CHAPTER

22

Area

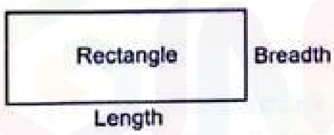
Area denotes the size of a surface which is the amount of space inside the boundary of a flat (2-dimensional) object such as square, rectangular or circle.

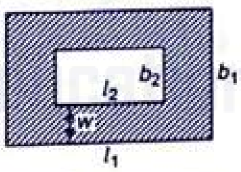
Square

- Area = Side × Side $= (S)^2 = \frac{1}{2}(\text{Diagonal})^2$
- Side $= \sqrt{\text{Area}}$
- Perimeter = 4 (Side)
- Diagonal $= \sqrt{2} \times (\text{Side})$

Rectangle

- Area = Length × Breadth
- Length $= \dfrac{\text{Area}}{\text{Breadth}}$
- Breadth $= \dfrac{\text{Area}}{\text{Length}}$
- Perimeter = 2 (Length + Breadth)
- Diagonal $= \sqrt{(\text{Length})^2 + (\text{Breadth})^2}$
- Area of track $= (l_1b_1 - l_2b_2)$





Example 1. A rectangular plot is 180 m^2 in area. If its length is 18 m. Then, its perimeter is

(a) 28 m (b) 56 m
(c) 360 m (d) None of these

Sol. (*b*) Breadth $= \dfrac{\text{Area}}{\text{Length}} = \dfrac{180}{18} = 10 \text{ m}$

Perimeter = 2 (length + breadth) = 2 (18 + 10) = 56 m

Example 2. The perimeter of a square is $2(2x + 4y)$. Then, the area is

(a) $x^2 - 4xy + 4y^2$ (b) $x^2 + 4y^2$
(c) $x^2 - 4y^2$ (d) $x^2 + 4xy + 4y^2$

Sol. (*d*) Perimeter = 4 × side

$$\text{Side} = \frac{2(2x + 4y)}{4} = x + 2y$$

Area of square $= (x + 2y)^2 = x^2 + 4xy + 4y^2$

Example 3. The side of a square exceeds the side of the another square by 4 cm and the sum of the areas of the two squares is 400 cm^2. The dimensions of the squares is

(a) 8 cm and 12 cm (b) 6 cm and 10 cm
(c) 12 cm and 16 cm (d) None of these

Sol. (*c*) Let side of a square = x cm

Side of another square $= (x + 4)$ cm

$\Rightarrow \quad x^2 + (x + 4)^2 = 400$ (by condition)

$x^2 + x^2 + 16 + 8x = 400 \Rightarrow 2x^2 + 8x - 384 = 0$

$x^2 + 4x - 192 = 0 \Rightarrow (x - 12)(x + 16) = 0$

$\Rightarrow \quad x - 12 = 0$ or $x + 16 = 0$

$x = 12$ or $x = -16$ (not possible)

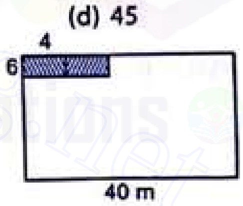
So, side of one square = 12 cm

Side of another square = 12 + 4 = 16 cm

Example 4. The area of the floor of a rectangular hall of length 40 m is 960 m^2. Carpets of size $6 \text{ m} \times 4 \text{ m}$ are available. Then, how many carpets are required to cover the hall?

(a) 20 (b) 30 (c) 40 (d) 45

Sol. (*c*) Area of the floor $= 960 \text{ m}^2$



Area of one carpet $= 6 \times 4 = 24 \text{ m}^2$

Number of carpets required

$$= \frac{\text{Area of floor}}{\text{Area of one carpet}} = \frac{960}{24} = 40$$

Here, 40 carpets are required to cover the hall.

Example 5. A lawn is in the shape of rectangle of length 60 m and width 40 m inside the lawn there is a footpath of uniform width 1 m boardering the lawn. The area of the path is

(a) 194 m^2 (b) 196 m^2
(c) 198 m^2 (d) 200 m^2

Sol. (*c*) Length of the outer rectangle = 60 m

Breadth of the outer rectangle = 40 m

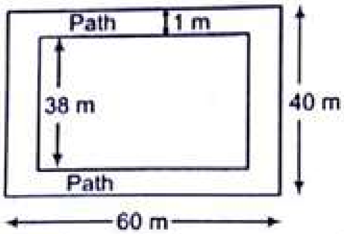
∴ Area of outer rectangle $= 60 \times 40 = 2400 \text{ m}^2$

Width of path = 1 m

∴ Length of the inner rectangle $= 60 \text{ m} - (1 + 1) \text{ m} = 58 \text{ m}$

Breadth of the inner rectangle $= 40 \text{ m} - (1 + 1) \text{ m} = 38 \text{ m}$

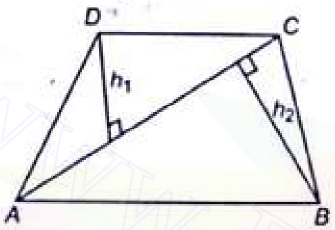
∴ Area of the inner rectangle $= 58 \times 38 = 2204 \text{ m}^2$



Area of the path = [Area of the outer rectangle] − [Area of the inner rectangle] $= (2400 - 2204)\,\text{m}^2 = 196\,\text{m}^2$

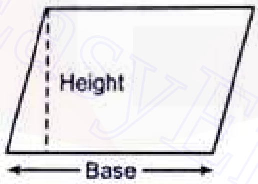
Quadrilateral

Area of the quadrilateral $= \frac{1}{2} \times \text{Diagonal} \times (h_1 + h_2)$

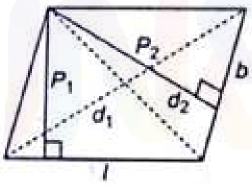


Parallelogram

- Area of the parallelogram $= (\text{Base} \times \text{Height})$



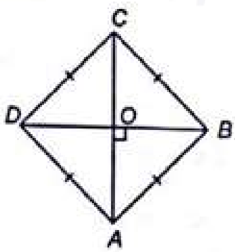
- Perimeter of a parallelogram = 2 (Sum of adjacent side)
- $l \times p_1 = b \times p_2$
- $d_1^2 + d_2^2 = 2(l^2 + b^2)$, where, d_1 and d_2 are the diagonals.



Rhombus

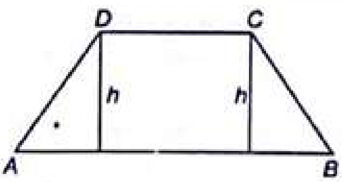
If d_1 and d_2 are the diagonals of the rhombus,

- Area $= \frac{1}{2} d_1 d_2 = 4$ (Side)
- Side $= \frac{1}{2}\sqrt{d_1^2 + d_2^2}$
- Perimeter $= 4 \times \text{side}$



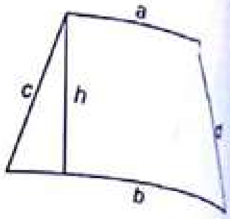
Trapezium

Area of trapezium $= \frac{1}{2}$ (Sum of parallel sides) $\times$ (Distance between them)



$$= \frac{1}{2}(AB + CD) \times h$$

- Area of trapezium, when the lengths of parallel and non-parallel sides are given



$$= \frac{a+b}{k}\sqrt{s(s-k)(s-c)(s-d)},$$

where, $k = (a - b)$ and $s = \frac{k + c + d}{2}$

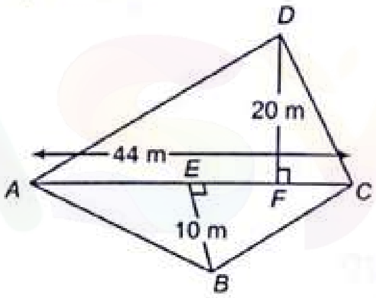
- Perpendicular distance (h) between the two parallel sides

$$= \frac{2}{k}\sqrt{s(s-k)(s-c)(s-d)}$$

Example 6. In a quadrilateral $ABCD$, diagonal $AC = 44$ cm and the length of the perpendicular drawn from B and D to AC are 10 cm and 20 cm respectively. The area of the quadrilateral is

(a) 330 cm^2 (b) 440 cm^2 (c) 550 cm^2 (d) 660 cm^2

Sol. (*d*) Area of quadrilateral

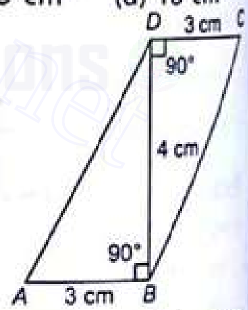


$$= \frac{1}{2}AC(h_1 + h_2) = \frac{1}{2}(44)(20 + 10) = \frac{1}{2} \times 40 \times 30 = 660\,\text{cm}^2$$

Example 7. $ABCD$ is a parallelogram as shown in figure, then its area is

(a) 12 cm^2 (b) 14 cm^2 (c) 15 cm^2 (d) 18 cm^2

Sol. (*a*) Area of parallelogram,



$ABCD$ = (Area of ΔABD + Area of ΔBDC)

$= 2$ (Area of ΔABD)

($\because$ Area ΔABD = Area ΔBDC)

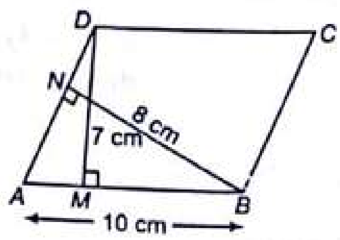
$= 2 \times \frac{1}{2} \times 3 \times 4$

$= 12\,\text{cm}^2$

Example 8. In the parallelogram $ABCD$, $AB = 10$ cm. The altitude corresponding to sides AB and AD are respectively 7 cm and 8 cm. Then, AD is

(a) 8.75 cm (b) 8.95 cm (c) 9 cm (d) 9.25 cm

Sol. (*a*) Area of parallelogram $ABCD$ = Base $\times$ Corresponding altitude



$\therefore$ Area of parallelogram $ABCD = AB \times DM = 10 \times 7 = 70 \text{ cm}^2$ ...(i)

Also, area of parallelogram

$$ABCD = AD \times 8 = 8AD$$

From Eqs. (i) and (ii), $8AD = 70$ ...(ii)

$$\therefore \quad AD = \frac{70}{8} = 8.75 \text{ cm}$$

Example 9. If the length of the diagonal of a rhombus is $(a+b)$ and its area is $\frac{a^2-b^2}{2}$ sq units, then the other diagonal is

(a) $a+b$ (b) $a-b$ (c) $\frac{a-b}{2}$ (d) $\frac{a+b}{2}$

Sol. (*b*) Area of rhombus $= \frac{1}{2} d_1 \times d_2 = \frac{a^2-b^2}{2}$

Let second diagonal be $= d$

$$\therefore \quad \frac{1}{2}(a+b)\cdot d = \frac{a^2-b^2}{2} \Rightarrow (a+b)d = a^2-b^2$$

$$\Rightarrow \quad d = \frac{(a^2-b^2)}{a+b} \Rightarrow d = (a-b)$$

Example 10. The difference between two parallel sides of a trapezium is 4 cm and the perpendicular distance between them is 19 cm. Find the lengths of the parallel sides, if the area of the trapezium is 475 cm^2.

(a) 22 cm and 18 cm (b) 25 cm and 21 cm
(c) 29 cm and 25 cm (d) 27 cm and 23 cm

Sol. (*d*) Let the lengths of the parallel sides of the trapezium be a cm and b cm.

Then, according to question $(a-b) = 4$ ...(i)

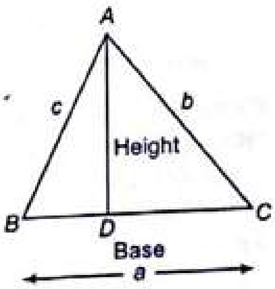
and $\frac{1}{2} \times (a+b) \times 19 = 475$ or $a+b = \frac{950}{19} = 50$

By solving Eqs. (i) and (ii), we get

$$a = 27 \text{ and } b = 23$$

Thus, length of parallel sides are 27 cm and 23 cm.

