CHAPTER

12

AREA OF PLANE FIGURES

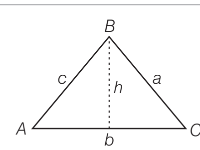
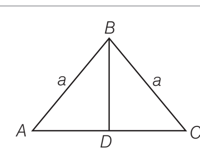
In this chapter, we study the Area of Plane Figures, triangle and its type Square, circle, semi-circle, Trapezium, Hexagon etc.

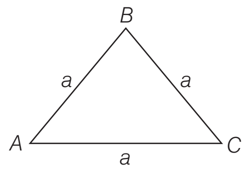
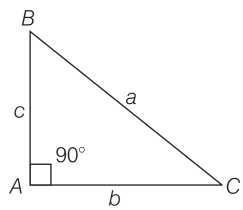
Plane figures are the flat shape in two dimensions, having length and width (breadth).

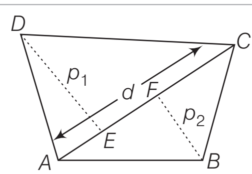
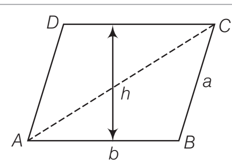
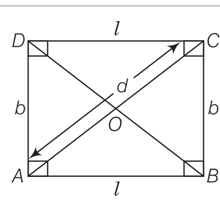
Perimeter The length of boundary of a simple closed figure is known as perimeter.

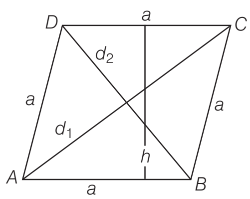
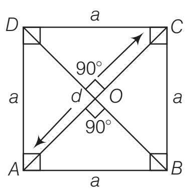
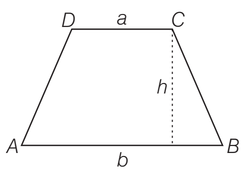
Area The measure of region enclosed in a simple closed curve is called area of closed curve.

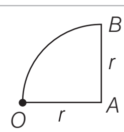
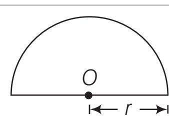
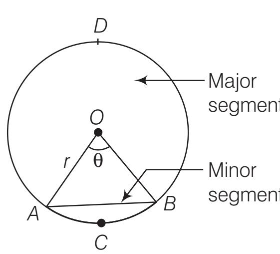
Perimeter and Area of Plane Figures

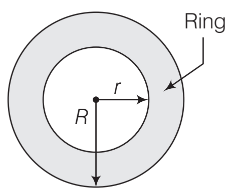
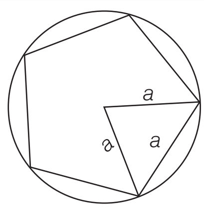
	Type	**Figure**	**Perimeter** (P)	**Area** (A)
1	Triangle		$P = a + b + c$ $= 2s$	$A = \frac{1}{2} \times$ base $\times$ height $= \frac{1}{2} bh$ $= \sqrt{s(s-a)(s-b)(s-c)}$
2	Isosceles Triangle		$P = 2a + b$	$A = \frac{b}{4}\sqrt{4a^2 - b^2}$

	Type	Figure	Perimeter (P)	Area (A)
3	Equilateral Triangle		$P = 3a$	$A = \frac{\sqrt{3}}{4}a^2$
4	Right Angled Triangle		$P = a + b + c = 2s$	$A = \frac{1}{2}bc$

	Type	Figure	Diagonal	Perimeter (P)	Area (A)
5	Quadrilateral	 Diagonal $AC = d$; DE , BF are two perpendiculars drawn on the diagonal (AC) and p_1 , p_2 are lengths of the two perpendiculars	$BD \neq AC$	$P = AB + BC + CD + DA$	$A = \frac{1}{2} \times d \times (p_1 + p_2)$
6	Parallelogram	 b = base, h = perpendicular distance between the base and its opposite side	$BD \neq AC$	$P = 2(a + b)$	$A = b \times h = 2\times$ (area of $\Delta\, ABD$) (or $\Delta\, BCD$)
7	Rectangle	 l = length, b = breadth d = diagonal	$BD = AC$ Also, $AO = OC$ $= OD = OB$ and $d^2 = l^2 + b^2$	$P = 2(l + b)$	$A = l \times b$ $= l \times \sqrt{d^2 - l^2}$ $= b \times \sqrt{d^2 - b^2}$

