EXERCISE 20.1 PAGE NO: 20.13

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 m^2?

Solution:

Given that,
Base of parallelogram = 24cm
Height of parallelogram = 10cm
Area of floor = 1080m^2
We know that,
Area of parallelogram = Base × Height
Area of 1 tile = 24 × 10 = 240cm^2
We know that, 1m = 100cm
So for 1080m^2 = 1080 × 100 × 100 cm^2
To calculate the Number of tiles required = Area of floor/Area of 1 tile
i.e., Number of tiles required = (1080 × 100 × 100) / (24 × 10) = 45000
∴ Number of tiles required = 45000

2. A plot is in the form of a rectangle ABCD having semi-circle on BC as shown in Fig. 20.23. If AB = 60 m and BC = 28 m, Find the area of the plot.

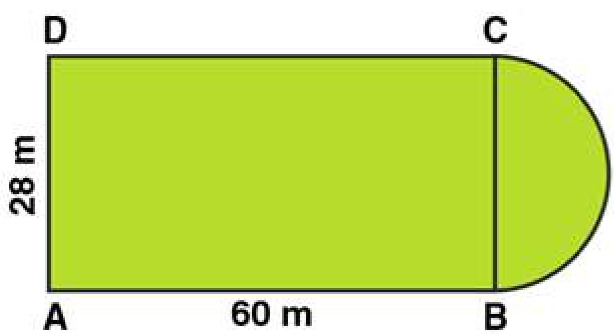


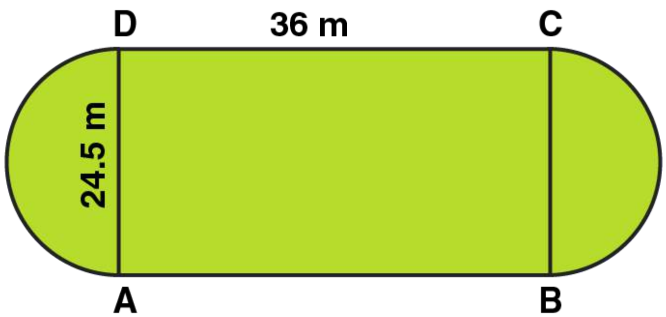
Fig. 20.23

Solution:

Area of the plot = Area of the rectangle + Area of semi-circle
Radius of semi-circle = BC/2 = 28/2 = 14m
Area of the Rectangular plot = Length × Breadth = 60 × 28 = 1680 m^2
Area of the Semi-circular portion = $\pi r^2/2$
= 1/2 × 22/7 × 14 × 14
= 308 m^2
∴ The total area of the plot = 1680 + 308 = 1988 m^2

3. A playground has the shape of a rectangle, with two semi-circles 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 the playground. (Take $\pi = 22/7$.)

Solution:



Area of the plot = Area of the Rectangle + 2 × area of one semi-circle

Radius of semi-circle = BC/2 = 24.5/2 = 12.25m

Area of the Rectangular plot = Length × Breadth = 36 × 24.5 = 882 m^2

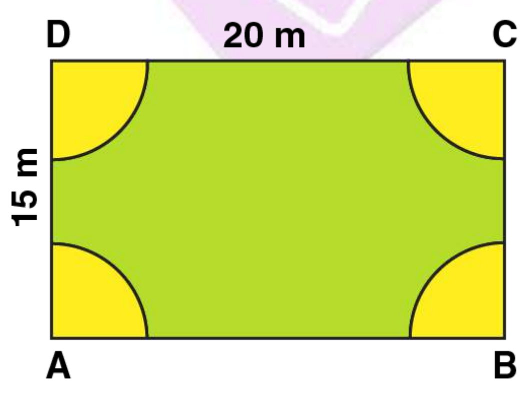
Area of the Semi-circular portions = 2 × $\pi r^2/2$

= 2 × 1/2 × 22/7 × 12.25 × 12.25 = 471.625 m^2

Area of the plot = 882 + 471.625 = 1353.625 m^2

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

Solution:



Area of the plot = Area of the rectangle - 4 × area of one quadrant

Radius of semi-circle = 3.5 m

Area of four quadrants = area of one circle

Area of the plot = Length × Breadth - πr^2

Area of the plot = 20 × 15 – (22/7 × 3.5 × 3.5)
Area of the plot = 300 – 38.5 = 261.5 m^2

5. The inside perimeter of a running track (shown in Fig. 20.24) is 400 m. The length of each of the straight portion is 90 m and the ends are semi-circles. If track is everywhere 14 m wide, find the area of the track. Also, find the length of the outer running track.

