$\frac{1}{2}\times(x+x+8)\times 24 = 312 \Rightarrow 2x+8=26 \Rightarrow \quad 2x=18 \Rightarrow x=9$$

$\therefore$ The two parallel sides are 9 m and 17 m.

Ex. 7. ***If the lengths of the parallel sides of an isosceles trapezium are 20 cm and 30 cm and the area is 100 cm², then what is the length of the non-parallel sides ?***

Sol. Area of the trapezium $= \frac{1}{2}(AB+EF)\times$ height



$$\Rightarrow 100 = \frac{1}{2}\times(20+30)\times h \Rightarrow h = 4 \Rightarrow \quad AC = BD = 4 \text{ cm}$$

$$\therefore \quad EA = BF = \sqrt{AC^2 + EC^2} = \sqrt{16+25} = \sqrt{41} \text{ cm.}$$

Ex. 8. ***What will be the area of the field ABGFEA ?***

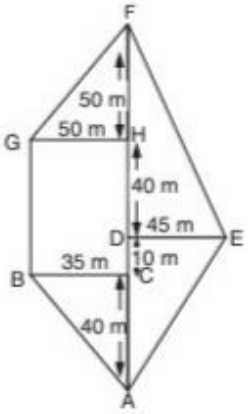
Sol. Area of field $ABGFEA$

= Area of ΔABC + Area of trapezium $BCHG$ + Area of ΔGHF + Area of ΔFDE + Area of ΔDEA

$$= \frac{1}{2}\times 40\times 35 + \frac{1}{2}\times(50+35)\times 50 + \frac{1}{2}\times 50\times 50 + \frac{1}{2}\times 90\times 45 + \frac{1}{2}\times 45\times 50$$

$$= 700 \text{ m}^2 + 2125 \text{ m}^2 + 1250 \text{ m}^2 + 2025 \text{ m}^2 + 1125 \text{ m}^2$$

$$= 7225 \text{ m}^2$$



SELF ASSESSMENT EXERCISE

1. The side of a rhombus is 10 cm and one diagonal is 16 cm. The area of the rhombus is
(a) 96 cm² (b) 95 cm²
(c) 94 cm² (d) 93 cm²

2. If the diagonals of a rhombus are 24 cm and 10 cm, then the area and perimeter of the rhombus are respectively
(a) 120 sq cm, 52 cm (b) 240 sq cm, 52 cm
(c) 120 sq cm, 64 cm (d) 240 sq cm, 64 cm

3. The diagonals of a rhombus are 32 cm and 24 cm respectively. The perimeter of the rhombus is
(a) 80 cm (b) 72 cm
(c) 68 cm (d) 88 cm

4. The perimeter of a rhombus is 40 cm. If the length of one of its diagonals be 12 m, then the length of the other diagonal is
(a) 14 cm (b) 15 cm
(c) 16 cm (d) 12 cm

5. If the perimeter of a rhombus is $4a$ and the lengths of the diagonals are x and y, then its area is
(a) $a(x + y)$ (b) $x^2 + y^2$
(c) xy (d) $\frac{1}{2}xy$

6. If the side of a rhombus is 20 metres and its shorter diagonal is three - fourths of its longer diagonal, then the area of the rhombus must be
(a) 375 m² (b) 380 m²
(c) 384 m² (d) 395 m²

7. A sheet is in the form of a rhombus whose diagonals are 10 m and 8 m. The cost of painting both of its surfaces at the rate of Rs 70 per m² is
(a) Rs 5600 (b) Rs 4000
(c) Rs 2800 (d) Rs 2000

8. A rhombus and a square have the same base. If the diagonals of the rhombus measure 30 cm and 16 cm respectively, find the area of the square.
(a) 225 cm² (b) 200 cm²
(c) 240 cm² (d) 289 cm²

9. If one of the diagonals of a rhombus is equal to its side, then the diagonals of the rhombus are in the ratio
(a) $\sqrt{3}:1$ (b) $\sqrt{2}:1$
(c) 3 : 1 (d) 2 : 1