	Type	Figure	Diagonal	Perimeter (P)	Area (A)
8	Rhombus		$BD \neq AC$ and $d_1^2 + d_2^2 = 4a^2$	$P = 4a = 2\sqrt{d_1^2 + d_2^2}$	$A = \frac{1}{2} \times d_1 \, x d_2$ $= a \times h$
9	Square	 a = length of side d = diagonal	$BD = AC$ and $OA = OB$ $= OC = OD$ and $d = a\sqrt{2}$	$P = 4a = 2d\sqrt{2}$	$A = a^2 = \frac{d^2}{2}$
10	Trapezium			P = sum of all sides	$A = \frac{1}{2}(a + b) \times h$

	Type	Figure	Perimeter (or Circumference)	Area
11	Quadrant		$P = 2r + \frac{\pi r}{2}$	$A = \frac{1}{4}\pi r^2$
12	Semi-circle		$P = (\pi r + 2r)$	$A = \frac{1}{2}\pi r^2$
13	Circle		Circumference of circle, $P = 2\pi r = \pi d$ Length of arc $AB = 2\pi r \times \frac{\theta}{360°}$	$A = \pi r^2$

	Type	Figure	Perimeter (or Circumference)	Area
14	Ring		$P = 2\pi R + 2\pi r$	$A = \pi R^2 - \pi r^2$ $= \pi(R^2 - r^2)$
15	Hexagon inscribed in a circle		$P = 6(a)$	$A = 6 \times \frac{\sqrt{3}a^2}{4}$

Conversion of Units

$100 \text{ mm}^2 = 1 \text{ cm}^2$ $\quad$ $100 \text{ cm}^2 = 1 \text{ dm}^2$

$100 \text{ dm}^2 = 1 \text{ m}^2$ $\quad$ $10000 \text{ cm}^2 = 1 \text{ m}^2$

$1 \text{ acre} = 100 \text{ m}^2$ $\quad$ $1 \text{ hectare} = 10000 \text{ m}^2$

$1 \text{ hectare} = 100 \text{ acres}$ $\quad$ $100 \text{ hectare} = 1 \text{ km}^2$

Example 1 The base of a triangular field is three times its altitude. If the cost of cultivating the field at ₹ 240 per hectare ₹ 3240, find its base and height.

(a) 900 m, 300 m (b) 910 m, 310 m
(c) 905 m, 315 m (d) None of these

Sol. (a) Area of the field $= \frac{\text{Total cost}}{\text{Rate}}$

$$= \frac{3240}{240} \text{ hectare}$$

$$= 13.5 \times 10000 \text{ m}^2$$

$$= 135000 \text{ m}^2$$

Let the height be x metre.

Then, base = $3x$ metre

$$\therefore \quad \frac{1}{2} \times x \times 3x = 135000$$

$$\Rightarrow \quad x^2 = 90000$$

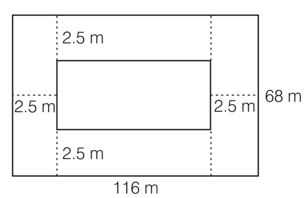
$$\Rightarrow \quad x = 300 \text{ m}$$

Hence, base is 900 and height is 300 m.

Example 2 A rectangular grassy plot is 116 m by 68 m. It has a gravel path 2.5 m wide all round it on the inside. Find the area of the path.

(a) 895 m^2 (b) 900 m^2
(c) 910 m^2 (d) 890 m^2

Sol. (*a*) Area of the plot $= (116 \times 68) = 7888 \text{ m}^2$



Area of the plot excluding the path

$$= (116 - 5) \times (68 - 5)$$

$$= 111 \times 63 = 6993 \text{ m}^2$$

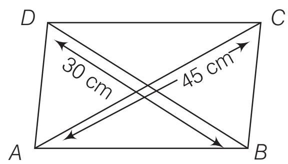
$\therefore$ Required area of path $= 7888 - 6993 = 895 \text{ m}^2$

Example 3 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 sq metre is ₹ 4.