Triangle

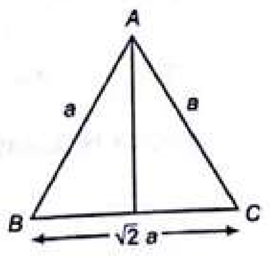


- Area of triangle $= \frac{1}{2}$ base $\times$ height
- Area of triangle $= \sqrt{s(s-a)(s-b)(s-c)}$

where a, b, c are the sides and

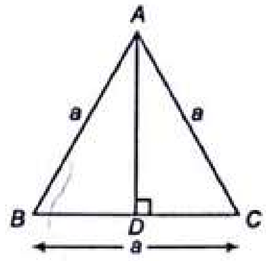
$$s = \text{semi-perimeter} = \frac{a+b+c}{2}$$

Area and Perimeter of a Right Angled Isosceles Triangle



- Area of triangle $= \frac{1}{2} a^2$
- Perimeter $= (2a + \sqrt{2}a)$
- Height $= a/\sqrt{2}$

Area of an Equilateral Triangle



- Area $= \frac{\sqrt{3}}{4} (\text{side})^2$
- Altitude $= \frac{\sqrt{3}}{2} (\text{side})$
- Perimeter $= 3$ (side)

Example 11. The area of a triangle whose sides are 9 cm, 12 cm and 15 cm is

(a) 45 cm^2 (b) 54 cm^2 (c) 56 cm^2 (d) 64 cm^2

Sol. (*b*) Here, $s = \frac{9+12+15}{2} = 18$ cm

Area $= \sqrt{s(s-a)(s-b)(s-c)}$ (Hero's formula)

$= \sqrt{18(18-9)(18-12)(18-15)} = \sqrt{18 \times 9 \times 6 \times 3} = 54 \text{ cm}^2$

Example 12. The perimeter of an equilateral triangle whose area is $4\sqrt{3} \text{ cm}^2$ is

(a) 4 cm (b) 3 cm (c) 12 cm (d) 7 cm

Sol. (*c*) Area $= \frac{\sqrt{3}}{4} (\text{side})^2$

$$\Rightarrow \quad \frac{\sqrt{3}}{4} (\text{side})^2 = 4\sqrt{3}$$

$$(\text{side})^2 = 16 \Rightarrow \text{side} = 4 \text{ cm}$$

$\therefore$ The perimeter $= 3 \times$ side $= 3 \times 4$ cm $= 12$ cm

Example 13. The base of triangular field is three times its altitude. If the cost of cultivating the field at 50 per hectare be ₹ 675, then its base and height are

(a) 900 m and 300 m (b) 600 m and 300 m
(c) 500 m and 200 m (d) None of these

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

$$= \frac{675}{50} = 13.5 \text{ hectares} = (13.5 \times 10000) \text{m}^2 = 135000 \text{m}^2$$

Let altitude be x m Then, according to question base $= 3x$ m

Again area of the field $= \frac{1}{2} \times \text{base} \times \text{altitude} = \frac{1}{2} \times 3x \times x$

or $\frac{3x^2}{2} = 135000$

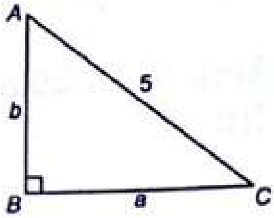
$$\therefore \quad x^2 = \frac{135000 \times 2}{3} = 90000 \Rightarrow x = 300$$

$\therefore$ Base $= 3x = 3 \times 300 = 900$ m and altitude $= x = 300$ m

Example 14. The perimeter of a right triangle is 12 cm. The hypotenuse is 5 cm. The other two sides and area of the triangle are

(a) 3, 4 and 6 cm^2 (b) 4, 3 and 12 cm^2
(b) 6, 2 and 6 cm^2 (d) None of these

Sol. (*a*) Perimeter = 12 cm



$\therefore \quad a+b+5=12 \Rightarrow a+b=7$ cm

Also by Pythagorus theorem,

$$a^2+b^2=25$$

Also, $(a+b)^2+(a-b)^2=2(a^2+b^2)$

$$(a-b)^2=2(a^2+b^2)-(a+b)^2$$
$$=2(25)-(7)^2=50-49=1$$

$\Rightarrow \quad a-b=\pm 1$

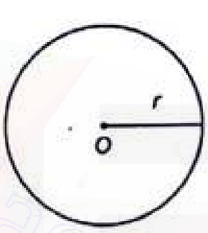
$\therefore \quad a+b=7$ and $a-b=1$ or $a-b=-1$

$\Rightarrow \quad a=4$ cm and $a=3$ cm

$b=3$ cm and $b=4$ cm

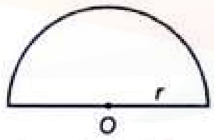
$\therefore$ Area of triangle $=\frac{1}{2}\times 3\times 4=6\text{ cm}^2$

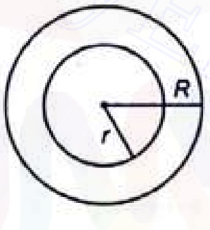
Circle



- Circumference of circle $=2\pi r=\pi D$

  [$\because$ D is diameter, $D=2r$]
- Area of circle $=\pi r^2$
- Area of semi-circle $=\frac{1}{2}\pi r^2$





- Perimeter of semi-circle

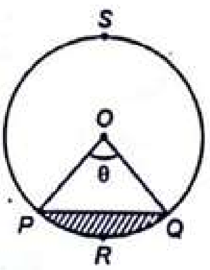
  $=(\pi r+2r)=\pi r+D$
- If 'R' and 'r' be outer and inner radii of a ring, then the area of ring $=\pi(R^2-r^2)$

Area of Sector

If θ be the angle at the centre of a circle of radius r, then

- Length of arc $\overline{PQ}=\frac{2\pi r\theta}{360°}$
- Area of sector $OPRQO=\frac{\pi r^2\theta}{360°}$
- Area of segment $PRQP$ = (Area of sector $OPRQO$) − Area of ΔOPQ

  $=\frac{\pi r^2\theta}{360°}-\frac{1}{2}r^2\sin\theta$



- Area of major segment $QSPQ$

  = (Area of circle) − (Area of segment $PRQP$)

Example 15. The circumference of a circle whose ara is 24.64 m^2 is

(a) 17.2 m (b) 17.4 m (c) 17.6 m (d) 18.0 m

Sol. (*c*) Let the radius of the circle be r metres.

Then, $\pi r^2=24.64$

or $\frac{22}{7}r^2=24.64$ or $r^2=\frac{7\times 24.64}{22}$ or $r=\sqrt{\frac{7\times 24.64}{22}}=2.8$

Thus, circumference $(2\pi r)=2\times\frac{22}{7}\times 2.8=17.6$ m

Example 16. If the radius of a circle is decreased by 20%, then the percentage decrease in its area is

(a) 26% (b) 32% (c) 36% (d) 53%

Sol. (*c*) Let initial radius of the circle be r, then new radius will be 80% of $r=r\times\frac{80}{100}=\frac{4r}{5}$

Initial area $=\pi r^2$ and New area $=\pi\left(\frac{4r}{5}\right)^2=\frac{16}{25}\pi r^2$

$\therefore$ Decrease in area $=\left(\pi r^2-\frac{16}{25}\pi r^2\right)=\frac{9}{25}\pi r^2$

$\therefore$ Percentage decrease in area $=\frac{9}{25}\pi r^2\times\frac{1}{\pi r^2}\times 100=36\%$

Example 17. The diameter of the driving wheel of a car is 140 cm. Then, in order to keep a speed of 66 km/h how many revolutions per minute must the wheel make?

(a) 250 (b) 275 (c) 290 (d) 295

Sol. (*a*) Radius of the wheel = 70 cm = 0.7 m

Circumference of the wheel $=\left(2\times\frac{22}{7}\times 0.7\right)$ m $=4.4$ m

Distance to be covered in 1 min $=\frac{66\times 1000}{60}=1100$ m

$\therefore$ Number of revolutions per minute $=\frac{1100}{4.4}=250$

Example 18. If the perimeter of a semi-circular protractor is 36 cm, then its diameter is

(a) 6 cm (b) 7 cm (c) 7.5 cm (d) 14 cm

Sol. (*a*) Let the radius of the protractor be 'r' cm, then perimeter

$$=(\pi r+2r)=(\pi+2)r=\frac{36}{7}r$$

or $\frac{36}{7}r=36 \quad \therefore \quad r=7$ cm

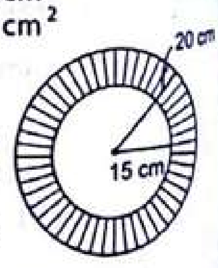
Hence, diameter of the protractor $=2r=2\times 7=14$ cm

Example 19. The area of a ring whose outer and inner radii are respectively 20 cm and 15 cm is

(a) 440 cm^2 (b) 550 cm^2
(c) 565 cm^2 (d) 675 cm^2

Sol. (*b*) Radius outer circle $(R)=20$ cm

Radius inner circle $(r)=15$ cm



$\therefore$ Area of the ring = [Area of outer circle − Area of inner circle]

$=(\pi R^2-\pi r^2)=\pi(R^2-r^2)=\frac{22}{7}(20^2-15^2)$

$=\frac{22}{7}(20+15)(20-15)=\frac{22}{7}\times 35\times 5=550\text{ cm}^2$

Miscellaneous

- Area of room = Length × Breadth
- Area of 4 walls of a room = 2 (Length + Breadth) × Height
- Radius of incircle of an equilateral triangle of side 'a' $= \dfrac{a}{2\sqrt{3}}$
- Radius of circumcircle of an equilateral triangle of side 'a' $= \dfrac{a}{\sqrt{3}}$
- Radius of incricle of a triangle $= \dfrac{\Delta}{S}$

  where $S = \dfrac{1}{2}(a+b+c)$
- Angle inscribed by minute-hand in 60 min = 360°
- Angle inscribed by hour-hand in 12 h = 360°
- Angle inscribed by minute-hand in 1 min = 6°
- Distance moved by a wheel in one revolution

  = Circumference of the wheel
- If the length of a square/rectangle is increased by x% and the breadth is increased by y% , the net effect on the area is given by

$$\text{Net effect} = \left[x + y + \frac{xy}{100}\right]\%.$$

- If the length of a square/rectangle is increased by x% and the breadth is decreased by y% the net effect on the area is given by

$$\text{Net effect} = \left[x - y - \frac{xy}{100}\right]\%.$$

- If the length and breadth of a square/rectangle are decreased by x% and y% respectively, the net effect on the area is given by

$$\text{Net effect} = \left[-x - y + \frac{xy}{100}\right]\%.$$

- If the side of a square/rectangle/triangle is doubled the area is increased by 300%, *i.e.*, the area becomes four times of itself.
- If the radius of a circle is dereased by x%, the net effect on the area is $\left(-\dfrac{x^2}{100}\right)$%, *i.e.*, the area is decreased by $\left(\dfrac{x^2}{100}\right)$%.
- If a floor of dimensions $(l \times b)$ is to be covered by a carpet of width wm the length of the carpet is $\left(\dfrac{lb}{w}\right)$ m.
- If a floor of dimensions $(l \times b)$m. is to be covered by a carpet of width wm at the rate ₹ X per metre, then the total amount required is ₹ $\left(\dfrac{Xlb}{w}\right)$.
- If a room of dimensions $(l \times b)$m. is to be paved with square tiles, then

  (i) the side of the square tile = HCF of l and b

  (ii) the number of tiles required $= \dfrac{l \times b}{(\text{HCF of } l \text{ and } b)^2}$
- If the sides of a rectangular field of area X sq m are in the ratio $m : n$, then the sides are given by $\sqrt{x \cdot \dfrac{m}{n}}$ and $\sqrt{x \cdot \dfrac{n}{m}}$.
- If the side of a regular polygon is a and the polygon has n sides, then the area of the polygon is $\left[\dfrac{n}{4}\cot\left(\dfrac{\pi}{n}\right)\right]a^2$ sq units.
- Area of a square inscribed in a circle of radius r is $2r^2$ and the side of a square inscribed in a circle of radius r is $\sqrt{2}r$.
- The area of the largest triangle inscribed in a semi-circle of radius r is r^2.
- The number of diagonals of a regular polygon of n sides is given by $\dfrac{n(n-3)}{2}$.
- If a square hall x m long is surrounded by a verandah (on the outside of the hall) d m wide, the area of the verandah is given by $4d(x+d)$ sq m.
- If the verandah is made inside, the area is given by $4d(x-d)$ sq m.

Example 20. The perimeter of a floor of a room is 18 m. What is the area of four walls of the room, if its height is 3 m?

(a) 27 m^2 (b) 54 m^2 (c) 58 m^2 (d) 64 m^2

Sol. (*b*) Let length and breadth of the room be l and b.

