

Mensuration-I

(Area of Trapezium and a polygon)

Exercise 20.1

Q.1 A flooring tile has the shape of a parallelogram whose base is 24 cm and the corresponding height is 10 cm. How many such tiles are required to cover a floor of area ~~1080 cm~~ 1080 m^2 ?

Sol:

$$\text{Base of tile} = 24 \text{ cm} = 0.24 \text{ m}$$

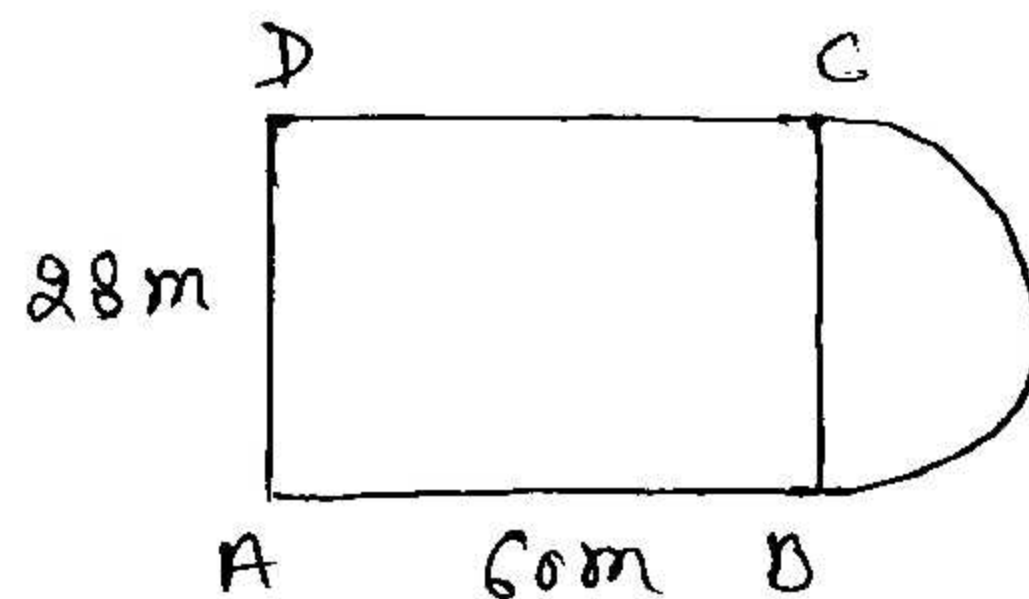
$$\text{height} = 10 \text{ cm} = 0.1 \text{ m}$$

$$\begin{aligned} \text{Area of one tile} &= B \times h \\ &= 0.24 \times 0.1 = 0.024 \text{ m}^2 \end{aligned}$$

$$\therefore \text{Area of floor} = 1080 \text{ m}^2$$

$$\begin{aligned} \text{Then No. of tiles} &= \frac{\text{Area of floor}}{\text{Area of one tile}} = \frac{1080}{0.024} \\ &= 45000 \text{ tiles.} \end{aligned}$$

Q.2 A Plot is in the form of a rectangle ABCD, having semicircle on BC as shown in fig 20.23. If $AB = 60 \text{ m}$, $BC = 28 \text{ m}$, find the area of plot.



Sol:

Diameter of Semicircular portion = 28 m (2)
radius = $\frac{28}{2} = 14$ m

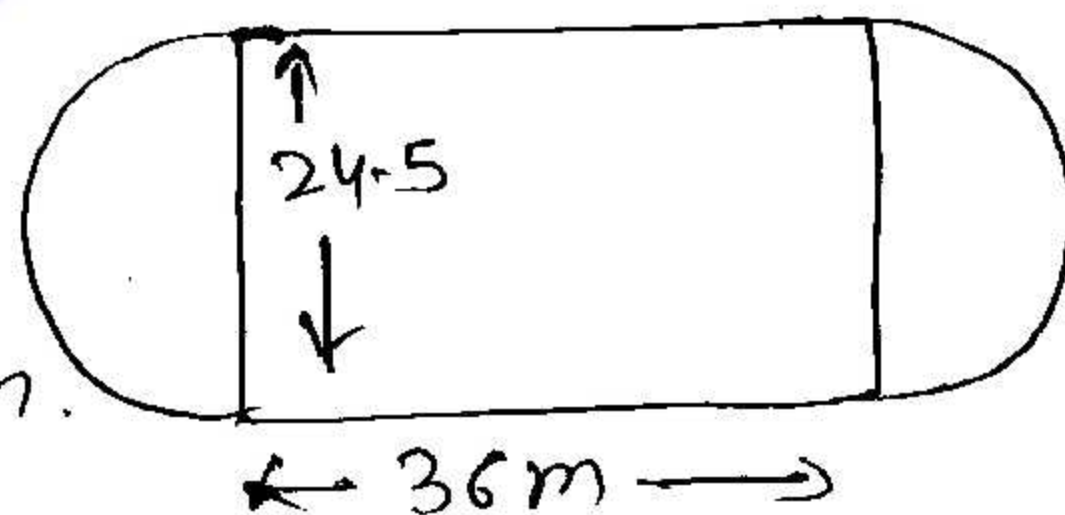
$$\begin{aligned}\text{Area of plot} &= \text{Area of rectangle} + \text{Area of Semi-circle} \\ &= (l \times b) + \frac{1}{2} \pi r^2 \\ &= (28 \times 60) + \frac{1}{2} \times \frac{22}{7} \times 14^2 \\ &= 1680 + 308 \\ &= 1988 \text{ m}^2\end{aligned}$$

Q3 A playground has the shape of a rectangle, with two semicircles on its smaller sides as diameters, added to its outside. If the sides of the rectangle are 36 m and 24.5 m. Find the area of playground.

Sol:

Diameter = 24.5 m

radius = $\frac{24.5}{2} = 12.25$ m.