(a) ₹ 800 (b) ₹ 810 (c) ₹ 820 (d) ₹ 850

Sol. (b) Area of one rhombus shaped tile $= \frac{1}{2} \times d_1 \times d_2$

$$= \frac{1}{2} \times 45 \times 30 = 45 \times 15 = 675 \text{ cm}^2$$



Now, floor of a building consists of 3000 tiles of such kind.

$\therefore$ Area of floor = Number of tiles × Area of one tile

$$= 3000 \times 675$$

$$= 2025000\,\text{cm}^2 = \frac{2025000}{10000}\,\text{m}^2$$

$$= 202.5\ \text{m}^2 \quad \left[\begin{array}{l} \because 1\ \text{m} = 100\ \text{cm} \\ \therefore\ 1\text{m}^2 = 10000\ \text{cm}^2 \end{array}\right]$$

$\because$ Rate of polishing the floor = ₹4 per m^2

$\therefore$ Total cost of polishing the floor = ₹ 4×202.5

$$= ₹810$$

Hence, the total cost of polishing the floor is ₹810.

Example 4 The area of trapezium is $450\,\text{m}^2$ and the distance between two parallel sides is 10 m and one of the parallel side 15 m. Find the other parallel side.

(a) 75 m (b) 80 m
(c) 85 m (d) 90 m

Sol. (*a*) Given, one of the parallel sides of the trapezium, $a = 15$ m and height $(h) = 10$ m

Let another side be b m.

Then, area of trapezium = 450 m^2

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

$$\Rightarrow \quad 450 = \frac{1}{2} \times 10 \times (15 + b)$$

$$\Rightarrow \quad \frac{450 \times 2}{10} = 15 + b$$

$$\Rightarrow \quad 90 = 15 + b$$

$$\therefore \quad b = 90 - 15 = 75$$

Hence, the other parallel side of trapezium is 75m.

Example 5 If the area of a semi-circular field is 30800 m^2, then find the perimeter of the field.

(a) 705 m (b) 710 m
(c) 700 m (d) 720 m

Sol. (*d*) Let the radius of the field be r.

Then, $\frac{1}{2}\pi r^2 = 30800$

$$\Rightarrow \quad \frac{1}{2} \times \frac{22}{7} \times r^2 = 30800$$

$$\Rightarrow \quad r^2 = 30800 \times 2 \times \frac{7}{22} = 19600$$

$$\Rightarrow \quad r = 140\ \text{m}$$

$\therefore$ The perimeter of the field = $\pi r + 2r$

$$= \frac{22}{7} \times 140 + 2 \times 140$$

$$= 440 + 280 = 720\,\text{m}$$

Example 6. In a circle of radius 35 cm, an arc subtends an angle of 72° at the centre. Find the length of the arc and the area of the sector.

(a) 660 cm^2 (b) 700 cm^2 (c) 770 cm^2 (d) 750 cm^2

Sol. (c) Length of the arc = $\frac{2\pi r\theta}{360°}$

$$= 2 \times \frac{22}{7} \times 35 \times \frac{72}{360} = 44\ \text{cm}$$

Area of the sector = $\frac{\pi r^2\theta}{360°}$

$$= \frac{22}{7} \times 35 \times 35 \times \frac{72}{360} = 770\ \text{cm}^2$$

Example 7. A regular hexagon is inscribed in a circle of radius 5 cm. The area of regular hexagon inscribed in a circle is

(a) $\frac{75}{2}$ cm^2 (b) $75\sqrt{3}$ cm^2
(c) $\frac{75\sqrt{3}}{2}$ cm^2 (d) None of these

Sol. (c) Area of hexagon inscribed in a circle

$$6 \times \frac{\sqrt{3}}{4}(a)^2 = 6\frac{\sqrt{3}}{4} \times (5)^2 = \frac{75}{2}\sqrt{3}\ \text{cm}^2$$

PRACTICE EXERCISE

1. The area of an equilateral triangle with side 10 cm is
(a) $15\sqrt{3}$ cm^2 (b) $25\sqrt{3}$ cm^2
(c) $5\sqrt{3}$ cm^2 (d) $35\sqrt{3}$ cm^2

2. An isosceles right angled triangle has area 200 cm^2. The length of its hypotenuse is
(a) $15\sqrt{2}$ cm (b) $\frac{10}{\sqrt{2}}$ cm
(c) $10\sqrt{2}$ cm (d) $20\sqrt{2}$ cm