Then, perimeter $= 2 \times (l+b) = 18$

$\therefore \quad l + b = 9 \quad \ldots(i)$

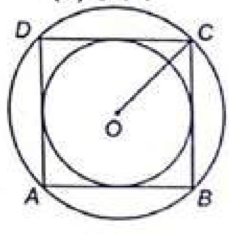
Area of four walls of the room

$\Rightarrow \quad 2 \times (l+b) \times h = 2 \times (9) \times 3 = 54\text{m}^2$

Example 21. The ratio of the areas of the incircle and circumcircle of a square are

(a) 1 : 1 (b) 2 : 1 (c) 1 : 2 (d) 3 : 1

Sol. (*c*) Let side $AB = BC = CD = AD = x$



$\therefore \quad$ Diagonal $= \sqrt{2}\,x$

$\therefore \quad$ Radius of incircle $= \dfrac{x}{2}$

Radius of circumcircle $= \dfrac{\sqrt{2}x}{2} = \dfrac{x}{\sqrt{2}}$

$\therefore \quad$ Required ratio $= \left(\dfrac{\pi x^2}{4} : \dfrac{\pi x^2}{2}\right) = 2 : 4 = 1 : 2$

Example 22. The minute-hand of a clock is 14 cm long. The area of the face of the clock inscribed by the minute hand in 30 min is

(a) 308 cm^2 (b) 312 cm^2
(c) 412 cm^2 (d) 416 cm^2

Sol. (*a*) Angle inscribed by the minute-hand in 60 min $= 360°$

Angle inscribed by the minute-hand in 30 min

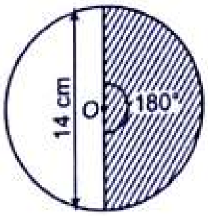
$$= \frac{360}{60} \times 30 = 180°$$

So, $\theta = 180°$ and $r = 14$ cm

Required area swept by minute-hand is 30 m

$$= \frac{\theta}{360°} \times \pi r^2 = \frac{180°}{360°} \times \frac{22}{7} \times 14 \times 14$$

$$= \frac{1}{2} \times \frac{22}{7} \times 14 \times 14 = 308 \text{ cm}^2$$



Example 23. Two circles touch internally. The sum of their areas is 116π cm^2 and distance between their circles is 6 cm. Then, the radii of the circles are

(a) 4 cm and 9 cm (b) 5 cm and 10 cm
(c) 4 cm and 8 cm (d) 4 cm and 10 cm

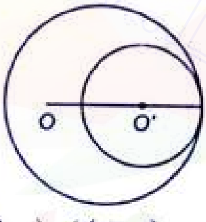
Sol. (*d*) Let the radius of outer circle $= R$

and radius of inner circle $= r$

$\therefore$ $\pi R^2 + \pi r^2 = 116\pi$

$R^2 + r^2 = 116$ ...(i)

If O and O′ be the centre of these circles, then $OO' = (R - r)$



Also, $(R - r) = 6$ (given)

So, $(R + r)^2 + (R - r)^2 = 2(R^2 + r^2)$

$\Rightarrow$ $(R + r)^2 = 2(116) - 36 = 196 \Rightarrow R + r = \sqrt{196}$

So $R + r = 14$ ...(i)

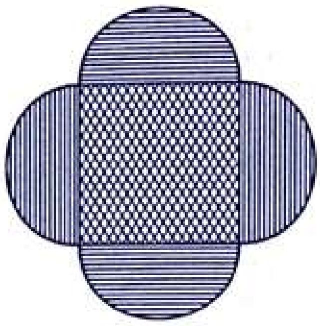
$R - r = 6$ ...(ii)

Solving Eqs. (i) and (ii), we get $r = 4$ cm and $R = 10$ cm

Example 24. A bed of roses is like the figure given below. In the centre is a square and on each side there is a semi-circle. The side of the square is 21 m. If each rose plant needs 6 m^2 of space, then the number of plants in the bed is

(a) 190 plants (b) 199 plants
(c) 201 plants (d) None of these

Sol. (*d*) The side of square $= 21$ m



$\therefore$ Radius of each semi-circle $= 10.5$ m

$\therefore$ Area of semi-circle $= 4\left(\frac{1}{2}\pi r^2\right)$

$$= 4 \times \frac{1}{2} \times \frac{22}{7} \times 10.5 \times 10.5 = 693 \text{ m}^2$$

Area of square $= 21 \times 21 = 441$ m^2

$\therefore$ Total area of bed $= 441 + 693 = 1134$ m^2

As one rose plant needs 6m^2 space.

$\therefore$ Number of rose plant $= \dfrac{\text{Total area}}{\text{Area required by one plant}}$

$$= \frac{1134}{6} = 189 \text{ plants}$$

Exercise

Level I

1. 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

2. 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

3. 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

4. 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

5. A rectangular grassy plot is 110 m by 65 m. It has a uniform path 2.5 m wide all around it on the inside. The area of the path is
(a) 750 cm^2 (b) 850 cm^2 (c) 950 cm^2 (d) 1050 cm^2

6. The length of a rectangle is 2 cm more than its breadth. The perimeter is 48 cm. The area of the rectangle (in cm^2) is
(a) 96 (b) 128 (c) 143 (d) 144

7. If the perimeter of a rectangular field is 200 m and its breadth is 40 m, then its ares (in m^2) is
(a) 1200 (b) 2400 (c) 3600 (d) 4800

8. 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

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

10. An isosceles right angle 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

11. With in a rectangular garden 10 m wide and 20 m long, we wish to pave a walk around the borders of uniform width so as to leave an area of 96 m^2 for flowers. The width of the walk is
(a) 1 m (b) 2 m
(c) 2.5 m (d) 2.56 m

12. 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

13. The ratio of the area of a square to that of the square drawn on its diagonal is
(a) 1 : 1 (b) 1 : 2 (c) 2 : 3 (d) 1 : 3

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

15. The cost of levelling a rectangular ground at ₹ 1.25 per m^2 is ₹ 900. If the length of the ground is 30 m, then the width is
(a) 6 m (b) 18 m (c) 24 m (d) 36 m

16. If 'x' is the median of an equilateral triangle, then its area is
(a) $\frac{x^2}{2}$ (b) x^2 (c) $\frac{\sqrt{3}x^2}{2}$ (d) $\frac{x^2}{\sqrt{3}}$

17. If the area of a square with side 'b' is equal to the area of a triangle with base 'b', then the altitude of the triangle is
(a) $\frac{b}{2}$ (b) $2b$ (c) b (d) $4b$

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

19. 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

20. If the radius of a circle is decreased by 50%, its area will decrease by
(a) 25% (b) 50% (c) 75% (d) 100%

21. The area of the circle whose circumference is equal to the perimeter of a square of side 11 cm is
(a) 154 cm^2 (b) 144 cm^2 (c) 134 cm^2 (d) 124 cm^2

22. 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

23. A horse is tied to a pole with 28 m long string. The area which the horse can graze is equal to
(a) 246 m^2 (b) 2404 m^2 (c) 2464 m^2 (d) 2164 m^2

24. How many times will a wheel of diameter 105 cm rotate in covering a distance of 330 m?
(a) 100 revolutions (b) 110 revolutions
(c) 90 revolutions (d) 105 revolutions

25. The area of ring is 418 cm^2. If the radius of the smaller circle is 6 cm. The radius of the bigger circle is
(a) 18 cm (b) 16 cm (c) 13 cm (d) 10 cm

26. The length of a rectangle is increased by 60%. By what per cent would the width have to be decreased to maintain the same area?
(a) $37\frac{1}{2}$% (b) 60% (c) 75% (d) 120%

27. The perimeter of a rectangular field is 240 m and the ratio between the length and breadth is 5 : 3. The area of the field is
(a) 33750 m^2 (b) 3375 m^2 (c) 3500 m^2 (d) 3950 m^2

28. The ratio between the length and breadth of a rectangular field is 5 : 2. If the breadth is 20 m less than the length, the perimeter of the field is
(a) $\frac{260}{3}$ m (b) 240 m (c) $\frac{280}{3}$ m (d) 360 m

29. 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

30. If the length and breadth of a rectangular plot are increased by 50% and 20% respectively, then the new area is how many times the original area?
(a) $\frac{5}{9}$ (b) 10
(c) $\frac{9}{5}$ (d) None of these

31. If the length of a rectangle is increased by 10% and the area is unchanged, then the corresponding breadth must be decreased by
(a) $9\frac{1}{11}$% (b) 10% (c) 11% (d) $11\frac{1}{9}$%

32. 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

33. The area of an isosceles triangle, each of whose equal sides is 13 cm and whose base is 24 cm is
(a) 60 cm^2 (b) 55 cm^2 (c) 50 cm^2 (d) 40 cm^2

34. The base of an isosceles triangle measures 24 cm and its area is 192 cm^2. Then, its perimeter
(a) 68 cm (b) 64 cm (c) 60 cm (d) 58 cm

35. 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
(a) 68 cm (b) 64 cm (c) 60 cm (d) 58 cm

36. The length and the breadth of a rectangular park are in the ratio 8 : 5. A path, 1.5 m wide running all around the out side of the park has an area of 594 m^2. The dimensions of the park are
(a) 120 m, 75 m (b) 110 m, 85 m
(c) 100 m, 95 m (d) None of these

37. A rectangular lawn, 75 m by 60 m has two roads, each 4 m wide, running through the middle of the lawn,

one parallel to length and the other parallel to breadth. The cost of gravelling the roads at ₹ 4.50 per m^2 is
(a) ₹ 2258 (b) ₹ 2358 (c) ₹ 2458 (d) ₹ 2558

38. In a four sided field, the length of the longer diagonal is 128 m. The lengths of the perpendicular from the opposite vertices upon this diagonal are 22.7 m and 17.3 m. The area of the field is
(a) 2246 m^2 (b) 2460 m^2 (c) 2540 m^2 (d) 2560 m^2

39. The adjacent sides of a parallelogram are 36 cm and 27 cm in length. If the distance between the shorter sides is 12 cm. The distance between the longer sides is
(a) 9 cm (b) 10 cm (c) 11 cm (d) 12 cm

40. A area of the quadrilateral whose sides measure 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

41. A field is in the form of a circle. The cost of ploughing the field at ₹1.50 per m^2 is ₹5775. The cost of fencing the field at ₹8.50 per m is
(a) ₹ 1870 (b) ₹ 2870 (c) ₹ 1970 (d) ₹ 2970

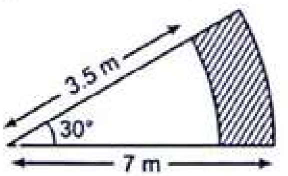
42. A bicycle wheel makes 5000 revolutions in moving 11 km. The diameter of the wheel is
(a) 50 cm (b) 60 cm (c) 70 cm (d) 80 cm

43. 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

44. Two circles touch externally. The sum of their areas is 130π cm^2 and the distance between their centres is 14 cm. The radii of the circles are
(a) 11 cm, 3 cm (b) 10 cm, 4 cm
(c) 9 cm, 5 cm (d) 8 cm, 6 cm

45. The minute hand of a clock is 12 cm long. The area of the face of the clock scribed by the minute hand in 35 min.
(a) 284 cm^2 (b) 294 cm^2 (c) 274 cm^2 (d) 264 cm^2

46. In the given figure, sectors of two concentric circles of radii 7 cm and 3.5 cm are shown. The area of the shaded region



(a) $\frac{77}{4}$ cm^2 (b) $\frac{77}{8}$ cm^2
(c) $\frac{77}{2}$ cm^2 (d) None of these

47. The length and the breadth of a room are in the ratio 5 : 3. The cost of white washing the walls at the rate 20 paise per m^2 is ₹32. If height of the room is 5 m, then the length and the breadth of the room are respectively.
(a) 10 m, 6 m (b) 9 m, 7 m (c) 8 m, 8 m (d) 7 m, 9 m

48. The area of a square field is 4 hectare. How much time will a man taken to run round the field at the speed of 6 km/h.
(a) 6 min (b) 8 min (c) 10 min (d) 12 min

49. If the diagonal of a square is doubled to make the diagonal of another square, the area of the new square will
(a) remain the same (b) become two fold
(c) become three fold (d) become four fold

50. A man walking at a speed of 4 km/h crosses a square field diagonally in 1.5 min. The area of the field is
(a) 4000 m^2 (b) 5000 m^2
(c) 10000 m^2 (d) None of these

51. The number of square tin sheets of side 20 cm that can be cut off from a square tin sheet of side 2 m is
(a) 100 (b) 125 (c) 200 (d) 225

52. Of the two square fields, the area of one is 1 hectare, while the other one is broader by 2%. The difference in their areas is
(a) 104 m^2 (b) 200 m^2 (c) 204 m^2 (d) 404 m^2

53. If the diameter of the circle is increased by 100%, its area is increased by
(a) 100% (b) 200%
(c) 300% (d) 400%

54. If the two parallel sides of a trapezium are 15 cm and 25 cm respectively and the distance between them is 7 cm, then the area of the trapezium is
(a) 105 cm^2 (b) 125 cm^2
(c) 140 cm^2 (d) None of these

55. The diagonals of a rhombus are 24 cm and 10 cm respectively. The perimeter of the rhombus is
(a) 50 cm (b) 52 cm
(c) 60 cm (d) 68 cm

56. The area of the largest circle that can be drawn inside a rectangle with sides 10 m by 8 m, is
(a) 16π m^2 (b) 20π m^2
(c) 25π m^2 (d) 80π m^2

57. The diagonal of a square A is $(x + y)$. The diagonal of a square B with twice the area of A is
(a) $x + 2y$ (b) $2x + y$
(c) $\sqrt{2}(x + y)$ (d) $\sqrt{(x + y)}$

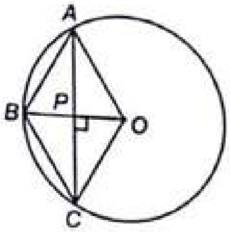
58. If the diameter of a circle is increased by 50, its area is increased by
(a) 100% (b) 200%
(c) 125% (d) 400%