10. A rhombus $OABC$ is drawn inside a circle whose centre is at O in such a way that the vertices A, B and C of the rhombus are on the circle. If the area of

the rhombus is $32\sqrt{3}$ m^2, then the radius of the circle is

(a) 64 m (b) 8 m

(c) 32 m (d) 46 m

11. The measure of each of the two opposite angles of a rhombus is 60° and the measure of one of its sides is 10 cm. The length of its smaller diagonal is

(a) 10 cm (b) $10\sqrt{3}$ cm

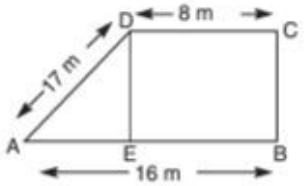
(c) $10\sqrt{2}$ cm (d) $\frac{5}{2}\sqrt{2}$ cm

12. If the sum of the lengths of the diagonals of a rhombus of side 4 cm is 10 cm, what is its area ?

(a) 8 cm^2 (b) 9 cm^2

(c) 10 cm^2 (d) 12 cm^2

13. In the given figure *ABCD* is trapezium in which the parallel sides *AB* and *CD* both are perpendicular to *BC*. If *AB* = 16 m, *CD* = 8 m and *AD* = 17 m. What is the area of the trapezium ?



(a) 140 m^2 (b) 168 m^2

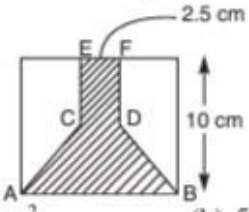
(c) 180 m^2 (d) 156.4 m^2

14. The lengths of the shorter and longer parallel sides of a trapezium are *x* cm and *y* cm respectively. If the area of the trapezium is $(x^2 - y^2)$, then the height of the trapezium is

(a) x (b) $(x + y)$

(c) y (d) $2(x - y)$

15. In the given figure, the side of the square is 10 cm. *EF* = 2.5 cm and *C* and *D* are half way between the top and bottom sides of the figure. The area of the shaded portion of the figure is



(a) 43.75 cm^2 (b) 56.25 cm^2

(c) 55.25 cm^2 (d) 50.25 cm^2

16. The cross-section of a canal is in the shape of trapezium. The canal is 15 m wide at the top and 9 m wide at the bottom. If the area of the cross-section is 720 m^2, then the depth of the canal is

(a) 58.4 m (b) 58.6 m

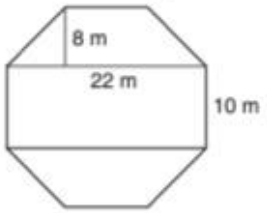
(c) 58.8 m (d) 60 m

17. The parallel sides of a field in the shape of a trapezium are 20 m and 41 m and the remaining two sides are 10 m and 17 m. Find the cost of levelling the field at the rate of Rs 30 per square metre ?

(a) Rs 6400 (b) Rs 7320

(c) Rs 7500 (d) Rs 7000

18. 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.



(a) 400 m^2 (b) 348 m^2

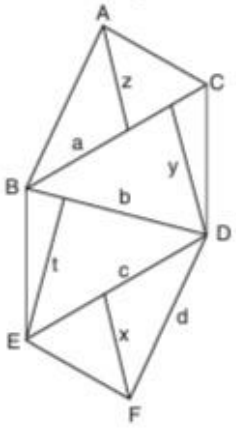
(c) 256 m^2 (d) 476 m^2

19. The parallel sides of a trapezium are 20 m and 30 m and its non-parallel sides are 6 m and 8 m. Find the area of the trapezium.

(a) 96 m^2 (b) 82 m^2

(c) 100 m^2 (d) 120 m^2

20. What is the area of the plot shown in the figure ?



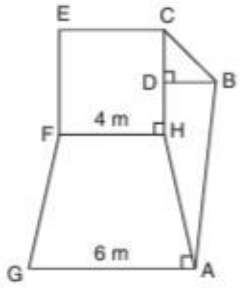
(a) $\frac{1}{2}(az + by + ct + dx)$

(b) $\frac{1}{2}(bt + cx + ay + az)$

(c) $\frac{1}{2}(cx + bt + by + az)$

(d) $\frac{1}{2}(d + t)(c + x) + \frac{1}{2}(a + b)(y + z)$

21. The area of the figure *ABCEFGA* is 84 m^2.
AH = *HC* = *AG* = 6 m and *CE* = *HF* = 4 m. If the angles marked in the figure are 90°, then the length of *DB* will be