3. The diagonal of a square field measures 50 m. The area of square field is
(a) 1250 m^2 (b) 1200 m^2
(c) 1205 m^2 (d) 1025 m^2

4. The sum of the length of two diagonals of a square is 144 cm, then the perimeter of square is
(a) 144 cm (b) $72\sqrt{2}$ cm
(c) $144\sqrt{2}$ cm (d) None of these

5. The circumference of a circle is 176 m. Then, its area is
(a) 2464 m^2 (b) 2164 m^2
(c) 2346 m^2 (d) 2246 m^2

6. The area of a rhombus whose one side and one diagonal measure 20 cm and 24 cm respectively, is
(a) 364 cm^2 (b) 374 cm^2
(c) 384 cm^2 (d) 394 cm^2

7. The area of the largest circle that can be drawn inside a square of side 14 cm in length, is
(a) 84 cm^2 (b) 96 cm^2
(c) 104 cm^2 (d) 154 cm^2

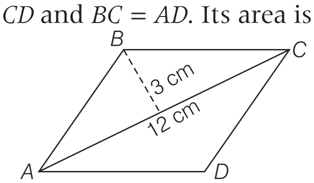
8. The least number of square slabs that can be fitted in a room 10.5 m long and 3 m wide, is
(a) 12 (b) 13
(c) 14 (d) 15

9. The length of a rectangle is 2 cm more than its breadth and the perimeter is 48 cm. The area of the rectangle (in cm^2) is
(a) 96 (b) 28
(c) 143 (d) 144

10. In a circle of radius 42 cm, an arc subtends an angle of 72° at the centre. The length of the arc is
(a) 52.8 cm (b) 53.8 cm
(c) 72.8 cm (d) 79.8 cm

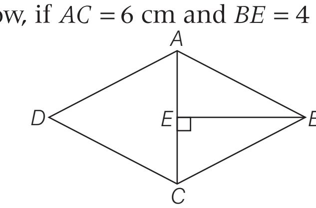
11. If the side of a square be increased by 50%, then the per cent increase in area is
(a) 50 (b) 100 (c) 125 (d) 150

12. The figure *ABCD* is a quadrilateral, in which $AB = CD$ and $BC = AD$. Its area is



(a) 72 cm^2 (b) 36 cm^2
(c) 24 cm^2 (d) 18 cm^2

13. What is the area of the rhombus *ABCD* below, if $AC = 6$ cm and $BE = 4$ cm?



(a) 36 cm^2 (b) 16 cm^2
(c) 24 cm^2 (d) 13 cm^2

14. The area of a parallelogram is 60 cm^2 and one of its altitude is 5 cm. The length of its corresponding side is
(a) 12 cm (b) 6 cm (c) 4 cm (d) 2 cm

15. If the ratio of the areas of two square is 4 :1, then the ratio of their perimeter is
(a) 2 : 1 (b) 1 : 2
(c) 1 : 4 (d) 4 : 1

16. The inner circumference of a circular park is 440 m. The track is 14 m wide. The diameter of the outer circle of the track is
(a) 168 m (b) 169 m (c) 144 m (d) 108 m

17. A wire is in the form of a circle of radius 42 cm. It is bent into a square. The side of the square is
(a) 33 cm (b) 66 cm
(c) 78 cm (d) 112 cm

18. The perimeter of a trapezium is 52 cm and its each non-parallel side is equal to 10 cm with its height 8 cm. It area is

(a) 124 cm^2 (b) 118 cm^2
(c) 128 cm^2 (d) 112 cm^2

19. The areas of two circles are in the ratio 49 : 64. Find the ratio of their circumferences.

(a) 7 : 8 (b) 5 : 8 (c) 5 : 3 (d) 5 : 9

20. The diameter of the wheels of a bus is 140 cm. How many revolutions per minute must a wheel make in order to move at a speed of 66 km/h ?