59. Which of the following is rational?
(a) Area of a circle with radius $\frac{1}{\pi}$
(b) Radius of a circle with area $\frac{1}{\pi}$
(c) Circumference of a circle with radius $\frac{1}{\pi}$
(d) Radius of a circle with circumference $\frac{1}{\pi}$

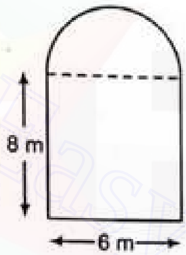
60. A circle and a square have the same perimeter. Then which one of the following is correct? (CDS 2010 II)
(a) The area of the circle is equal to that of square
(b) The area of the circle is larger than that of square
(c) The area of the circle is less than that of square
(d) No conclusion can be drawn

Level II

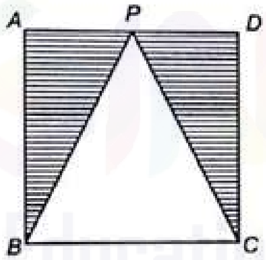
1. A paper is in the form of a rectangle $ABCD$ in which $AB = 18$ cm and $BC = 14$ cm. A semi-circular position with BC as diameter is cut off. The area of the remaining paper is
   (a) 160 cm^2 (b) 165 cm^2
   (c) 175 cm^2 (d) 180 cm^2

2. In the given figure $OABC$ is a rhombus whose three vertices A, B, C lies on the circle of radius 10 cm. The area of rhombus is
   

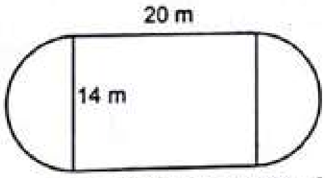
   (a) $50\sqrt{3}$ cm^2
   (b) $100\sqrt{3}$ cm^2
   (c) $75\sqrt{3}$ cm^2
   (d) $125\sqrt{3}$ cm^2

3. The cross-section of a railway tunnel is a rectangle 6 m broad and 8 m high, surrounded by a semi-circle as shown in the adjoining figure. The tunnel is 35 m long. The cost of plastering the internal surface of the tunnel excluding the floor, at the rate of ₹ 3 per m^2 is
   

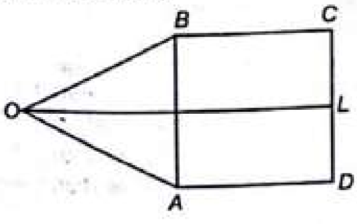
   (a) ₹ 2380 b) ₹ 1780
   (c) ₹ 2170 (d) ₹ 2670

4. In the adjoining figure $AB = 2AD = a$. P is the mid-point of AD. The area of the shaded region is
   

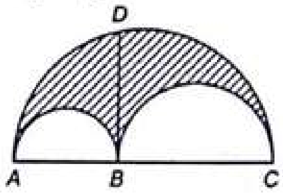
   (a) $\frac{1}{3}a^2$ (b) $\frac{1}{2}a^2$
   (c) $\frac{1}{4}a^2$ (d) a^2

5. A garden is in the form of a rectangle with semi-circular ends on the either side as shown in the diagram below. The length and breadth of the rectangle are 20 m and 14 m, respectively. The cost of levelling the plot at ₹ 25 per m^2 is
   

   (a) ₹ 10850 (b) ₹ 5425 (c) ₹ 8510 (d) ₹ 4255

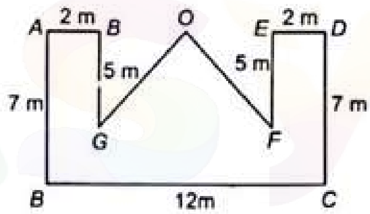
6. $ABCD$ is a square of side a, ABO is an equilateral triangle and OL is perpendicular to CD. Then, area of the trapezium $AOLD$ is
   

   (a) $\frac{a^2}{2} + \frac{\sqrt{3}}{8}a^2$ (b) $\frac{a^3}{2} + \frac{\sqrt{3}}{4}a^3$
   (c) $a^3 + \sqrt{3}\,a^3$ (d) $\frac{a^3}{2} + \frac{\sqrt{3}}{2}a^3$

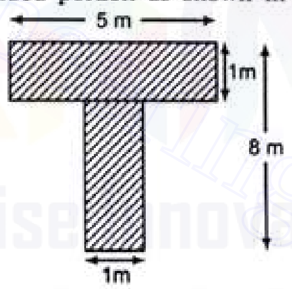
7. Consider the adjoining figure, let $AB = 4$ cm, $BC = 14$ cm, then the area (shaded) bounded by three semi-circles as shown in the adjoining figure in cm^2, is π times
   

   (a) 48 (b) 24 (c) 14 (d) 12

8. The area of a circular ring between two concentric circles of radii r and $r + k$ units, respectively is
   (a) $\pi(2k + r)k$ sq units (b) $\pi(2r + k)k$ sq units
   (c) $\pi(2r + k)r$ sq units (d) $\pi(2rk + k)$ sq units

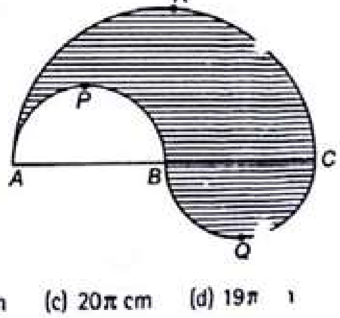
9. In the given frame work, it being given that $OG = OF$. Then, area of the frame work is
   

   (a) 64 m^2
   (b) 62 m^2
   (c) 60 m^2 (d) 58 m^2

10. Area of shaded portion as shown in the figure is
    

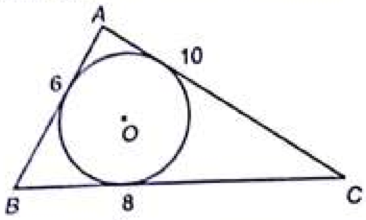
    (a) 10 m^2 (b) 12 m^2 (c) 14 m^2 (d) 16 m^2

11. A paper is in the form of a square of side 20 m. Semi-circles are drawn inside the square paper on two apposite sides as diameter. The semi-circular portions are cut off. The area of the remaining paper is
    (a) $(400 - 2\pi)$ m^2 (b) $(400 - 100\pi)$ m^2
    (c) $(400 - 200\pi)$ m^2 (d) (200π) m^2

12. The boundary of the shaded region in the adjoining diagram consists of three semi-circular arc, the smaller two being equal. If the diameter of the large one is 10 cm, then the length of the boundary is
    

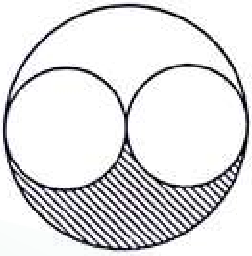
    (a) 31cm (b) 10π cm (c) 20π cm (d) 19π

13. A circle is inscribed in a triangle whose sides are 6 m, 8 m and 10 m, then the area of circle is (in m^2)



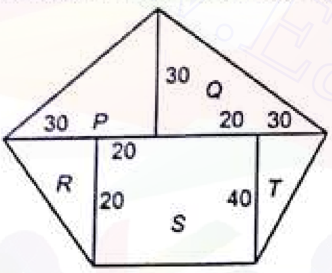
(a) 3π (b) $\frac{3}{2}\pi$ (c) 4π (d) 5π

14. In the adjoining figure, the larger circle with radius 4 cm is touched internally by two smaller circles which also touch each other externally at the centre O of the larger circle. The area of shaded region is (in cm^2)



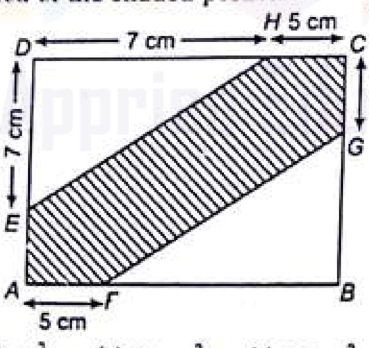
(a) π (b) 2π
(c) 3π (d) 4π

15. The area covered in the adjoining figure is



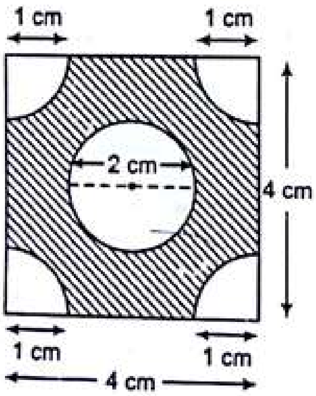
(a) 1800 sq units (b) 2800 sq units
(c) 3600 sq units (d) 1900 sq units

16. The area of the shaded portion in the given figure is



(a) $95\ cm^2$ (b) $98\ cm^2$ (c) $99\ cm^2$ (d) $108\ cm^2$

17. The four corners are circle quadrants and at the centre there is a circle. The area of shaded region is



(a) $(16 - \pi)\ cm^2$
(b) $(16 - 2\pi)\ cm^2$
(c) $(8 - 2\pi)\ cm^2$
(d) $(18 - 2\pi)\ cm^2$

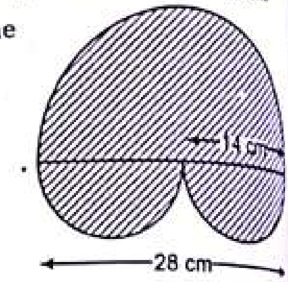
18. If the perimeter of a rhombus is $4a$ and the lengths of its diagonals are x and y, then its area is

(a) $\frac{1}{2}a^2xy$ (b) axy (c) $\frac{(x^2+y^2)}{2}$ (d) $\frac{1}{2}xy$

19. The area of a circle inscribed in an equilateral triangle of side 12 cm is

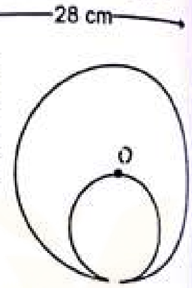
(a) $8\pi\ cm^2$ (b) $10\pi\ cm^2$ (c) $12\pi\ cm^2$ (d) $14\pi\ cm^2$

20. The shaded area in the given figure is



(a) $462\ cm^2$
(b) $562\ cm^2$
(c) $362\ cm^2$
(d) $862\ cm^2$

21. In the adjoining figure, a smaller circle touches a larger circle internally and passes through the centre O of the latter. If the area of the smaller circle is $200\ cm^2$. The area of the larger circle in cm^2 is



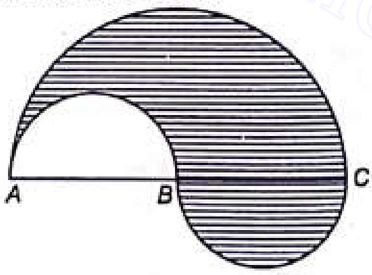
(a) $200\ cm^2$ (b) $400\ cm^2$
(c) $600\ cm^2$ (d) $800\ cm^2$

22. Calculate the area of the field $ABEGFDCA$ from the data

	Metres to G	
	204	
To F 94	198	
	122	10 to E
To D 64	117	
To C 14	88	
	63	7 to B
	From A	

(a) $8110\ m^2$ (b) $9560\ m^2$ (c) $7110\ m^2$ (d) $8110\ m^2$

23. The area of shaded region in the adjoining figure, if $AC = 10$ m and $AB = BC$ is



(a) $125\pi\ m^2$ (b) $25\pi\ m^2$ (c) $\frac{25}{2}\pi\ m^2$ (d) $\frac{30}{7}\pi\ m^2$

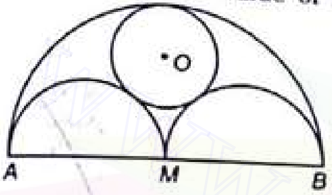
24. The lengths of two sides of a right angled triangle which contain the right angle are a and b, respectively. Three squares are drawn on the three sides of the triangle on the outer side. What is the total area of the triangle and the three squares? **(CDS 2011 II)**

(a) $2(a^2 + b^2) + ab$ (b) $2(a^2 + b^2) + 2.5ab$
(c) $2(a^2 + b^2) + 0.5ab$ (d) $25(a^2 + b^2)$

25. A grassy field has the shape of an equilateral triangle of side 6 m. A horse is tied to one of its vertices with a rope of length 4.2 m. The percentage of the total area of the field which is available for grazing is best approximated by **(CDS 2011 I)**
(a) 50% (b) 55% (c) 59% (d) 62%

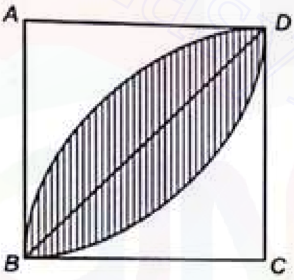
26. The two diagonals of a rhombus are of lengths 55 cm and 48 cm If p is the perpendicular height of the rhombus, then which one of the following is correct? **(CDS 2011 I)**
(a) 36 cm $< p <$ 37 cm (b) 35 cm $< p <$ 36 cm
(c) 34 cm $< p <$ 35 cm (d) 33 cm $< p <$ 34 cm