(a) 2.5 m (b) 5 m
(c) 6 m (d) 12 m

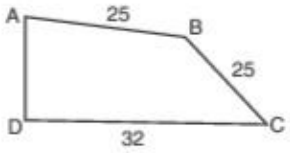
22. Consider a square of length 3 units. Also consider two points on each side of the square trisecting it into equal parts. The area of the octagon made by these eight points will be

(a) 4 unit^2 (b) 6 unit^2
(c) 7 unit^2 (d) 8 unit^2

23. The area of a regular hexagon of side $2\sqrt{3}$ cm is

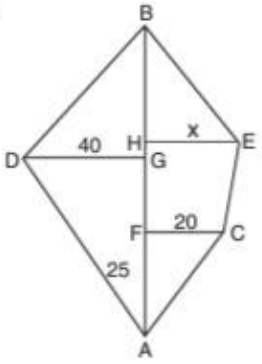
(a) $18\sqrt{3}$ cm^2 (b) $12\sqrt{3}$ cm^2
(c) $36\sqrt{3}$ cm^2 (d) $27\sqrt{3}$ cm^2

24. Two sides of a plot measure 32 m and 24 m and the angle between them a perfect right angle. The other two sides measure 25 m each and the other three angles are not right angles. What is the area of the plot (in m^2) ?



(a) 768 (b) 534
(c) 696.5 (d) 684

25. The area of the given field is 3500 m^2. $AF = 25$ m, $AG = 50$ m, $AH = 75$ m and $AB = 100$ m. The rest of the dimensions are shown in the figure. Find the value of x.



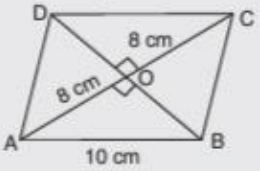
(a) 17 m (b) 20 m
(c) 22 m (d) 25 m

Answers

1. (a)	**2.** (a)	**3.** (a)	**4.** (c)	**5.** (d)	**6.** (c)	**7.** (a)	**8.** (d)	**9.** (a)	**10.** (b)
11. (a)	**12.** (b)	**13.** (c)	**14.** (c)	**15.** (a)	**16.** (d)	**17.** (b)	**18.** (d)	**19.** (a)	**20.** (b)
21. (b)	**22.** (c)	**23.** (a)	**24.** (d)	**25.** (b)					

Hints and Solutions

1. (a) Since the diagonals of a rhombus bisect each other at right angles.



In ΔAOB, $BO^2 = \sqrt{AB^2 - AO^2}$

$= \sqrt{100 - 64}$ cm

$= \sqrt{36}$ cm $= 6$ cm

$\therefore$ The other diagonal $= 2 \times 6$ cm $= 12$ cm

$\therefore$ Area of the rhombus $= \frac{1}{2} \times 16$ cm $\times 12$ cm

$= 96$ cm^2.

2. (a) Each side of the rhombus $= \sqrt{\left(\frac{24}{2}\right)^2 + \left(\frac{10}{2}\right)^2}$

$= \sqrt{12^2 + 5^2} = \sqrt{144 + 25} = \sqrt{169} = 13$ cm

$\therefore$ Area of the rhombus $= \frac{1}{2} \times 24$ cm $\times 10$ cm

$= 120$ cm^2

Perimeter $= 4 \times 13$ cm $= 52$ cm.

3. (a) Similar to Q. No. 2.

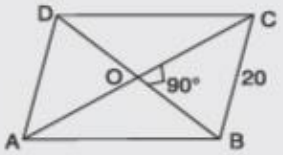
4. (c) Each side of the rhombus $= \frac{40 \text{ cm}}{4} = 10$ cm

Length of the other diagonal $= 2 \times \sqrt{10^2 - \left(\frac{12}{2}\right)^2}$

$= 2 \times \sqrt{100 - 36} = 2 \times \sqrt{64}$ cm $= 16$ cm.