(a) 200 (b) 250 (c) 300 (d) 350

21. The length of the sides of a triangle are in the ratio 3 : 4 : 5 and its perimeter is 144 cm. The area of the triangle is

(a) 684 cm^2 (b) 664 cm^2
(c) 764 cm^2 (d) 864 cm^2

22. The difference between the sides at right angles in a right angled triangle is 14 cm. The area of the triangle is 120 cm^2. The perimeter of the triangle is

(a) 68 cm (b) 64 cm
(c) 60 cm (d) 58 cm

23. The area of the quadrilateral whose sides measures 9 cm, 40 cm, 28 cm and 15 cm and in which the angle between the first two sides is a right angle, is

(a) 206 cm^2 (b) 306 cm^2
(c) 356 cm^2 (d) 380 cm^2

24. If three sides of a triangle are 6 cm, 8 cm and 10 cm, then the altitude of the triangle using the largest side as base will be

(a) 8 cm (b) 6 cm
(c) 4.8 cm (d) 4.4 cm

25. The area of a circle is 13.86 hectares. The cost of fencing it at the rate of 60 paise per metre is

(a) ₹ 784.00 (b) ₹ 788.00
(c) ₹ 792.00 (d) ₹ 796.00

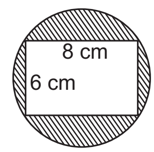
26. If the diagonal of a rectangle is 13 cm and its perimeter is 34 cm, then its area will be

(a) 442 cm^2 (b) 260 cm^2
(c) 60 cm^2 (d) 20 cm^2

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

(a) 58.4 m (b) 58.6 m
(c) 58.8 m (d) 60 m

28. In the adjacent figure, find the area of the shaded region.

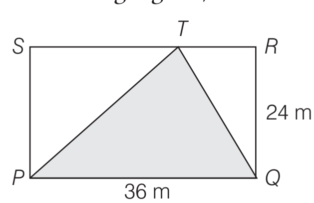


(a) 15.28 cm^2
(b) 61.14 cm^2
(c) 30.57 cm^2
(d) 40.76 cm^2

29. A square and an equilateral triangle have equal perimeters. If the area of the equilateral triangle is $16\sqrt{3}$ cm^2, then the side of the square is

(a) 4 cm (b) $4\sqrt{2}$ cm
(c) $6\sqrt{2}$ cm (d) 6 cm

30. find the figure area of the shaded portion. In the following figure,



(a) 433m^2 (b) 432 m^2
(c) 434 m^2 (d) None of these

31. A regular hexagon is inscribed in a circle of radius 8 cm. The perimeter of the regular hexagon is

(a) 48 cm (b) 50 cm
(c) 52 cm (d) 54 cm

32. Find the area of regular hexagon inscribed in a circle of radius 10 cm.

(a) $140\sqrt{3}$ cm^2 (b) $150\sqrt{3}$ cm^2
(c) $120\sqrt{3}$ cm^2 (d) None of these

Answers

1	*(b)*	2	*(d)*	3	*(a)*	4	*(c)*	5	*(a)*	6	*(c)*	7	*(d)*	8	*(c)*	9	*(c)*	10	*(a)*
11	*(c)*	12	*(b)*	13	*(c)*	14	*(a)*	15	*(a)*	16	*(a)*	17	*(b)*	18	*(c)*	19	*(a)*	20	*(b)*
21	*(d)*	22	*(c)*	23	*(b)*	24	*(c)*	25	*(c)*	26	*(c)*	27	*(d)*	28	*(c)*	29	*(d)*	30	*(b)*

Hints and Solutions

1. Area of equilateral triangle $= \frac{\sqrt{3}}{4}(\text{side})^2$

$$= \frac{\sqrt{3}}{4} \times 10 \times 10 = 25\sqrt{3}\ \text{cm}^2$$

2. Area of an isosceles right angled triangle

$$= \frac{1}{2}(\text{side})^2 = 200\ \text{cm}^2$$

$\therefore$ side $= 20$ cm

$\therefore$ Hypotenuse $= \sqrt{a^2+a^2} = \sqrt{2}\,a = 20\sqrt{2}$ cm

3. Area of square $= \frac{1}{2} \times (\text{diagonal})^2$

$$= \frac{1}{2} \times 50 \times 50 = 1250\ \text{m}^2$$

4. Length of a diagonal of square $= \frac{144}{2} = 72$ cm

Side of square $= \frac{\text{length of diagonal}}{\sqrt{2}} = \frac{72}{\sqrt{2}}$ cm