27. In the given figure, AB is a line of length $2a$ with M as mid-point. Semi-circles are drawn on one side with AM, MB and AB as diameters. A circle with centre O and radius r is drawn such that this circle touches all the three semi-circles what is the value of r? **(CDS 2010 II)**



(a) $\frac{2a}{3}$ (b) $\frac{a}{2}$ (c) $\frac{a}{3}$ (d) $\frac{a}{4}$

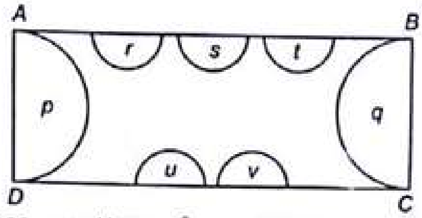
28. In the given figure, the side of square $ABCD$ is 7cm. What is the area of the shaded portion, formed by the arcs BD of the circles with centre at C and A? **(CDS 2010 I)**



(a) 7 cm^2 (b) 28 cm^2
(c) 14 cm^2 (d) 21 cm^2

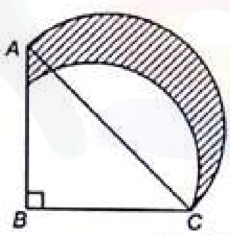
29. Three circular laminas of the same radius are cut out from a larger circular lamina. When the radius of each lamina cut out is the largest possible, then what is the ratio (approximate) of the area of the residual piece of the original lamina to its original total area? **(CDS 2010 I)**
(a) 0.30 (b) 0.35 (c) 0.40 (d) 0.45

30. Seven semi-circular areas are removed from the rectangle $ABCD$ as shown in the figure below in which $AB = 2$ cm and $AD = 0.5$ cm. The radius of each semi-circle r, s, t, u, v is half of that of semi-circle p or q. What is the area of the remaining portion? **(CDS 2009 II)**



(a) $(128 - 13\pi)/128$ cm^2 (b) $(125 - 13\pi)/125$ cm^2
(c) $(128 - 15\pi)/128$ cm^2 (d) None of these

31. In the given figure, ABC is a right angled triangle, right angled at B. $BC = 21$ cm and $AB = 28$ cm. Width AC as diameter of a semi-circle and width BC as radius a quarter circle are drawn. What is the area of the shaded portion? **(CDS 2008 II)**



(a) 425 cm^2 (b) 425.75 cm^2
(c) 428 cm^2 (d) 428.75 cm^2

32. A circle is inscribed in an equilateral triangle of side a. What is the area of any square inscribed in this circle? **(CDS 2007 II)**
(a) $\frac{a^2}{3}$ (b) $\frac{a^2}{4}$
(c) $\frac{a^2}{6}$ (d) $\frac{a^2}{8}$

Answers

Level I

1. (a)	2. (b)	3. (c)	4. (a)	5. (b)	6. (c)	7. (b)	8. (a)	9. (c)	10. (d)
11. (b)	12. (c)	13. (b)	14. (a)	15. (c)	16. (d)	17. (b)	18. (c)	19. (d)	20. (c)
21. (a)	22. (b)	23. (c)	24. (a)	25. (c)	26. (a)	27. (b)	28. (c)	29. (a)	30. (c)
31. (a)	32. (d)	33. (a)	34. (b)	35. (c)	36. (a)	37. (b)	38. (d)	39. (a)	40. (b)
41. (a)	42. (c)	43. (b)	44. (a)	45. (d)	46. (b)	47. (a)	48. (b)	49. (d)	50. (b)
51. (a)	52. (d)	53. (c)	54. (c)	55. (b)	56. (a)	57. (c)	58. (c)	59. (c)	60. (b)

Level II

1. (c)	2. (a)	3. (d)	4. (c)	5. (a)	6. (a)	7. (c)	8. (b)	9. (a)	10. (b)
11. (b)	12. (b)	13. (c)	14. (d)	15. (c)	16. (a)	17. (b)	18. (d)	19. (c)	20. (a)
21. (d)	22. (b)	23. (c)	24. (c)	25. (c)	26. (a)	27. (c)	28. (b)	29. (b)	30. (a)
31. (d)	32. (c)								

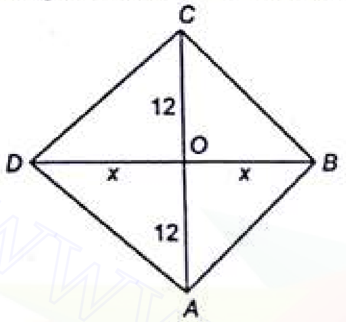
Hints and Solutions

Level I

1. Area of square $= \frac{1}{2} \times (\text{diagonal})^2 = \frac{1}{2} \times 50 \times 50 = 1250\,\text{m}^2$

2. Area of equilateral triangle $= \frac{\sqrt{3}}{4} a^2 = \frac{\sqrt{3}}{4} \times 10 \times 10 = 25\sqrt{3}\ \text{cm}^2$

3. Let the other diagonal be $2x$. So in ΔAOB, $(20)^2 = (12)^2 + x^2$



or $\quad x^2 = 400 - 144 \quad x^2 = 256 \Rightarrow x = 16$ cm

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

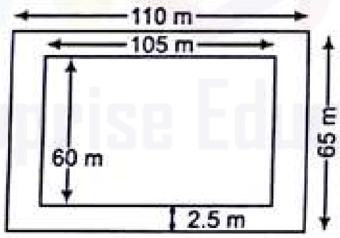
$\therefore \quad$ Area $= \frac{1}{2} \times d_1 d_2 = \frac{1}{2} \times 24 \times 32 = 384\ \text{cm}^2$

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

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

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

5. Area of plot $= 110 \times 65\,\text{m}^2 = 7150\,\text{m}^2$



Area of the plot excluding the path

$= (110 - 5) \times (65 - 5) = (105 \times 60) = 6300\,\text{m}^2$

$\therefore$ Area of path $= 7150 - 6300 = 850\,\text{m}^2$

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

So, $2[x + (x - 2)] = 48 \Rightarrow 4x - 4 = 48 \Rightarrow x = \frac{52}{4} = 13$

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

Here, $\quad$ area $= l \times b = 13 \times 11 = 143\ \text{cm}^2$

7. Perimeter $= 2$ (length + breadth) $= 200$

$\therefore$ Length + Breadth $= 100$

$\therefore \quad$ Length $= 100 -$ Breadth $= 100 - 40 = 60$

$\therefore \quad$ Area of field $= 60 \times 40 = 2400\,\text{m}^2$

8. Length of the arc $= \frac{2\pi r\theta}{360°} = \frac{2 \times 22 \times 42 \times 72}{7 \times 360} = 52.8$ cm

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

Let side of square be 'a', then

$$a^2 + a^2 = (72)^2$$

$$2a^2 = (72)^2 \;\Rightarrow\; \sqrt{2}a = 72 \;\Rightarrow\; a = \frac{72}{\sqrt{2}}$$

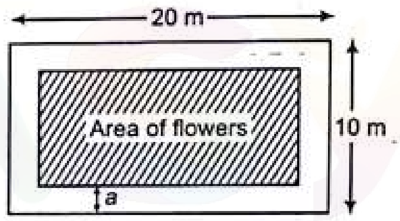
$\therefore$ The perimeter of square $= 4a = 4 \times \frac{72}{\sqrt{2}} = 144\sqrt{2}$ cm

10. Area of an isosceles triangle with side 'a' $= \frac{1}{2} a^2 = 200\,\text{cm}^2$

$\therefore \quad$ Side $= a = 20$ cm

Here, hypotenuse $= \sqrt{a^2 + a^2} = \sqrt{2}a = 20\sqrt{2}$ cm

11. Let the width of the walk be 'a' metres.



$\therefore \quad (20 - 2a)(10 - 2a) = 96$ (given)

$\Rightarrow \quad 4a^2 - 60a + 104 = 0$

$\Rightarrow \quad a^2 - 15a + 26 = 0$

$\Rightarrow \quad (a - 13)(a - 2) = 0$

But $a \neq 13$, so $a = 2$ m

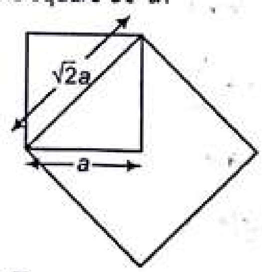
12. Side of the greatest square tile = GCM of the length and breadth of the room

= GCM of 10.5 and 3 is 1.5 m

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

$\therefore$ Number of tiles needed $= \frac{10.5 \times 3}{2.25} = 14$ tiles

13. Let the side of the square be 'a'.



$\therefore$ Its diagonal $= \sqrt{2}a$

Its area $= a^2$

Area of square on the diagonal

$= (\sqrt{2}a)^2 = 2a^2$

Required ratio $= \frac{a^2}{2a^2} = 1 : 2$

14. Let the sides of the two squares be 'a' and 'b'.

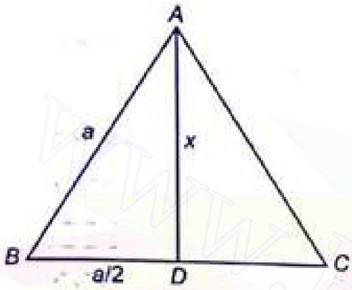
$\therefore \quad \frac{a^2}{b^2} = \frac{4}{1}$ or $\left(\frac{a}{b}\right)^2 = \left(\frac{2}{1}\right)^2$ or $\frac{a}{b} = \frac{2}{1}$

$\therefore$ Ratio of perimeter $= \frac{4a}{4b} = \frac{2}{1}$

15. Area $= \frac{\text{Total cost of levelling}}{\text{Rate}} = \left(\frac{900}{125}\right) \text{m}^2 = 720 \text{ m}^2$

$\therefore$ Breadth of ground $= \frac{\text{Area}}{\text{Length}} = \left(\frac{720}{30}\right) \text{m} = 24 \text{ m}$

16. Here, $a^2 = \frac{a^2}{4} + x^2$



$\Rightarrow \quad x^2 = \frac{3a^2}{4}$ or $a^2 = \frac{4x^2}{3}$

$\therefore$ Area of equilateral triangle

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

$= \frac{\sqrt{3}}{4} \cdot \frac{4x^2}{3} = \frac{x^2}{\sqrt{3}}$

17. $\frac{1}{2} \times b \times \text{Altitude} = b^2$ (by condition)

$\therefore$ Altitude $= \frac{b^2 \times 2}{b} = 2b$

18. Let side be a.

Area of square $= a^2$

New side $= a + \frac{a}{2} = \frac{3a}{2}$

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

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

$\therefore$ Per cent increase in area $= \frac{5a^2}{4a^2} \times 100 = 125\%$

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

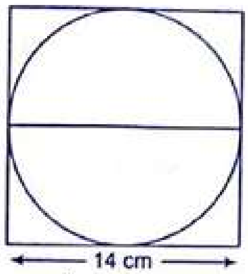
$\therefore \quad r = 7$ cm

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

20. Let original radius $= r_1$

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

New radius $= \frac{r}{2}$



New area of circle $= \frac{\pi r^2}{4}$

$\therefore$ Decrease in area $= \pi r^2 - \frac{\pi r^2}{4} = \frac{3\pi r^2}{4}$

Decrease per cent in area $= \left(\frac{3}{4}\pi r^2 \times \frac{1}{\pi r^2} \times 100\right)\% = 75\%$

21. Circumference of circle $= 4 \times 11 = 44$

$\therefore \quad 2\pi r = 44$ cm (by condition)

$r = \frac{44}{2\pi} = 7$ cm

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

22. Circumference of circle $= 2\pi r = 2 \times \frac{22}{7} \times 42 = 264$ cm

$\therefore$ Length of wire = 264 cm

Wire is bent into a square.