5. (d) Area $= \frac{1}{2} \times$ Product of diagonals $= \frac{1}{2} xy$

6. (c) Let $AC = x$. Then $BD = \frac{3x}{4}$



$\therefore \quad OC^2 + OB^2 = BC^2$

$\Rightarrow \frac{x^2}{4} + \frac{9x^2}{64} = 20^2$

$\Rightarrow \frac{25x^2}{64} = 400 \quad \Rightarrow \quad x^2 = \frac{400 \times 64}{25} = 1024$

$\Rightarrow x = 32 \quad \Rightarrow \quad AC = 32$ cm and $BD = 24$ cm.

$\therefore$ Area of the rhombus $= \frac{1}{2} \times AC \times BD$

$= \frac{1}{2} \times 32 \times 24 \text{ cm}^2 = 384 \text{ cm}^2$.

7. (a) Cost of painting both its surfaces

$= 2 \times 70 \times$ Area of one surface

$= \text{Rs} \left(2 \times 70 \times \frac{1}{2} \times 10 \times 8 \right) = \text{Rs } 5600.$

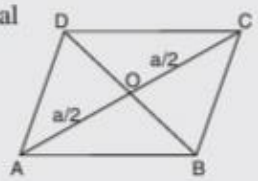
8. (d) Each side of the square = each side of the rhombus $= \sqrt{\left(\frac{30}{2}\right)^2 + \left(\frac{16}{2}\right)^2}$

$= \sqrt{225 + 64} = \sqrt{289} = 17$ cm

$\therefore$ Area of the square $= (17)^2 \text{ cm}^2 = 289 \text{ cm}^2$.

9. (a) Let side AB = diagonal $AC = a$ units

Then, the other diagonal



$= 2 \times \sqrt{a^2 - \left(\frac{a}{2}\right)^2}$

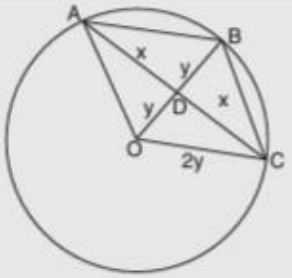
$= 2 \times \sqrt{a^2 - \frac{a^2}{4}}$

$= 2 \times \sqrt{\frac{3a^2}{4}} = \sqrt{3}a$

$\therefore$ Required ratio $= \frac{\sqrt{3}a}{a} = \sqrt{3} : 1$.

10. (b) Let $AC = 2x$, $OB = 2y$.

$\therefore$ Radius $= OC = 2y = OB$



From ΔODC,

$OC^2 = OD^2 + CD^2$

$\Rightarrow 4y^2 = y^2 + x^2 \Rightarrow x^2 = 3y^2 \Rightarrow x = \sqrt{3}\,y \quad \ldots (1)$

Also,

Area of $\Delta ODC = \frac{1}{4} \times$ Area of rhombus $OABC$

$\Rightarrow \frac{1}{2} \times x \times y = \frac{1}{4} \times 32\sqrt{3} \quad \Rightarrow \quad xy = 16\sqrt{3} \quad \ldots (2)$

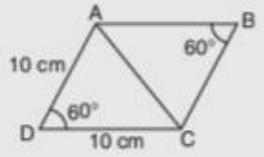
From (1) and (2) we have, $y = 4$ and $x = 4\sqrt{3}$

$\therefore$ Radius of the circle $= 2y = 8$ m.

11. (a) Let $\angle B = \angle D = 60°$

In ΔADC,

$AD = DC$ (adjacent sides of a rhombus)



$\Rightarrow \angle ACD = \angle DAC = \frac{180° - 60°}{2} = 60°$

(Isosceles Δ property)

$\therefore$ ΔADC is an equilateral triangle

$\Rightarrow AC = AD = DC = 10$ cm.

12. (b) Let d_1 and d_2 be the lengths of the diagonals of the rhombus. Then,

$\left(\frac{d_1}{2}\right)^2 + \left(\frac{d_2}{2}\right)^2 = 4^2 \Rightarrow \frac{d_1^2}{4} + \frac{d_2^2}{4} = 16$

$\Rightarrow d_1^2 + d_2^2 = 64$

$\Rightarrow (d_1 + d_2)^2 - 2d_1d_2 = 64$

$\Rightarrow 10^2 - 2d_1d_2 = 64 \qquad (\because d_1 + d_2 = 10)$

$\Rightarrow 2d_1d_2 = 100 - 64 = 36$

$\Rightarrow d_1d_2 = 18 \quad \Rightarrow \quad \frac{1}{2} d_1d_2 = 9 \text{ cm}^2$

$\therefore$ Area of the rhombus $= 9 \text{ cm}^2$.