$\therefore$ The perimeter of square $= 4a = 4 \times \frac{72}{\sqrt{2}}$

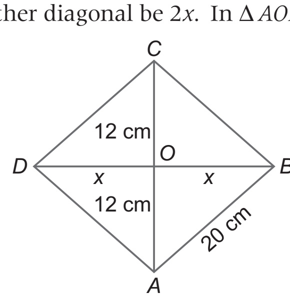
$$= 144\sqrt{2}\ \text{cm}$$

5. Circumference of circle $= 2\pi r = 176$ m

$\Rightarrow$ $r = \frac{176 \times 7}{2 \times 22} = 28$ m

$\therefore$ Area $= \pi r^2 = \frac{22}{7} \times 28 \times 28 = 2464\ \text{m}^2$

6. Let the other diagonal be $2x$. In ΔAOB,



$$(20)^2 = (12)^2 + x^2$$

$\Rightarrow$ $x^2 = 256$

$\Rightarrow$ $x = 16$ cm

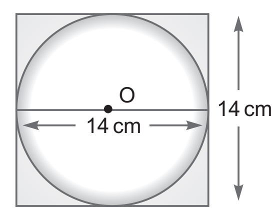
$\therefore$ Other diagonal $= 2x = 32$ cm

$\therefore$ Area $= \frac{1}{2} \times d_1 d_2$

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

$$= 384\ \text{cm}^2$$

7. Diameter of circle = side of square = 14 cm



$\Rightarrow$ $r = 7$ cm

$\therefore$ Area of circle, $\pi r^2 = \frac{22}{7} \times 7 \times 7 = 154\ \text{cm}^2$

8. Side of the greatest square tile = GCM of the length and breadth of the room

GCM of 10.5 and 3 = 1.5 m.

$\therefore$ Area of room $= 10.5 \times 3\ \text{m}^2$

$\therefore$ Number of tiles needed $= \frac{10.5 \times 3}{1.5 \times 1.5} = 14$ tiles

9. Let length $= x$ cm and breadth $= (x-2)$ cm

$\therefore$ $2[x + (x-2)] = 48$

$\Rightarrow$ $4x - 4 = 48$

$\Rightarrow$ $x = \frac{52}{4} = 13$ cm

$\therefore$ Length = 13 cm and breadth = 11 cm

Hence, area $= l \times b$

$$= 13 \times 11 = 143\ \text{cm}^2$$

10. Length of an arc

$$= 2\pi r \times \frac{\theta}{360°} = \frac{2 \times 22 \times 42 \times 72°}{7 \times 360°}$$

$$= \frac{264}{5} = 52.8 \text{ cm}$$

11. Let the original side of a square be 'a'.

$\therefore$ Area of square $= a^2$

Now, new side $= a + \frac{a}{2} = \frac{3a}{2}$

$\Rightarrow$ New area $= \frac{9a^2}{4}$

$\therefore$ Increase in area $= \frac{9a^2}{4} - a^2 = \frac{5a^2}{4}$

$\therefore$ Percent increase in area

$$= \frac{5a^2}{4a^2} \times 100 = 125\%$$

12. It is clear from the figure that, quadrilateral $ABCD$ is a parallelogram. The diagonal AC of the given parallelogram $ABCD$ divides it into two triangles of equal areas.