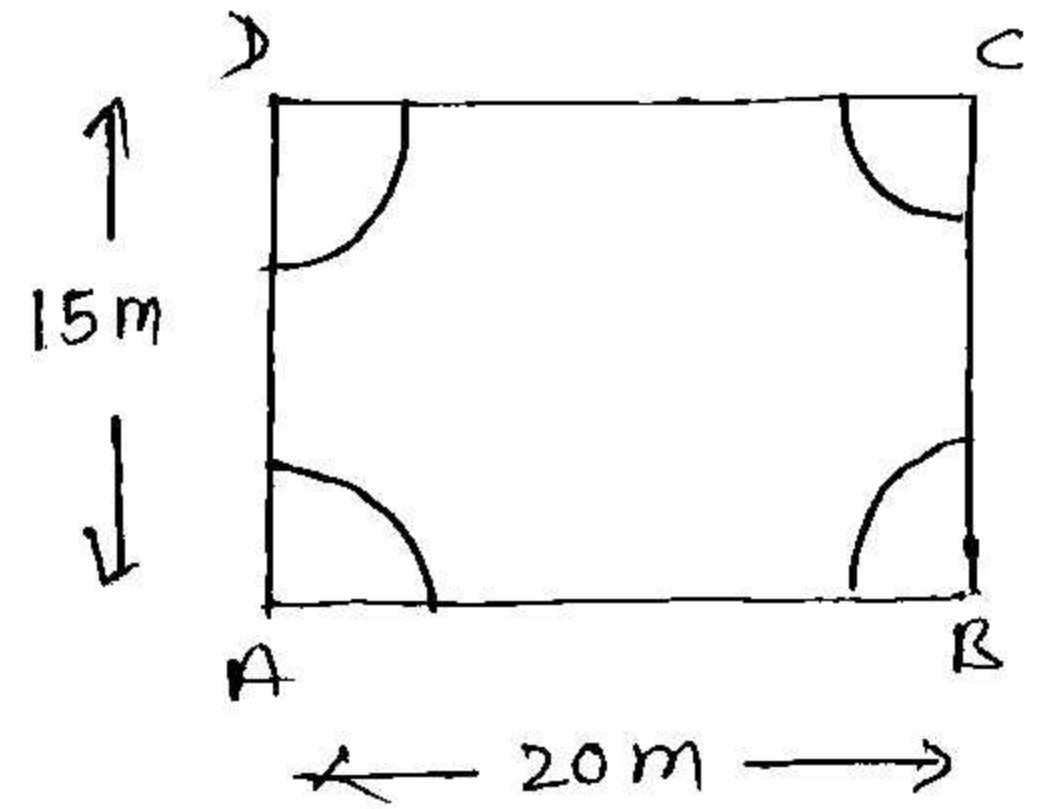


$$\begin{aligned}\text{Area of playground} &= \text{Area of rectangle} + \text{Area of 2 semicircles} \\ &= (36 \times 24.5) + 2 \left(\frac{1}{2} \times \frac{22}{7} \times 12.25 \times 12.25 \right) \\ &= 882 + 471.625 \\ &= 1353.625 \text{ m}^2\end{aligned}$$

Q.4 A rectangular piece is 20m long and 15m wide. From its four corners, quadrants of radius 3.5m have been cut. Find the area of the remaining part.

Sol:

radius of quadrants = 3.5m.



Area of remaining part

= Area of rectangle - Area of 4 quadrants

$$= (20 \times 15) - 4 \left(\frac{1}{4} \times \frac{22}{7} \times 3.5 \times 3.5 \right)$$

$$= 300 - 38.5 = 261.5 \text{ m}^2$$

Q.5 The inside perimeter of a running track is 400m. The length of each of the straight portion is 90m and the ends are semicircles. If track is everywhere 14m wide, find the area of the track. Also, find the length of the outer running track.

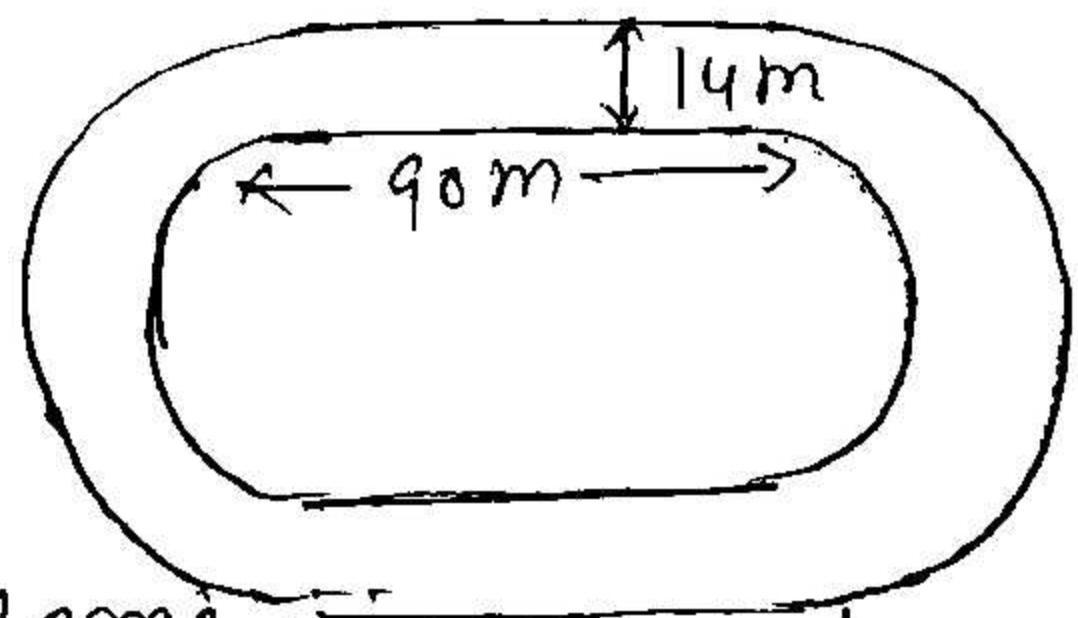
Sol:

Perimeter of inner track

= 2 × length of rectangle

+ Perimeter of two semi circular ends

$$400 = 90 + 90 + \left(2 \times \frac{22}{7} \times r \right)$$



$$\Rightarrow 400 - 180 = \frac{44}{7} \pi$$

$$\Rightarrow \frac{220 \times 7}{44} = r \Rightarrow r = 35 \text{ m}$$

So, radius of Inner circle = 35 m.