$\therefore$ Perimeter of square = 264

$\therefore$ 4 × sides of square = 264

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

23. Length of string = radius of circle = 28 m

Area over which the horse can graze

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

24. Circumference of the wheel $= \pi d = \frac{22}{7} \times 105 = 330$ cm

Distance covered in 1 revolution = 330 cm

As, 330 m = 33000 cm

Number of revolution to cover 33000 cm

$= \frac{33000}{330} = 100$ revolution

25. Area of ring $= \pi(R^2 - r^2)$

Here, $r = 6$ cm, $R = ?$

Area of ring $= 418 = \frac{22}{7}(R^2 - 6^2)$ (given)

$R^2 - 36 = \frac{418 \times 7}{22}$

$R^2 = 133 + 36 = 169 \Rightarrow R = \sqrt{169} = 13$ cm

26. Let length $= l$ and breadth $= b$

$\therefore$ New length $= l + \frac{60}{100} \times l = \frac{8l}{5}$

New breadth $= a$

Then, $lb = \frac{8l}{5} \times a$ or $a = \frac{5b}{8}$ (by condition)

Decrease per cent $=\left[\left(b-\frac{5}{8}b\right)\times\frac{1}{b}\times 100\right]\%=37\frac{1}{2}\%$

27. Perimeter $=240$ m

$\therefore$ Length + Breadth $=\frac{240}{2}=120$ m

$\therefore$ Length $=\frac{5}{8}\times 120=75$ m

Breadth $=\frac{3}{8}\times 120=45$ m

$\therefore$ Area of rectangle $=(75\times 45)\text{m}^2=3375\text{m}^2$

28. Let length be $5x$ and breadth be $2x$.

$\because$ $5x-2x=20$

$3x=20 \Rightarrow x=\frac{20}{3}$

$\therefore$ Perimeter $=2(5x+2x)=14x=14\times\frac{20}{3}=\frac{280}{3}$ m

29. Inner circumference $=2\pi r=440$ m

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

Width of track $=14$ m

$\therefore$ Radius of outer circle $=(70+14)$ m $=84$ m

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

30. Let length $=x$ and the breadth $=y$

The original a $=xy$

New length $=150\%$ of $x=\frac{150x}{100}=\frac{3x}{2}$

New breadth $=120\%$ of $y=\frac{120y}{100}=\frac{6y}{5}$

New area $=\frac{3x}{2}\times\frac{6y}{5}=\frac{9}{5}xy=\frac{9}{5}$ (original area)

31. Let length $=l$ and breadth $=b$

New breadth $=z$

Then, $(110\% \text{ of } l)\times z=l\times b$

$\frac{110lz}{100}=lb \Rightarrow z=\frac{10b}{11}$

$\therefore$ Percentage decrease in breadth $=\left[\left(b-\frac{10}{11}b\right)\times\frac{1}{b}\times 100\right]$

$=9\frac{1}{11}\%$

32. Dividing 144 cm in the ratio $3:4:5$, we get $a=36$ cm, $b=48$ cm, $c=60$ cm

Then, $s=\frac{a+b+c}{2}=\frac{36+48+60}{2}=72$ cm

$\therefore$ Area of triangle $=\sqrt{s(s-a)(s-b)(s-c)}=\sqrt{72\times 36\times 24\times 12}$

$=72\times 12=864\text{ cm}^2$

33. Let each equal side $=a=13$ cm and base $b=24$ cm

$\therefore$ Ara of the triangle $=\frac{1}{4}b\cdot\sqrt{4a^2-b^2}$

$=\left[\frac{1}{4}\times 24\times\sqrt{4\times 169-24\times 24}\right]\text{cm}^2=60\text{ cm}^2$

34. Here, base $b=24$ cm, let each equal side be 'a' cm.

Then, area $=\frac{1}{4}b\cdot\sqrt{4a^2-b^2}=\frac{1}{4}\times 24\times\sqrt{4a^2-576}$

$=12\times\sqrt{a^2-144}$

$12\times\sqrt{a^2-144}=192$ (given)

$\sqrt{a^2-144}=16$

$a^2-144=256 \Rightarrow a=20$ cm

$\therefore$ Perimeter of triangle $=(2a+b)=(40+24)=64$ cm

35. Let the sides containing angles be x cm and $(x-14)$ cm

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

But area $=120\text{ cm}^2$

$\Rightarrow \frac{1}{2}x(x-14)=120$ (given) $\Rightarrow x^2-14x-240=0$

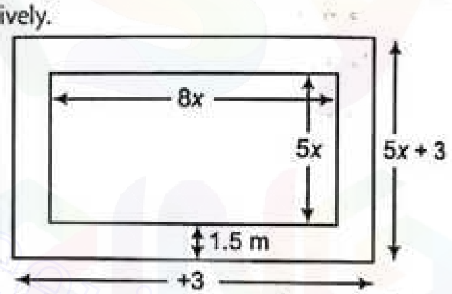
$\Rightarrow$ $(x-24)(x+10)=0 \Rightarrow x\neq -10$

$\Rightarrow$ $x=24$, other side $=24-14=10$ cm

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

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

36. Let the length and breadth of the park be $8x$ m and $5x$ m respectively.



$\therefore$ Area of the park $=(8x\times 5x)\text{m}^2=40x^2\text{ m}^2$

Length of park including the path $=(8x+3)$ m

Breadth of park including the path $=(5x+3)$ m

$\therefore$ Area of the park including the path $=(8x+3)(5x+3)\text{m}^2$

$\therefore$ Area of the path $=(8x+3)(5x+3)-40x^2=(39x+9)\text{m}^2$

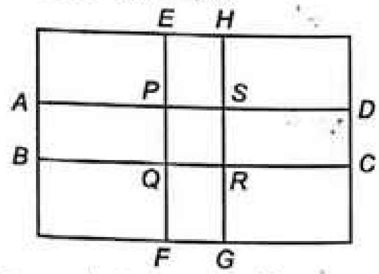
$\therefore$ $39x+9=594 \Rightarrow 39x=585 \Rightarrow x=15$

$\therefore$ Length $=(8\times 15)$ m $=120$ m

Breadth $=(5\times 15)$ m $=75$ m

37. Area of road $ABCD=(75\times 4)\text{ m}^2$

Area of road $EFGH=(60\times 4)\text{m}^2$



Area common to both $=(4\times 4)\text{m}^2$

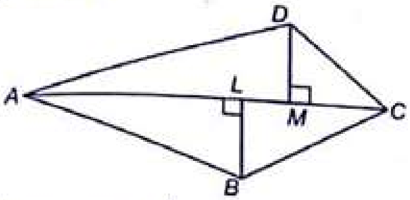
$\therefore$ Area of road $=(300+240-16)=524\text{ m}^2$

$\therefore$ Cost of gravelling the roads $=₹\,(524\times 450)$

$=₹\,2358$

38. Here, $AC = 128$ m, $BL = 22.7$ m, $DM = 17.3$ m

$\therefore$ Area of the field

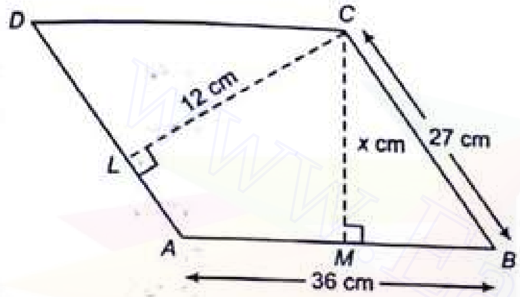


$= \frac{1}{2}[AC(BL + DM)] = \frac{1}{2} \times 128(22.7 \times 17.3) = 64 \times 40 = 2560\,\text{m}^2$

39. Let distance between the longer sides be x cm.

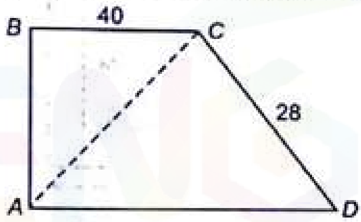
Area of parallelogram $= AD \times LC = MC \times AB$

$\therefore \quad 36 \times x = 27 \times 12 \Rightarrow x = \frac{27 \times 12}{36} = 9$



$\therefore$ Distance between the longer sides = 9 cm

40. Applying Pythagorus 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

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

$= 180 + 14 \times 3 \times 3 = 180 + 126 = 306\,\text{cm}^2$

41. Area of the field $= \frac{\text{Total cost of ploughing}}{\text{Rate per m}^2}$

$= \left(\frac{5775}{1.5}\right)\text{m}^2 = 5775 \times \frac{2}{3} = 3850\,\text{m}^2$

Let radius be r.

Then, $\quad \pi r^2 = 3850$

$\Rightarrow \quad r^2 = \frac{3850}{\pi} - \frac{3850}{22} \times 7 = 1225$

$r = \sqrt{1225} = 35$

Circumference of the field $= 2\pi r$

$= 2 \times \frac{22}{7} \times 35 = 220$ m

$\therefore$ Cost of fencing the field $= 220 \times \frac{17}{2} =$ ₹ 1870

42. Distance covered in one revolution $= \frac{11 \times 1000 \times 100}{5000} = 220$ cm

$\therefore$ The circumference of the wheel = 220 cm

Let the diameter be 'D'.

Then, $\quad \pi D = 220 \Rightarrow \frac{22}{7} \times D = 220$

$D = \frac{220 \times 7}{22} = 70$ cm

43. Distance covered by wheel in 1 min

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

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

Number of revolutions in 1 min $= \left(\frac{110000}{440}\right) = 250$

44. Let radius of given circles be x cm and $(14 - x)$ cm.

$\therefore$ Sum of areas of circle $= [\pi x^2 + \pi(14 - x)^2]$

$130\pi = \pi x^2 + \pi(14 - x^2)$ (by condition)

$130 = 2x^2 - 28x + 196$

$\Rightarrow \quad x^2 - 14x + 33 = 0$

$(x - 11)(x - 3) = 0 \Rightarrow x = 11$ or $x = 3$

$\therefore$ The radii of circles are 11 cm and 3 cm.

45. Angle inscribed by minute-hand in 60 min = 360

Angle inscribed in 35 min $= \frac{360°}{60} \times 35 = 210°$

$r = 12$ cm

$\therefore$ Area swept by the minute-hand in 35 min

= Area of sector with $r = 12$cm and $\theta = 210°$

$= \frac{22}{7} \times \left(12 \times 12 \times \frac{210}{360}\right)\text{cm}^2 = 264\,\text{cm}^2$

46. Area of the shaded region

= (Area of sector with $r = 7$ cm, $\theta = 30°$)

− (Area of sector with $r = 3.5$ cm, $\theta = 30°$)

$= \left[\left(\frac{22}{7} \times 7 \times 7 \times \frac{30}{360}\right) - \left(\frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times \frac{30}{360}\right)\right]\text{cm}^2$

$= \left(\frac{77}{6} - \frac{77}{24}\right)\text{cm}^2 = \frac{77}{8}\,\text{cm}^2$

47. Let the length and the breadth of the room be $5x$ and $3x$ cm.

So, area of four walls $= \frac{32}{0.20} = 160\,\text{m}^2$

$\therefore \quad 2(5x + 3x) \times 5 = 160$ (by condition)

$\Rightarrow \quad 8x = 16 \Rightarrow x = 2$

$\therefore$ Length $= 5x = 10$ cm, Breadth $= 3x = 6$ cm.

48. The area of the square field = 4 hectare

$= 4 \times 10000 = 40000\,\text{m}^2$

Side of field $= \sqrt{40000} = 200$ m

$\therefore$ It perimeter $= 200 \times 4 = 800$ m

$\therefore$ Time taken to run around $= \frac{800}{6 \times 1000} = \frac{8}{60}$ h = 8 min

49. Let the diagonal so square be 'a'.

$\therefore$ Its area $= \frac{1}{2}a^2$

New diagonal $= 2a$

$\therefore$ New area $= \frac{1}{2}(2a)^2 = \frac{4a^2}{2} = 2a^2$

As, $2a^2 = 4\left(\frac{1}{2}a^2\right) = 4$ (original area)

50. Length of diagonal = Distance travelled in 1.5 min

$$= \frac{4000 \times 1.5}{60} = 100 \text{ cm}$$

$\therefore$ Area of the field $= \frac{1}{2}(\text{diagonal})^2 = \frac{1}{2}(100 \times 100)\text{m}^2 = 5000\text{m}^2$

51. Area of tin sheet $= (2m)^2 = 4m^2$

$$= 4 \times 100 \times 100 = 40000 \text{ cm}^2$$

Area of small square tin pieces $= (20)^2 = 400 \text{ cm}^2$

$\therefore$ Number of small tin sheet $= \frac{40000}{400} = 100$

52. Area of field = 1 hectare $= 10000\text{m}^2$

$\therefore$ Side = 100 m

$\therefore$ Side of other field = 102% of 100 = 102

$\therefore$ Area of the field $= 102 \times 102 = 10404$

$\therefore$ Difference of area $= 10404 - 10000 = 404\text{m}^2$

53. Let diameter $= 2r$

$\therefore$ Area $= \pi r^2$

New diameter $= 4r$

New area $= 4\pi r^2$

$\therefore$ Increase in area $= 4\pi r^2 - \pi r^2 = 3\pi r^2$

$\therefore$ Increase percentage in area $= \left(\frac{3\pi r^2}{\pi r^2} \times 100\right)\% = 300\%$

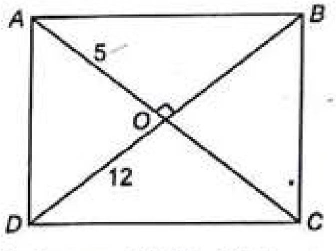
54. Area of trapezium $= \frac{1}{2}$ (Sum of parallel sides) $\times$ Distance between them

$$= \frac{1}{2}(25 + 15) \times 7 = 140 \text{ cm}^2$$

55. Here, $AO = 5, DO = 12$

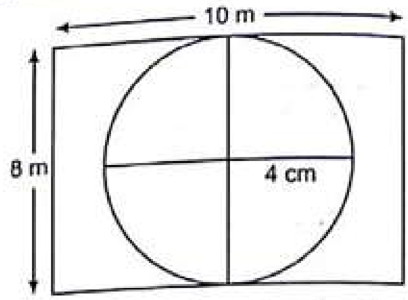
$\therefore$ $AD = \sqrt{OA^2 + OD^2} = \sqrt{5^2 + 12^2}$

$= \sqrt{169} = 13$ cm



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

56. Here, radius of circle $= 4$ m



$\therefore$ Area of circle $= \pi r^2 = \pi 4^2 = 16\pi \text{ m}^2$

57. Let 'a' be the side of the square A.

Then, $2a^2 = (x + y)^2$

$\therefore$ Area of square $B = 2 \times$Area of square A

$= 2 \times (2a^2) = 4a^2$

But $4a^2 = 2(x + y)^2$

$\therefore$ Side of square $B = \sqrt{2}(x + y)$

58. Let the diameter of circle $= d$

Then, area of circle $= \pi \times \left(\frac{d}{2}\right)^2 = \frac{\pi d^2}{4}$

and new diameter = 150% of $\frac{3d}{2}$

$\therefore$ New area of the circle $= \frac{\pi 9d^2}{16}$

$\therefore$ Increase in area $= \frac{9\pi d^2}{16} - \frac{\pi d^2}{4} = \frac{5\pi d^2}{16}$

$\therefore$ Increase per cent in area $= (5\pi \frac{d^2}{16} \times \frac{4}{\pi d^2} \times 100) = 125\%$

59. (a) Area of circle with radius $\frac{1}{\pi} = \pi \times \frac{1}{\pi^2} = \frac{1}{\pi}$

which is irrational.