13. (c) $AE = AB - EB = AB - DC = 16 \text{ m} - 8 \text{ m} = 8 \text{ m}$

$\therefore$ In ΔAED,

$DE^2 = AD^2 - AE^2 = 17^2 - 8^2 = 289 - 64 = 225$

$\Rightarrow DE = 15$ m

$\therefore$ Area of the trapezium $ABCD$

$$= \frac{1}{2} \times (AB + DC) \times DE$$

$$= \frac{1}{2} \times (16\text{ m} + 8\text{ m}) \times 15\text{ m}$$

$$= \frac{1}{2} \times 24\text{ m} \times 15\text{ m} = 180\text{ m}^2.$$

14. (c) Area of trapezium

$$= \frac{1}{2} \times \text{(Sum of parallel sides)} \times \text{height}$$

$$\Rightarrow \frac{1}{2} \times (x + y) \times \text{height} = (x^2 - y^2)$$

$$\Rightarrow \text{height} = \frac{2(x+y)(x-y)}{(x+y)} = 2(x - y)$$

15. (a) Area of the shaded part = Area of rectangle $CDEF$ + Area of trapezium $ABCD$

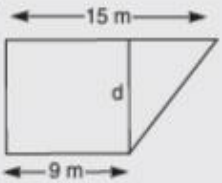
$$= 2.5\text{ cm} \times 5\text{ cm} + \frac{1}{2} \times (2.5\text{ cm} + 10\text{ cm}) \times 5\text{ cm}$$

$$= 12.5\text{ cm}^2 + 31.25\text{ cm}^2 = 43.75\text{ cm}^2.$$

16. (d) Area of cross-section = 720 m^2

$$\Rightarrow \frac{1}{2} \times (9\text{ m} + 15\text{ m}) \times d = 720$$

$$\Rightarrow d = \frac{720 \times 2}{24}\text{ m} = 60\text{ m}.$$

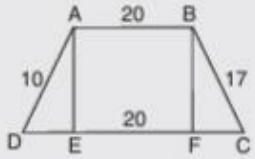


17. (b) $DC = 41$ m (Given)

$\therefore$ $DE + FC = 41 - 20 = 21$m

Let $DE = x$, therefore

$FC = (21 - x)$



From $\Delta ADE, AE^2 = (10)^2 - x^2 = 100 - x^2$

From $\Delta BCF, BF^2 = (17)^2 - (21 - x)^2$

$= 289 - (441 + x^2 - 42x)$

$= -x^2 + 42x - 152$

Since $AE = BF$, $100 - x^2 = -x^2 + 42x - 152$

$\Rightarrow 42x = 252 \Rightarrow x = 6$

$\therefore AE = BF = \sqrt{100 - 6^2} = 8$

$\therefore$ Area of the trapezium $ABCD$

= Area of ΔAED + Area of ΔBCF + Area of rectangle $ABEF$

$$= \left(\frac{1}{2} \times 8 \times 6 + \frac{1}{2} \times 15 \times 8 + 20 \times 8\right)\text{ m}^2$$

$= (24 + 60 + 160)\text{ m}^2 = 244\text{ m}^2$

$\therefore$ Cost of levelling the field at Rs 30 per m^2

= Rs (244×30) = Rs 7320.

18. (d) Area of the octagonal surface

$$= 2 \times \frac{1}{2} \times (22\text{ m} + 10\text{ m}) \times 8\text{ m} + 22\text{ m} \times 10\text{ m}$$

$$= 32\text{ m} \times 8\text{ m} + 220\text{ m}^2 = 256\text{ m}^2 + 220\text{ m}^2 = 476\text{ m}^2$$

19. (a) Similar to Q. 17.