Now, Radius of outer track = $35 + 14 = 49 \text{ m}$.

Length of outer track = $2 \times \text{length of rectangle}$
+ Perimeter of two outer semi
circular ends

$$= 2 \times 90 + 2 \times \frac{22}{7} \times 49$$

$$= 180 + 308$$

$$= 488 \text{ m.}$$

Now, Area of track = Area of two rectangular portion
+ Area of two semi circular
rings

$$= 2(90 \times 14) + \frac{22}{7} [49^2 - 35^2]$$

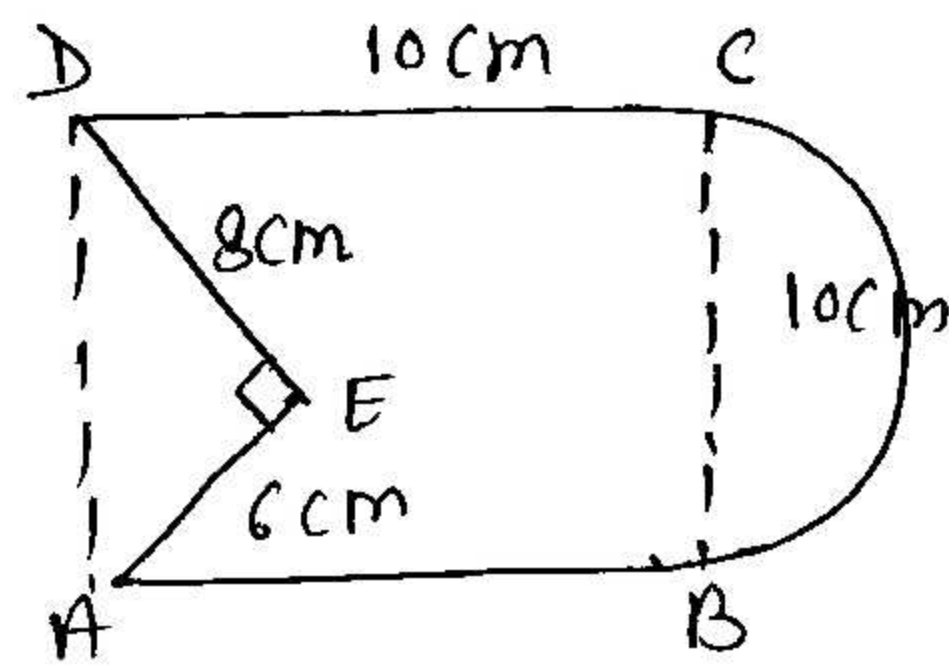
$$= 2520 + \frac{22}{7} \times 84 \times 14^2$$

$$= 2520 + 3696$$

$$= 6216 \text{ m}^2$$

Q.6 Find the area of fig 20.25, in square cm, correct to one place of decimal.

Solution



Area of figure = Area of square ABCD + Area of semicircle
 - Area of triangle

$$= (10)^2 + \frac{1}{2} \times \frac{22}{7} \times 5 \times 5 - \frac{1}{2} \times 8 \times 6$$

$$= 100 + 39.28 - 24$$

$$= 115.28 = 115.3 \text{ cm}^2$$

Q.7 The diameter of a wheel of a bus is 90 cm which makes 315 revolutions per minute. Determine its speed in km/h.

Solution: Diameter of wheel = 90 cm = 0.9 m
 No. of revolutions per minute = 315

$$\therefore \text{Distance travelled by wheel in one revolution} = 2\pi r$$

$$= 2 \times \frac{22}{7} \times 0.9 = \frac{39.6}{7} \text{ m}$$

$\therefore$ Distance travelled in 315 revolutions

$$= \frac{39.6}{7} \times 315 = 1782 \text{ m.}$$

hence Distance travelled in 1 ~~min~~ second = $\frac{1782}{60} \text{ m.}$

$$\text{Speed in km/h} = \frac{1782}{60} \times \frac{18}{5} \text{ km/h} = 53.46 \text{ km/h}$$

⑥

Q8 The area of a rhombus is 240 cm^2 and one of the diagonal is 16 cm . Find another diagonal.