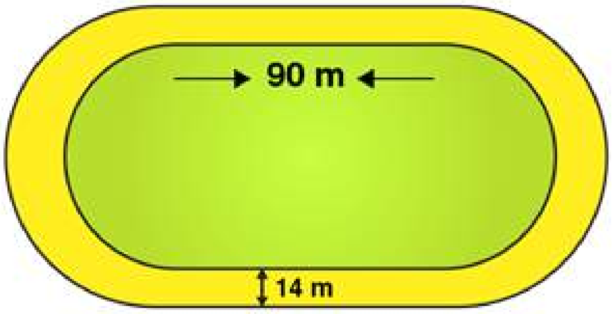


Fig. 20.24

Solution:
Perimeter of the inner track = 2 × Length of rectangle + perimeter of two semi-circular ends
Perimeter of the inner track = Length + Length + 2πr
400 = 90 + 90 + (2 × 22/7 × r)
(2 × 22/7 × r) = 400 – 180
(2 × 22/7 × r) = 220
44r = 220 × 7
44r = 1540
r = 1540/44 = 35
r = 35m
So, the radius of inner circle = 35 m
Now, let's calculate the radius of outer track
Radius of outer track = Radius of inner track + width of the track
Radius of outer track = 35 + 14 = 49m
Length of outer track = 2× Length of rectangle + perimeter of two outer semi-circular ends
Length of outer track = 2× 90 + 2πr
Length of outer track = 2× 90 + (2 × 22/7 × 49)
Length of outer track = 180 + 308 = 488
So, Length of outer track = 488m
Area of inner track = Area of inner rectangle + Area of two inner semi-circles

Area of inner track = Length × Breadth + πr^2
Area of inner track = 90 × 70 + (22/7 × 35 × 35)
Area of inner track = 6300 + 3850
So, Area of inner track = 10150 m^2
Area of outer track = Area of outer rectangle + Area of two outer semi-circles
Breadth of outer track = 35 + 35 +14 + 14 = 98 m
Area of outer track = length× breadth + πr^2
Area of outer track = 90 × 98 + (22/7 × 49 × 49)
Area of outer track = 8820 + 7546
So, Area of outer track = 16366 m^2
Now, let's calculate area of path
Area of path = Area of outer track – Area of inner track
Area of path = 16366 – 10150 = 6216
So, Area of path = 6216 m^2

6. Find the area of Fig. 20.25, in square cm, correct to one place of decimal. (Take π =22/7)

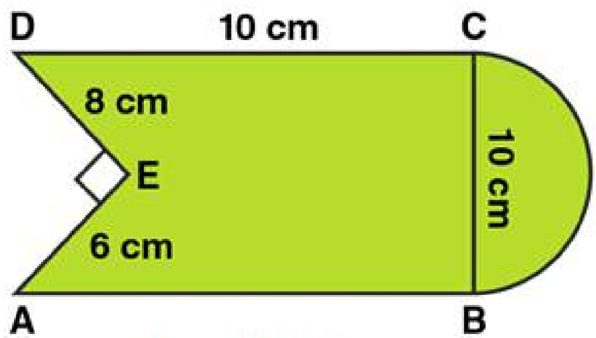


Fig. 20.25

Solution:
Area of the Figure = Area of square + Area of semi-circle – Area of right angled triangle
Area of the Figure = side × side + $\pi r^2/2$ – (1/2 × base × height)
Area of the Figure = 10 × 10 + (1/2 × 22/7 × 5 × 5) – (1/2 × 8 × 6)
Area of the Figure = 100 + 39.28 – 24
Area of the Figure = 115.3
So, Area of the Figure = 115.3 cm^2

7. The diameter of a wheel of a bus is 90 cm which makes 315 revolutions per minute. Determine its speed in kilometres per hour. (Take π=22/7)
Solution:

Given that, Diameter of a wheel = 90 cm
We know that, Perimeter of wheel = 2πd
Perimeter of wheel = 22/7 × 90 = 282.857
So, Perimeter of a wheel = 282.857 cm
Distance covered in 315 revolutions = 282.857× 315 = 89099.955 cm
One km = 100000 cm
Therefore, Distance covered = 89099.955/100000 = 0.89 km
Speed in km per hour = 0.89 × 60 = 53.4 km per hour

8. The area of a rhombus is 240 cm^2 and one of the diagonal is 16 cm. Find another diagonal.
Solution:
Area of rhombus = 1/2 × d1 × d2
240 = 1/2 × 16 × d2
240 = 8 × d2
d2 = 240/8 = 30
So, the other diagonal is 30 cm

9. The diagonals of a rhombus are 7.5 cm and 12 cm. Find its area.
Solution:
Area of rhombus = 1/2 × d1 × d2
Area of rhombus = 1/2 × 7.5 × 12
Area of rhombus = 6 × 7.5 = 45
So, Area of rhombus = 45 cm^2

10. The diagonal of a quadrilateral shaped field is 24 m and the perpendiculars dropped on it from the remaining opposite vertices are 8 m and 13 m. Find the area of the field.
Solution:
Area of quadrilateral = 1/2 × d1 × (p1 + p2)
Area of quadrilateral = 1/2 × 24 × (8 + 13)
Area of quadrilateral = 12 × 21 = 252
So, Area of quadrilateral is 252 cm^2

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.
Solution:
Given that,
Side of rhombus = 6 cm