20. (b) Area of the plot

= Area of ΔABC + Area of ΔBCD + Area of ΔBED + Area of ΔEFD

$$= \frac{1}{2} \times a \times z + \frac{1}{2} \times a \times y \times \frac{1}{2} \times b \times t + \frac{1}{2} \times c \times x$$

$$= \frac{1}{2}(az + ay + bt + cx)$$

21. (b) Area of rectangle $CEFH$ + Area of trapezium $FHAG$

$$= (4 \times 6)\text{ m}^2 + \left(\frac{1}{2} \times (6 + 4) \times 6\right)\text{m}^2$$

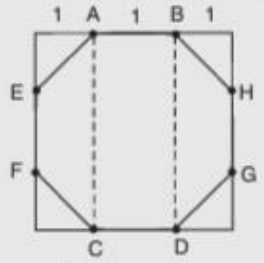
$= 24\text{ m}^2 + 30\text{ m}^2 = 54\text{ m}^2$

$\therefore$ Area of right angled $\Delta ABC = 84\text{ m}^2 - 54\text{ m}^2 = 30\text{ m}^2$

$$\Rightarrow \frac{1}{2} \times 12 \times BD = 30 \Rightarrow BD = 5\text{ m}.$$

22. (c) Area of octagon $ABHGDCFE$

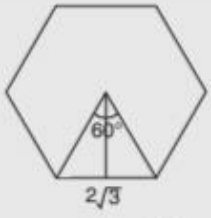
= Area of rectangle $ABDC$ + Area of trapezium $BHGD$ + Area of trapezium $ACFE$



$$= (1 \times 3) + \frac{1}{2} \times (1 + 3) \times 1 + \frac{1}{2} \times (1 + 3) \times 1$$

$= 7$ sq. units.

23. (a) A regular hexagon consists of 6 equilateral triangles of equal areas.

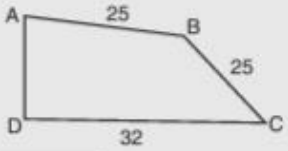


Area of a triangle $= \frac{\sqrt{3}}{4}(2\sqrt{3})^2 = 3\sqrt{3}\ \text{cm}^2$

$\therefore$ Required area $= 6 \times 3\sqrt{3}\ \text{cm}^2 = 18\sqrt{3}\ \text{cm}^2$.

24. (d) In right angle ΔADC,

$AC^2 = AD^2 + DC^2$



$\Rightarrow AC = \sqrt{24^2 + 32^2} = \sqrt{576 + 1024} = \sqrt{1600}$

$= 40$ m

$\therefore$ Area of the plot

= Area of ΔADC + Area of ΔABC

For ΔABC, $S = \frac{25 + 25 + 40}{2}$ m $= 45$ m

$\therefore$ Required area

$= \frac{1}{2} \times 24\ \text{m} \times 32\ \text{m}$

$+ \sqrt{45(45-25)(45-25)(45-40)}\ \text{m}^2$

$= 384\ \text{m}^2 + \sqrt{45 \times 20 \times 20 \times 5}\ \text{m}^2$

$= 384\ \text{m}^2 + 300\ \text{m}^2 = 684\ \text{m}^2$.

25. (b) Total area = Area of ΔAFC + Area of ΔAGD + Area of trapezium $FCEH$ + Area of ΔBGE + Area of ΔDGB

$= \frac{1}{2} \times AF \times FC + \frac{1}{2} \times AG \times DG$

$+ \frac{1}{2} \times (CF + EH) \times HF$

$+ \frac{1}{2} \times BH \times HE + \frac{1}{2} \times BG \times DG$

$\Rightarrow \frac{1}{2} \times 25 \times 20 + \frac{1}{2} \times 50 \times 40 + \frac{1}{2} \times (20 + x) \times 50$

$+ \frac{1}{2} \times 25 \times x + \frac{1}{2} \times 50 \times 40 = 3500$

$\Rightarrow 250 + 1000 + (20 + x)25 + 12.5x + 1000 = 3500$

$\Rightarrow 2250 + 500 + 25x + 12.5x = 3500$

$\Rightarrow 37.5x = 3500 - 2750 = 750$

$\Rightarrow x = \frac{750}{37.5} = 20$ m