Area of the $\Delta ABC = \frac{1}{2} \times \text{Base} \times \text{Height}$

$$= \frac{1}{2} \times 12 \times 3 = 18 \text{ cm}^2$$

$\therefore$ Area of the parallelogram $ABCD$

$$= 2 \times \text{Area of } \Delta ABC$$

$$= 2 \times 18 = 36 \text{ cm}^2$$

13. The diagonal AC of the rhombus $ABCD$ divides it into two triangles of equal areas.

Now, area of $\Delta ABC = \frac{1}{2} \times \text{Base} \times \text{Height}$

$$= \frac{1}{2} \times 4 \times 6 = 12 \text{ cm}^2$$

$\therefore$ Area of the rhombus $ABCD = 2 \times$ Area of ΔABC

$$= 2 \times 12 = 24 \text{ cm}^2$$

14. We know that,

Area of a parallelogram = Side $\times$ Altitude

$\Rightarrow$ $a \times h = 60 \Rightarrow a \times 5 = 60$

$\Rightarrow$ $a = \frac{60}{5}$

$\therefore$ $a = 12 \text{ cm}$

15. Let the sides of the two square be a and b.

$\therefore$ Ratio of their areas

$$\frac{a^2}{b^2} = \frac{4}{1}$$

or $\left(\frac{a}{b}\right)^2 = \left(\frac{2}{1}\right)^2$

$\Rightarrow$ $\frac{a}{b} = \frac{2}{1}$

$\therefore$ $a : b = 2 : 1$

16. Inner circumference of a park

$$= 2\pi r = 440 \text{ m}$$

$\Rightarrow$ $r = \frac{440}{2 \times 22} \times 7 = 70 \text{ m}$

Width of track = 14 m

$\Rightarrow$ Radius of outer circle

$$= (70 + 14) = 84 \text{ m}$$

$\therefore$ Diameter of outer circle $= 2 \times 84 = 168$ m

17. Circumference of circle $= 2\pi r$

$$= 2 \times \frac{22}{7} \times 42 = 264 \text{ cm}$$

$\therefore$ Length of wire = 264 cm

Now, wire is bent into a square.

$\therefore$ Perimeter of square = length of wire = 264 cm

$\Rightarrow$ 4 $\times$ side of square = 264

$\therefore$ Side of square $= \frac{264}{4} = 66$ cm

18. Given, perimeter of a trapezium is 52 cm and each non-parallel side is of 10 cm.

Then, sum of its parallel sides

$$= 52 - (10 + 10)$$

$= 52 - 20 = 32$ cm

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

$$= \frac{1}{2} \times 32 \times 8$$

$[\because h = 8 \text{ cm and } a + b = 32 \text{ cm}]$

$$= 128 \text{ cm}^2$$

19. Given, the area of two circles are in the ratio 49 : 64.

Area of a circle $= \pi r^2$

Let area of the first circle $= \pi r_1^2$

and area of the second circle $= \pi r_2^2$

According to the question, $\dfrac{49}{64} = \dfrac{\pi r_1^2}{\pi r_2^2}$

$$\Rightarrow \quad \frac{49}{64} = \frac{r_1^2}{r_2^2}$$

$$\Rightarrow \quad \frac{(7)^2}{(8)^2} = \frac{r_1^2}{r_2^2} \Rightarrow \left(\frac{7}{8}\right)^2 = \left(\frac{r_1}{r_2}\right)^2$$

$\therefore \quad r_1 = 7$ and $r_2 = 8$

The ratio of circumferences of these two circles

$$= \frac{2\pi r_1}{2\pi r_2} = \frac{r_1}{r_2} = \frac{7}{8}$$

[$\because$ circumference of circle $= 2\pi r$]

Hence, required ratio is 7 : 8.

20. Distance covered by wheel in one minute

$$= \left(\frac{66 \times 1000 \times 100}{60}\right) = 110000 \text{ cm}$$

Circumference of wheel

$$= \left(2 \times \frac{22}{7} \times 70\right) = 440 \text{ cm}$$

$\therefore$ Number of revolutions in 1 min

$$= \left(\frac{110000}{440}\right) = 250$$

21. Given, perimeter of triangle = 144 cm

$\therefore$ Sides of triangle are

$$a = \frac{3}{3+4+5} \times 144 = 36 \text{ cm}$$

and $\quad b = 48$ cm,

$c = 60$ cm

$$\text{Now, } s = \frac{a+b+c}{2} = \frac{36+48+60}{2}$$

$= 72$ cm

$\therefore$ Area of triangle $= \sqrt{s(s-a)(s-b)(s-c)}$

$$= \sqrt{72 \times 36 \times 24 \times 12} = 72 \times 12$$

$= 864 \text{ cm}^2$

22. Let the sides containing right angled be x cm and $(x-14)$ cm.

$$\therefore \text{ Area} = \left[\frac{1}{2} x \times (x-14)\right] \text{cm}^2$$

$$\Rightarrow \quad \frac{1}{2} x(x-14) = 120 \quad [\because \text{area} = 120 \text{ cm}^2]$$

$$\Rightarrow \quad x^2 - 14x - 240 = 0$$

$$\Rightarrow \quad (x-24)(x+10) = 0 \Rightarrow x = 24$$

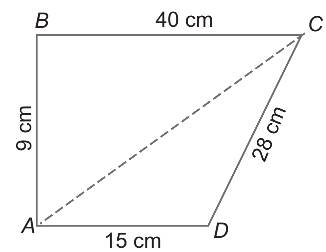
and $\quad x \neq -10$

Other side $= 24 - 14 = 10$ cm

$$\Rightarrow \text{Hypotenuse} = \sqrt{24^2 + 10^2} = \sqrt{676} = 26 \text{ cm}$$

$\therefore \quad$ Perimeter $= (24 + 10 + 26) = 60$ cm.