(b) Radius of circle $= \sqrt{\frac{\text{Area}}{\pi}} = \sqrt{\frac{\frac{1}{\pi}}{\pi}} = \sqrt{\frac{1}{\pi^2}} = \frac{1}{\pi}$

which is irrational.

(c) Circumference of circle with radius $\frac{1}{\pi} = 2\pi \cdot \frac{1}{\pi} = 2$

which is rational.

60. Let r be the radius of the circle and a be the side of square

By given condition, $2\pi r = 4a$

$\therefore$ $a = \frac{\pi r}{2}$

$\therefore$ Area of square $= \left(\frac{\pi r}{2}\right)^2 = \frac{\pi^2 r^2}{4} = \frac{9.86r^2}{4} = 2.46r^2$

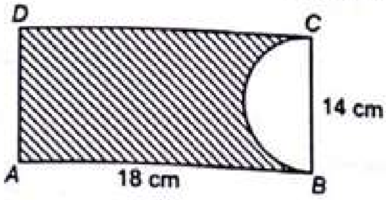
and area of circle $= \pi r^2 = 3.14r^2$

Here, area of the circle is larger than that of square.

Level II

1. Required area = (Area of rectangle $ABCD$)

$-$ (Area of semi-circle with $r = 7$ cm)



$$= \left[18 \times 14 - \frac{1}{2} \times \pi \times 7^2\right] = 252 - \frac{1}{2} \times \frac{22}{7} \times 7 \times 7 \text{ cm}^2$$

$$= 252 - 77 = 175 \text{ cm}^2$$

2. Here, $OA = OB = OC = 10$ cm

Also, $AC = 2CP$

and $CP = \sqrt{OC^2 - OP^2} = \sqrt{75} = 5\sqrt{3}$ cm

As, $AC = 2PC$

$\therefore$ $AC = 10\sqrt{3}$ cm

$\therefore$ Area of the rhombus $OABC$

$$= \frac{1}{2} OB \times AC = \frac{1}{2} \times 10 \times 10\sqrt{3} = 50\sqrt{3} \text{ cm}^2$$

3. Area to be plastering = 2 (Area of parallel walls of height 8 m)

+ (Area of semi-cylinderical top)

$\therefore$ Area of walls $= 2 \times (8 \times 35) = 560 \text{ m}^2$

Area of semi-circular top $= \frac{22}{7} \times 3 \times 35 = 22 \times 3 \times 5 = 330 \text{m}^2$

$\therefore$ Total area to be plastering $= 560 + 330 = 890 \text{m}^2$

$\therefore$ Cost of plastering = ₹ (890×3) = ₹ 2670

4. Area of shaded region

$= \text{Area } \Delta ABP + \text{Area of } \Delta PDC$

$$= \frac{1}{2} \times AB \times AP + \frac{1}{2} DC \times PD = \frac{1}{2} \times AB \times AP + \frac{1}{2} AB \times PD$$

$$= \frac{1}{2} AB (AP + PD) \qquad (\because AB = DC)$$

$$= \frac{1}{2} AB \times AD \qquad [\because AD = (AP + PD)]$$

$$= \frac{1}{2} AB \times \frac{AB}{2} = \frac{1}{4} a^2 \qquad \left[\because AB = a \text{ and } AD = \frac{a}{2}\right]$$

5. Area to be levelled = Area of rectangle

+ 2 (Area of semi-circular ends)

$$= 20 \times 14 + 2 \times \frac{1}{2} \times \frac{22}{7} \times 7 \times 7$$

$$= 280 + 154 = 434 \text{ m}^2$$

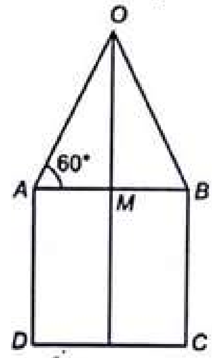
$\therefore$ Cost of levelling = ₹ (434×25) = ₹ 10850

6. As, OAB is equilateral triangle

$\therefore$ $\angle OAM = 60°$ and $AB = OA = OB = a$

$\therefore$ (altitude) $OM = \frac{\sqrt{3}}{2}$ side $= \frac{\sqrt{3}}{2} a$

$\therefore$ $OL = OM + ML = \frac{\sqrt{3}}{2} a + a$



$\therefore$ Area of trapezium $= \frac{1}{2}(AD + OL) AM$

$$= \frac{1}{2}\left(a + \frac{\sqrt{3}}{2} a + a\right)\frac{a}{2} \qquad \left(\because AM = \frac{1}{2} AB\right)$$

$$= \frac{\sqrt{3}}{8} a^2 + \frac{a^2}{2}$$

7. The area (shaded) bounded by three semi-circle = Area of semi-circle with AC as diameter $-$ (Area of semi-circle with diameter AB + Area of semi-circle with diameter BC)

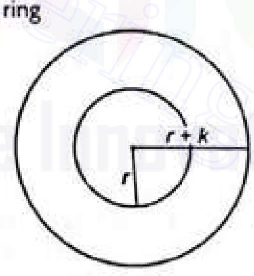
$$= \frac{1}{2} \pi (9)^2 - \left[\frac{1}{2} \pi (7)^2 + \frac{1}{2} \pi (2)^2\right]$$

$$= \pi \frac{81}{2} - \frac{1}{2}[49\pi + 4\pi]$$

$$= \frac{\pi\, 81}{2} - \frac{1}{2}[53\pi] = \frac{\pi}{2}(81 - 53) = \frac{\pi (28)}{2} = 14\pi$$

$\therefore$ Area of shaded region = 14 times π

8. Area of circular ring



$$= \pi (r + k)^2 - \pi r^2$$

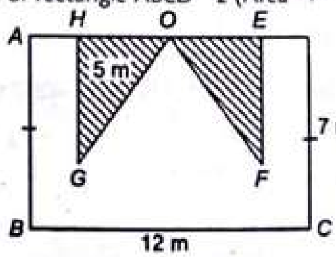
$$= \pi [(r + k)^2 - r^2]$$

$$= \pi (r^2 + k^2 + 2rk - r^2) = \pi (k^2 + 2rk)$$

$$= \pi (2r + k) k \text{ sq units}$$

9. Area of frame-work $ABCDEFOGHA$ =

Area of rectangle $ABCD - 2$ (Area [illegible]OG)



$HO = AO - AH = 6 - 2$

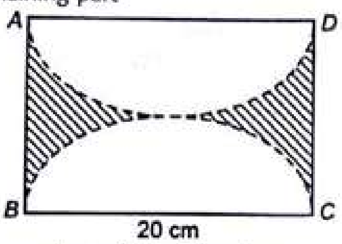
Also, $HG = AB - 2 = 7 - 2 = 5\text{ m}$

Area of frame-work $= 12 \times 7 - 2\left(\frac{1}{2} \times 5 \times 4\right) = 84 - 20 = 64\text{m}^2$

10. Area of shaded region = Area of horizontal rectangle + Area of vertical rectangle

$= 5 \times 1 + (8 - 1) \times 1 = 5 + 7 = 12\text{ m}^2$

11. Area of remaining part



= Area of shaded region

= Area of square − 2 (Area of semi-circle)

$= 20 \times 20 - 2\left(\frac{1}{2} \times \pi \times 10^2\right) = (400 - 100\,\pi)\text{m}^2$

12. Length of boundary = Length arc ($APB + BQC + ARC$)

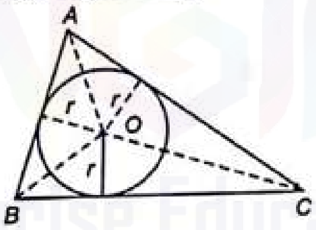
$= \pi\left(\frac{AB}{2}\right) + \pi\left(\frac{BC}{2}\right) + \pi\left(\frac{AC}{2}\right)$

$= \pi\left(\frac{5}{2}\right) + \pi\left(\frac{5}{2}\right) + \pi(5)$

$= \frac{20\pi}{2} = 10\,\pi\text{ cm}$

13. As, $AB^2 + BC^2 = AC^2$

$\therefore$ ABC is a right angled triangle.



$\therefore$ $\angle ABC = 90°$

Now, area of (ΔABC) = Area of (ΔOBA) + Area of (ΔOBC) + Area of (ΔOAC)

$\frac{1}{2} \times AB \times BC = \frac{1}{2} \times AB \times r + \frac{1}{2} \times r \times BC + \frac{1}{2} \times r \times AC$

$= \frac{1}{2} r(AB + BC + AC)$

$\frac{1}{2} \times 8 \times 6 = \frac{1}{2} r(6 + 8 + 10) \Rightarrow 24 = 12r \Rightarrow r = 2\text{ m}$

$\therefore$ Area of inscribed circle $= \pi r^2 = 4\pi\text{ m}^2$

14. Radius of smaller circle = 2 cm

$\therefore$ Area of shaded region $= \frac{1}{2}$ [Area of larger circle − 2(Area of smaller circle)]

$= \frac{1}{2}[\pi\, 4^2 - 2(\pi)2^2]$

$= \frac{1}{2}[16\,\pi - 8\,\pi] = \frac{1}{2}(8\,\pi) = 4\,\pi\text{ cm}^2$

15. The area covered in the figure

= Area of ΔP + Area of ΔQ + Area of ΔR + Area of ΔT + Area of trapezium S

$= \frac{1}{2} \times 30 \times 50 + \frac{1}{2} \times 50 \times 30 + \frac{1}{2} \times 30 \times 20 + \frac{1}{2} \times 30 \times 40 + \frac{1}{2}(20 + 40) \times 40$ sq units

$= [750 + 750 + 300 + 600 + 1200] = 3600$ sq units

16. Area of shaded region = Area of square − (Area of ΔEDH + Area of ΔFBC)

$= \left[12 \times 12 - \left(\frac{1}{2} \times 7 \times 7 + \frac{1}{2} \times 7 \times 7\right)\right] = [144 - 49] = 95\text{ cm}^2$

17. Area of shaded region = Area of square − {4 × Area of a sector + Area of circle at centre}

$= 4 \times 4 - \left\{4 \times \frac{90}{300} \times \pi \times 1^2 + \pi \times 1^2\right\}$

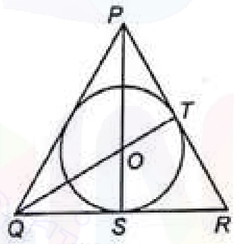
$= 16 - \{\pi + \pi\}$

$= (16 - 2\,\pi)\text{ cm}^2$

18. Area of rhombus

$= \frac{1}{2}$ product of diagonals $= \frac{1}{2} xy$

19. Here, PQR is an equilateral triangle in which a circle has been inscribed. Let OS be radius of cricle



Then, $OS = r$

$\therefore$ $\angle OQS = 30°$

$\therefore$ In ΔOQS, $\frac{OQ}{OS} = \text{cosec } 30°$

$\frac{OQ}{OS} = 2 \Rightarrow OQ = 2OS = 2r$

Also, $QS = 6\text{ cm}$

$\therefore$ $r^2 + 6^2 = (2r)^2$

$3r^2 = 36$

$\therefore$ $r^2 = 12$

$\therefore$ $r = 2\sqrt{3}\text{ cm}$

$\therefore$ Area of circle $= \pi r^2 = \pi(2\sqrt{3})^2 = 12\pi\text{ cm}^2$

20. Area of shaded region

= Area of bigger semi-circle + 2 (Area of small semi-circle)