Sol: $\therefore$ Area of rhombus $= \frac{1}{2} \times d_1 \times d_2$

$$\Rightarrow 240 = \frac{1}{2} \times 16 \times d_2$$

$$\Rightarrow \frac{240}{8} = d_2$$

$$\Rightarrow d_2 = 30 \text{ cm}.$$

Q9 The diagonal of a rhombus are 7.5 cm and 12 cm . Find its area.

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

$$= \frac{1}{2} \times 7.5 \times 12 = 7.5 \times 6$$
$$= 45 \text{ cm}^2$$

Q10 The diagonal of a quadrilateral shaped field is 24 m and the perpendicular dropped on it from the remaining opposite vertices are 8 m and 13 m . Find the area of the field.

Sol: $\therefore$ Area of quadrilateral $= \frac{1}{2} \times \text{diagonal} \times (\text{Sum of perpendiculars drawn to the diagonal})$

$$= \frac{1}{2} \times 24 \times (8 + 13)$$

$$= 12 \times 21$$

$$= 252 \text{ cm}^2$$

Q.11 Find the area of a rhombus whose side is 6 cm and whose altitude is 4 cm. If one of its diagonals is 8 cm long. Find the length of the other diagonal. (7)

Sol: Area of rhombus = Base $\times$ height
 $= 6 \text{ cm} \times 4 \text{ cm} = 24 \text{ cm}^2$

one diagonal = 8 cm

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

$\Rightarrow 24 = \frac{1}{2} \times 8 \times d_2$

$\Rightarrow \frac{24 \times 2}{8} = d_2$

$\Rightarrow d_2 = 6 \text{ cm}.$

Q.12 The floor of a building consists of 3000 tiles which are rhombus shaped and each of its diagonals are 45 cm and 30 cm in length. Find the total cost of polishing the floor, if the cost per m^2 is Rs. 4.

Sol: diagonals are 45 cm and 30 cm.

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

$\therefore$ Area of 3000 tiles = $675 \times 3000 \text{ cm}^2$
 $= \frac{2025000}{10000} \text{ m}^2$
 $= 202.5 \text{ m}^2$

∴ The cost of tiling = Rs 4/m²

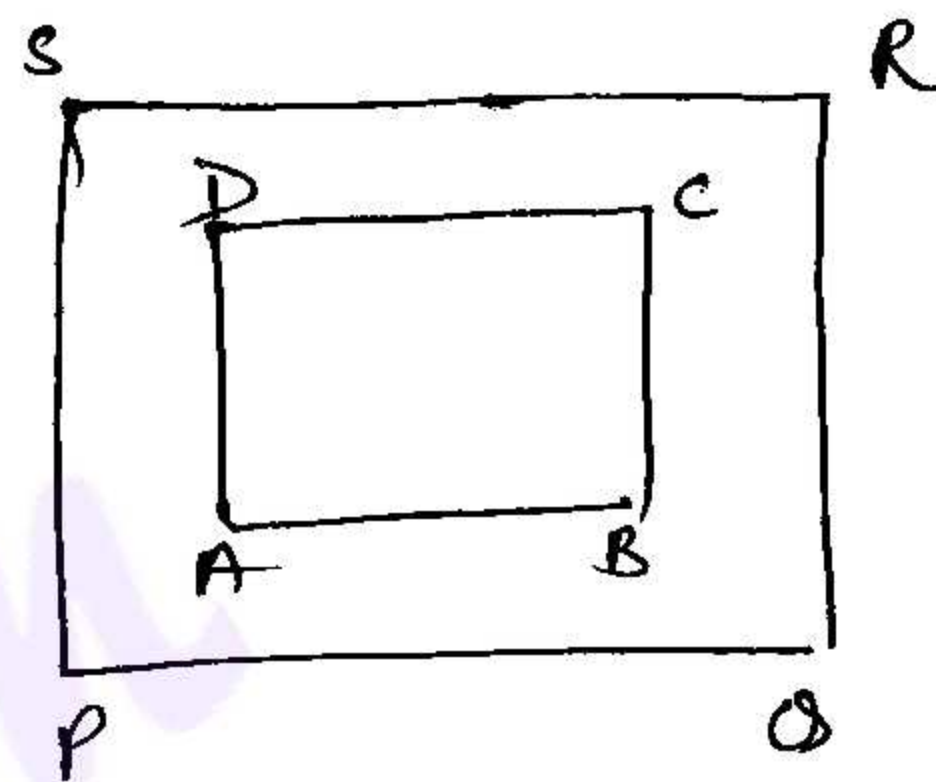
$$\therefore \text{Total cost} = 202.5 \times 4 = \text{Rs } 810.$$