23. Applying Pythagoras theorem in ΔABC we get,



$$9^2 + 40^2 = AC^2$$

$$\Rightarrow \quad AC = \sqrt{1681} = 41 \text{ cm}$$

$\therefore$ Area of quadrilateral

$= $ area of ΔABC + area of ΔADC

$$= \frac{1}{2}(9 \times 40) + \sqrt{42 \times 1 \times 14 \times 27}$$

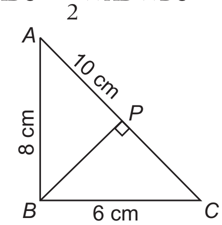
$$\left[\because s = \frac{15+28+41}{2} = 42 \text{ cm}\right]$$

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

$= 180 + 14 \times 3 \times 3$

$= 180 + 126 = 306 \text{ cm}^2$

24. Area of $\Delta ABC = \dfrac{1}{2} \times AB \times BC$



$$\Rightarrow \quad \frac{1}{2} \times 8 \times 6 = \frac{1}{2} \times AC \times BP$$

$\Rightarrow \quad \frac{1}{2} \times 48 = \frac{1}{2} \times 10 \times BP$

$\Rightarrow \quad BP = 4.8 \text{ cm}$

25. Since, 1 hec $= 10000 \text{ m}^2$

Also, $\quad \pi r^2 = 13.86 \times 10000$

$\Rightarrow \quad r = \sqrt{\frac{138600}{22} \times 7} = 210 \text{ m}$

Circumference of circle $= 2\pi r = 1320 \text{m}$

$\therefore$ Total cost of fencing $= 1320 \times 0.60 =$ ₹792

26. Since, $\quad 2(l + b) = 34 \Rightarrow l + b = 17$

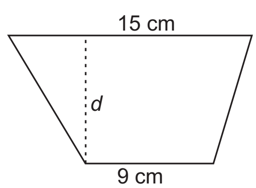
and $\sqrt{l^2 + b^2} = 13 \Rightarrow l^2 + b^2 = 169$

On solving, we get $l = 12$ and $b = 5$

$\therefore$ Area of rectangle 5 $= l \times b$

$= 12 \times 5 = 60 \text{ cm}^2$

27. Area of cross-section of canal $= \frac{1}{2}(15 + 9) \times d$



$\Rightarrow \quad 720 = \frac{1}{2} \times 24 \times d$

$\Rightarrow \quad d = 60 \text{ m}$

28. Diameter of circle $= \sqrt{6^2 + 8^2} = 10$ cm

$\therefore$ Area of cricle $= \pi (5)^2 = 25\pi \text{ cm}^2$

$= 25 \times \frac{22}{7} = 78.57 \text{ cm}^2$

and area of rectangle $= 8 \times 6 = 48$ cm

$\therefore$ Shaded area $= 78.57 - 48$

$= 30.57 \text{ cm}^2$

29. Area of equilateral triangle $= \frac{\sqrt{3}}{4} a^2$

$\Rightarrow \quad \frac{\sqrt{3}}{4} a^2 = 16\sqrt{3} \Rightarrow a^2 = 64 \Rightarrow a = 8$ cm

Since, perimeter of square = perimeter of an equilateral triangle

$\Rightarrow \quad 4x = 3 \times 8 \quad \Rightarrow \quad x = 6$ cm

30. Area of the shaded portion = Area of ΔPTQ

$\because$ Area of a triangle $= \frac{1}{2} \times$ Base $\times$ Height

So, in ΔPTQ, RQ = Height

$\therefore$ Area of $\Delta PTQ = \frac{1}{2} \times 36 \times 24 = 18 \times 24 = 432 \text{ m}^2$

31. The perimeter of regular hexagon

$= 6 \times$ radius of a circle $= 6 \times 8 = 48$ cm

32. Area of regular hexagon inscribed in a circle

$= \frac{6\sqrt{3}}{4}(r)^2$

$= \frac{6\sqrt{3}}{4} \times (10)^2 = 150\sqrt{3} \text{ cm}^2$