$= \frac{1}{2}\pi(14)^2 + 2\left(\frac{1}{2} \times \pi \times 7 \times 7\right)$

$= \frac{1}{2} \times \frac{22}{7} \times 14 \times 14 + \frac{22}{7} \times 7 \times 7$

$= 308 + 154 = 462\text{ cm}^2$

21. Let r be the radius of smaller circle

$\therefore \quad \pi r^2 = 200$

$\therefore \quad r^2 = \frac{200}{\pi}$

Let radius of bigger circle $= R$

$\Rightarrow \quad R = 2r$

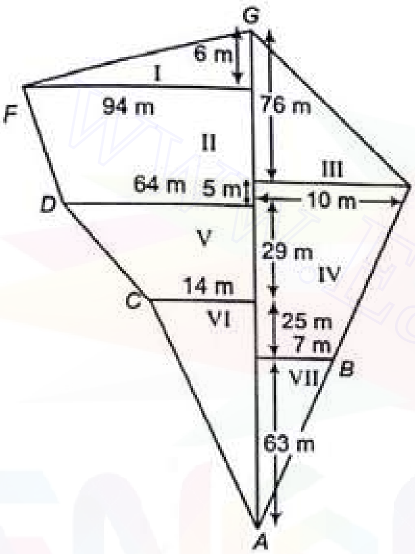
$\Rightarrow \quad R^2 = 4r^2$

$\therefore$ Area of larger circle $= \pi R^2 = \pi \cdot 4 \cdot \frac{200}{\pi} = 800 \text{ cm}^2$

22. Area of field = Area of figure

(I + II + III + IV + V + VI + VII)

$\therefore$ Area of figure $\text{I} = \frac{1}{2} \times 94 \times 6 = 282 \text{ m}^2$



$\therefore$ Area of figure $\text{II} = \frac{1}{2} \times (94 + 64) \times 81$

$= \frac{1}{2} \times 158 \times 81$

$= 79 \times 81 = 6399 \text{ m}^2$

Area of figure $\text{III} = \frac{1}{2} \times 10 \times 82 = 410 \text{m}^2$

Area of figure $\text{IV} = \frac{1}{2} \times (10 + 7) \times 54$

$= \frac{17 \times 59}{2} = 5015 \text{ m}^2$

Area of figure $\text{V} = \frac{1}{2} \times 29 \times (64 + 14)$

$= \frac{1}{2} \times 29 \times 78 = 1131 \text{m}^2$

Area of figure $\text{VI} = \frac{1}{2} \times 14 \times 88 = 616 \text{m}^2$

Area of figure $\text{VII} = \frac{1}{2} \times 63 \times 7 = 220.5 \text{ m}^2$

$\therefore$ Area of field $= (282 + 6399 + 410 + 501.5 + 1131 + 616 + 220.5)$

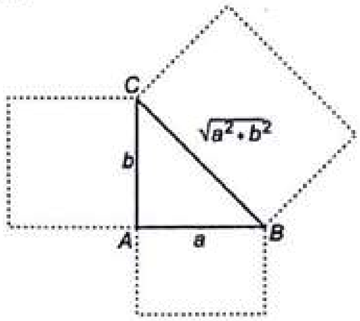
$= 9560 \text{ m}^2$

23. Area of shaded region = Area of larger semi-circle

$= \frac{1}{2} \times \pi \times (5)^2 = \frac{25}{2} \pi \text{ m}^2$

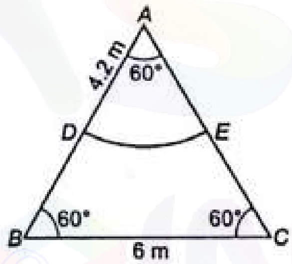
{$\because$ area of semi-circle with diameter AB = Area of semi-circle with diameter BC}

24. $\therefore$ Total area



$= a^2 + b^2 + (\sqrt{a^2 + b^2})^2 + \frac{1}{2} ab = 2(a^2 + b^2) + 0.5ab$

25. Suppose, a horse is tied at vertex A. Then, area available grazing field is ADE.



Now, area of curve $ADE = \frac{\pi r^2 \theta}{360°}$

$= \frac{22 \times (4.2)^2 \times 60°}{7 \times 360°} = 9.24$

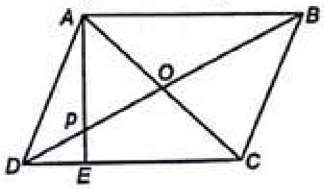
and area of equilateral $\Delta ABC = \frac{\sqrt{3}}{4} (\text{side})^2$

$= \frac{\sqrt{3}}{4} \times (6)^2 = 15.57$

$\therefore$ Required percentage $= \frac{9.24}{15.57} \times 100 = 59.34\%$

$= 59\%$ (approx)

26. Area of rhombus $= \frac{1}{2} \times d_1 \times d_2 = \frac{1}{2} \times 55 \times 48$ ...(i)



$= 1320$ cm

$\therefore$ Area of rhombus = Base × Height $= DC \times AE$

$\therefore$ $DC \times AE = 1320$ [from Eq. (i)]

$$\Rightarrow \quad p\times\sqrt{OD^2+OC^2}=1320$$

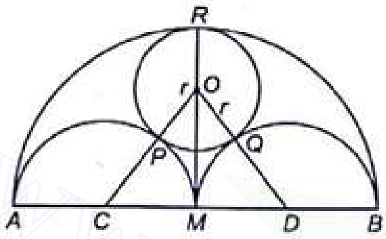
$$\Rightarrow \quad p\times\sqrt{\left(\frac{55}{2}\right)^2+\left(\frac{48}{2}\right)^2}=1320$$

$$\Rightarrow \quad p\times\sqrt{\frac{5329}{4}}=1320$$

$$\Rightarrow \quad p=\frac{1320}{36.5}=36.16$$

$$36\text{ cm}<p<37\text{ cm}$$

27. Given, $AB=2a$



$$\Rightarrow \quad AM=a$$

and $\quad AC=CM=MD=BD=\dfrac{a}{2}$

Now, $\quad OC=OP+PC=OP+CM=r+\dfrac{a}{2}$

and $OD=OQ+QD=OQ+MD=r+\dfrac{a}{2}$

$\therefore$ ΔOCD is an isosceles triangle. $\quad (\because OC=OD)$

Also, M is mid-point of CD.

$$\Rightarrow \quad \angle OMC=90^\circ$$

In ΔOMC,

$$OC^2=OM^2+CM^2$$

$$\Rightarrow \quad \left(r+\frac{a}{2}\right)^2=(a-r)^2+\left(\frac{a}{2}\right)^2$$

$$\Rightarrow \quad r^2+\frac{a^2}{4}+ar=a^2+r^2-2ar+\frac{a^2}{4} \Rightarrow r=\frac{a}{3}$$

28. Area of curve $BCDE=\dfrac{1}{4}\pi(7)^2$

$$=\frac{22}{7\times4}\times7\times7=\frac{77}{2}\text{ cm}^2$$

Area of $\Delta BCD=\dfrac{1}{2}\times7\times7=\dfrac{49}{2}\text{ cm}^2$

$\therefore$ Required area of shaded region $=2$ Area of curve $BEDB$

$$=2\left[\frac{77}{2}-\frac{49}{2}\right]=2\left[\frac{28}{2}\right]=28\text{ cm}^2$$

29. In ΔADC,

$$(2r)^2=r^2+DC^2$$

$$\Rightarrow \quad 4r^2-r^2=DC^2 \Rightarrow DC=\sqrt{3}r$$

$$\because \quad OC=\frac{2}{3}DC=\frac{2}{3}\times\sqrt{3}r=\frac{2r}{\sqrt{3}}$$

Radius of larger circular lamina $=OE$

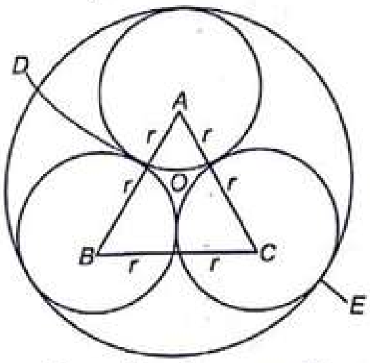
$$OC+CE=\frac{2r}{\sqrt{3}}+r=\frac{(2+\sqrt{3})r}{\sqrt{3}}$$

Area of 3 laminas $=3\pi r^2$

Area of larger lamina $=\pi\left[\dfrac{(2+\sqrt{3})}{\sqrt{3}}r\right]^2$

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

$$=\frac{(7+4\sqrt{3})}{3}\pi r^2$$



Residual area $=\left[\dfrac{7+4\sqrt{3}}{3}-3\right]\pi r^2=\dfrac{(4\sqrt{3}-2)}{3}\pi r^2$

$$\therefore \quad \text{Ratio}=\frac{\left(\dfrac{4\sqrt{3}-2}{3}\right)\pi r^2}{\dfrac{7+4\sqrt{3}}{3}\pi r^2}$$

$$=\frac{4\sqrt{3}-2}{7+4\sqrt{3}}\times\frac{7-4\sqrt{3}}{7-4\sqrt{3}}$$

$$=\frac{28\sqrt{3}-48-14+8\sqrt{3}}{49-48}$$

$$=36\sqrt{3}-62=36\times1.732-62$$

$$=62.352-62=0.35$$

30. Area of 2 bigger semi-circles $=2\times\dfrac{\pi r^2}{2}$

$$=2\pi\left(\frac{0.5}{2}\right)^2\times\frac{1}{2}=\frac{0.25\pi}{4}\text{ cm}^2$$

Area of 5 smaller semi-circles $=\dfrac{5\pi r^2}{2}$

$$=5\times\pi\times\frac{1}{2}\times\left(\frac{0.5}{4}\right)^2$$

$$=\frac{5\pi}{2}\times\frac{0.25}{16}=\frac{1.25\pi}{32}\text{ cm}^2$$

Area of rectangle $ABCD=2\times0.5=1\text{ cm}^2$

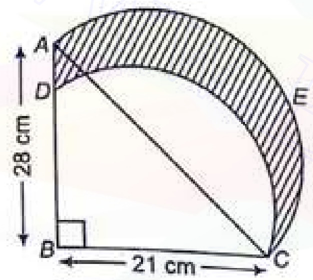
Area of remaining portion $=1-\dfrac{0.25\pi}{4}-\dfrac{1.25\pi}{32}$

$$=1-\frac{\pi}{16}-\frac{5\pi}{128}$$

$$=\frac{128-8\pi-5\pi}{128}$$

$$=\frac{128-13\pi}{128}\text{ cm}^2$$

31. In ΔABC,



$$AC^2 = \sqrt{28^2+21^2} = \sqrt{784+441} = \sqrt{1225}$$

$\Rightarrow$ $AC = 35$ cm

Area of shaded portion = Area of semi-circle ACE
+ Area of ΔABC − Area of quadrant circle BCD

$$= \frac{\pi r^2}{2} + \frac{1}{2} \times BC \times BA - \frac{\pi}{4} \times r_1^2$$

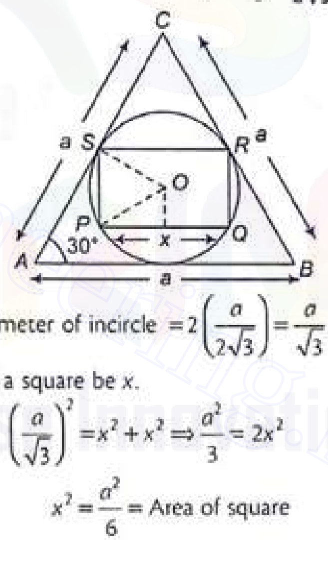
$$= \frac{22}{7} \times \frac{1}{2} \times \frac{35}{2} \times \frac{35}{2} + \frac{1}{2} \times 21 \times 28 - \frac{22}{7 \times 4} \times 21 \times 21$$

$$= \frac{5 \times 11 \times 35}{4} + \frac{1}{2}[21 \times 28 - 33 \times 21]$$

$$= \frac{1925}{4} + \frac{1}{2}(-105) = 481.25 - 52.50 = 428.75 \text{ cm}^2$$

32. Length of an equilateral triangle is $a\frac{\sqrt{3}}{2}$.

$\therefore$ Radius of incircle $= \frac{a\sqrt{3}}{2} \times \frac{1}{3} = \frac{a}{2\sqrt{3}}$



$\therefore$ Diameter of incircle $= 2\left(\frac{a}{2\sqrt{3}}\right) = \frac{a}{\sqrt{3}}$

Let side of a square be x.

$\therefore$ $\left(\frac{a}{\sqrt{3}}\right)^2 = x^2 + x^2 \Rightarrow \frac{a^2}{3} = 2x^2$

$\therefore$ $x^2 = \frac{a^2}{6}$ = Area of square