Q.13 A rectangular grassy plot is 112m long and 78m broad. It has a gravel path 2.5m wide all around it on the side. Find the area of path and the cost of constructing it at Rs 4.50 square metre.

Sol. length AB = 112m, BC = 78m
width of path = 2.5m

$$\therefore \text{length PQ} = 112 + 5 = 117\text{m}$$

$$\text{QR} = 78 + 5 = 83\text{m}$$

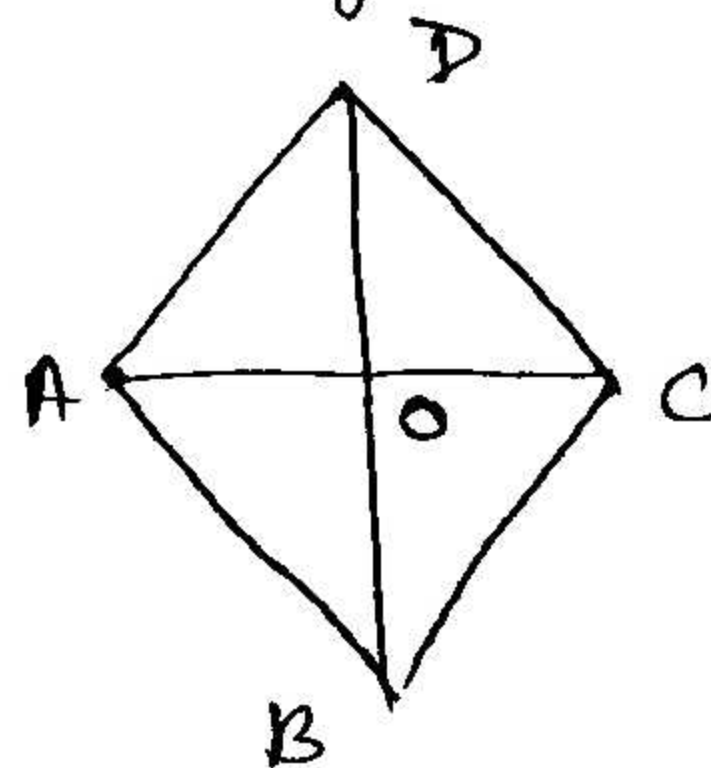


$$\begin{aligned} \text{Area of path} &= \text{Area of rectangle PQRS} - \text{Ar. of rectangle ABCD} \\ &= 117 \times 83 - 112 \times 78 \\ &= 9711 - 8736 = 975\text{m}^2 \end{aligned}$$

$$\begin{aligned} \text{Cost of gravelling} &= 975 \times 4.5 \\ &= \text{Rs } 4387.5 \end{aligned}$$

Q.14 Find the area of rhombus, each side of which measures 20cm and one of whose diagonals is 24cm

Sol. Given AD = 20cm,
AC = 24cm
∴ OA = $\frac{1}{2} \times 24 = 12\text{cm}.$



(9)

$$\begin{aligned} \text{In } \triangle AOD, AD^2 &= OA^2 + OD^2 \\ \Rightarrow (20)^2 &= (12)^2 + OD^2 \\ \Rightarrow 400 - 144 &= OD^2 \\ \Rightarrow 256 &= OD^2 \\ \Rightarrow OD &= \sqrt{256} = 16 \text{ m.} \end{aligned}$$

Hence, $BD = 2 \times 16 = 32 \text{ m}$

$$\begin{aligned} \text{Area of rhombus} &= \frac{1}{2} \times \text{Product of diagonals.} \\ &= \frac{1}{2} \times 24 \times 32 \\ &= 12 \times 32 = 384 \text{ cm}^2 \end{aligned}$$

Q.15 The length of a side of a square field is 4 m. What will be the altitude of the rhombus, if the area of the rhombus is equal to the square field and one of its diagonals is 2 m?

Sol: Side of square = 4 m
one diagonal of rhombus = 2 m

$$\therefore \text{Area of rhombus} = \text{Area of square}$$

$$= \frac{1}{2} \times 2 \times d_2 = 4 \times 4$$

$$\Rightarrow d_2 = 16$$

$$\begin{aligned} \therefore \text{Side of rhombus} &= \frac{1}{2} \sqrt{d_1^2 + d_2^2} \\ &= \frac{1}{2} \sqrt{(2)^2 + (16)^2} \end{aligned}$$

$$\begin{aligned} &= \frac{1}{2} \sqrt{4 + 256} = \frac{1}{2} \sqrt{260} \\ &= \frac{2\sqrt{65}}{2} = \sqrt{65} \end{aligned}$$

$$\therefore \text{Area of rhombus} = \text{Base} \times \text{height}$$

$$\Rightarrow 16 = 565 \times h$$

$$h = \frac{16}{565} \text{ cm}$$

Q.17 The cost of fencing a square field at 60 paise per metre is Rs 1200. Find the cost of reaping the field at the rate of 50 paise per 100 sq. metres.

Sol! Cost of fencing a park = Rs 1200
Rate of fencing = ~~Rs 60~~ 60 paise/metre
= Rs 0.6/metre

$$\text{Perimeter} = \frac{1200}{0.6} = 2000 \text{ m}$$

$$\therefore \text{Side of field} = \frac{2000}{4} = 500 \text{ m.}$$

$$\begin{aligned} \text{Area of square field} &= 500 \times 500 \\ &= 250000 \text{ m}^2 \end{aligned}$$

$$\therefore \text{Cost of reaping} = \frac{250000 \times 0.5}{100} = \text{Rs } 1250$$

Q.18 In exchange of a square plot one of whose sides is 30 metres and the corresponding altitude is 16 m. Find the cost of levelling a garden at the rate of Rs 2 per m².

Sol! Area of square = side² = 84 × 84 = 7056.

$$\text{Area of rectangle} = 7056$$

$$144 \times b = 7056$$

$$\Rightarrow b = \frac{7056}{144} = 49$$

$\therefore$ width of rectangle = 49 m

①9 The area of a rhombus is 84 m^2 . If its perimeter is 84 m. Find its altitude.

Sol:

$$\text{Perimeter} = 4 \times \text{side}$$

$$\frac{84}{4} = \text{side}$$

$$\Rightarrow \text{side} = 21 \text{ m.}$$

$$\therefore \text{Area of rhombus} = \text{Base} \times \text{length of altitude}$$

$$\Rightarrow 84 = 21 \times \text{length of altitude}$$

$$\Rightarrow \text{length of altitude} = \frac{84}{21} = 4 \text{ m.}$$

Q.20 A garden is in the form of a rhombus whose side is 30 metres and the corresponding altitude is 16 m. Find the cost of levelling the garden at the rate of Rs 2/m².

Sol:

$$\text{side of rhombus} = 30 \text{ m.}$$

$$\text{altitude} = 16 \text{ m}$$

$$\text{Area of garden} = 30 \times 16 = 480 \text{ m}^2$$

$$\text{rate of levelling} = \text{Rs. } 2/\text{m}^2$$

$$\therefore \text{Cost of levelling} = \text{Rs } 480 \times 2 = \text{Rs } 960.$$

Q. 22 The area of a rhombus is equal to the area of triangle whose base and the corresponding altitude are 24.8 cm and 16.5 cm respectively. If one of the diagonal of the rhombus is 22 cm, find the length of the other diagonal.

Solution: $\therefore$ Area of rhombus = Area of ^{triangle} $\therefore$

$$\Rightarrow \frac{1}{2} \times 22 \times d_2 = \frac{1}{2} \times 24.8 \times 16.5$$

$$\Rightarrow d_2 = \frac{24.8 \times 16.5}{22}$$

$$= 18.6 \text{ cm.}$$

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