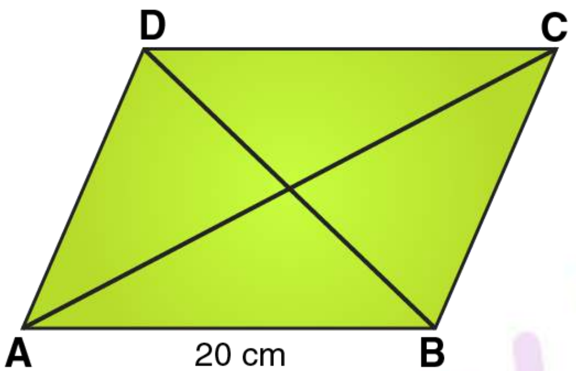
Altitude of rhombus = 4 cm
Since rhombus is a parallelogram, therefore area of parallelogram = base × altitude
i.e., Area of parallelogram = 6 × 4 = 24 cm^2
Area of parallelogram = Area of rhombus
Area of rhombus = 1/2 × d1 × d2
24 = 1/2 × 8 × d2
24 = 4 × d2
d2 = 24/4 = 6
So, length of other diagonal of rhombus is 6 cm

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.
Solution:
We know that,
Area of rhombus = 1/2 × d1 × d2
Area of rhombus = 1/2 × 45 × 30
Area of rhombus = 1350/2 = 675
So, Area of rhombus = 675 cm^2
∴ Area of one tile = 675 cm^2
Now, Area of 3000 tiles = 675× 3000 = 2025000 cm^2
Area of tiles in m^2 = 2025000/10000 = 202.5 m^2
Total cost for polishing the floor = 202.5× 4 = Rs 810

13. A rectangular grassy plot is 112 m long and 78 m broad. It has gravel path 2.5 m wide all around it on the side. Find the area of the path and the cost of constructing it at Rs. 4.50 per square metre.
Solution:
We know that,
Inner area of rectangle = length × breadth
Inner area of rectangle = 112 × 78 = 8736 m^2
Width of path = 2.5 m
Length of outer rectangle = 112 – (2.5 + 2.5) = 107 m
Breadth of outer rectangle = 78 – (2.5 + 2.5) = 73 m
And,
Outer area of rectangle = length × breadth
Outer area of rectangle = 107 × 73 = 7811 m^2
Now let's calculate Area of path,
Area of path = Outer area of rectangle – Inner area of rectangle

Area of path = 8736 – 7811 = 925 m^2
Also given that,
Cost of construction for 1 m^2 = Rs 4.50
∴ Cost of construction for 925 m^2 = 925 × 4.50 = Rs 4162.5

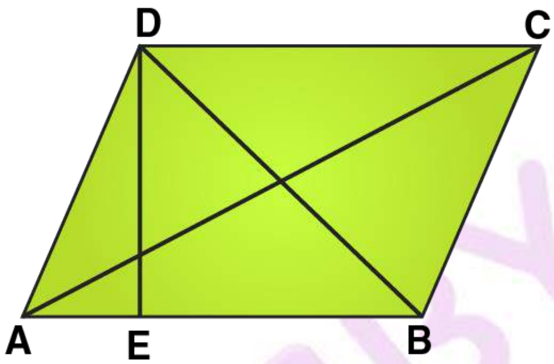
14. Find the area of a rhombus, each side of which measures 20 cm and one of whose diagonals is 24 cm.
Solution:



Given that,
Length of side of rhombus = 20 cm
Length of one diagonal = 24 cm
In ΔAOB,
Using Pythagoras theorem:
$AB^2 = OA^2 + OB^2$
$20^2 = 12^2 + OB^2$
$OB^2 = 20^2 – 12^2$
$OB^2 = 400 – 144$
$OB^2 = 256$
OB = 16
So, length of the other diameter = 16 × 2 = 32 cm
Area of rhombus = 1/2 × d1 × d2
Area of rhombus = 1/2 × 24 × 32
Area of rhombus = 384 cm^2

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 diagonal is 2 m?
Solution:

Given that,
Length of a side of a square = 4 m
Area of square = side^2
Area of square = $4 \times 4 = 16$ m^2
We know that,
Area of square = Area of rhombus
So, Area of rhombus = 16 m^2
Area of rhombus = $1/2 \times d1 \times d2$
$16 = 1/2 \times 2 \times d2$
$16 = d2$
∴ the diagonal of rhombus = 16 m
In ΔAOB,



Using Pythagoras theorem:
$AB^2 = OA^2 + OB^2$
$AB^2 = 8^2 + 1^2$
$AB^2 = 65$
$AB = \sqrt{65}$
Since rhombus is a parallelogram, therefore area of parallelogram = base × altitude
Area of parallelogram = AB × DE
$16 = \sqrt{65} \times DE$
$DE = 16/\sqrt{65}$
i.e., Altitude of Rhombus = $16/\sqrt{65}$ cm

16. Find the area of the field in the form of a rhombus, if the length of each side be 14 cm and the altitude be 16 cm.
Solution:
Given that,
Side of rhombus = 14 cm
Altitude of rhombus = 16 cm

Since rhombus is a parallelogram, therefore
Area of parallelogram = base × altitude
Area of parallelogram = 14 × 16 = 224 cm^2

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.
Solution:
Perimeter of square field = Cost of fencing / rate of fencing
Perimeter of square field = 1200/0.6 = 2000
So, Perimeter of square field = 2000 m
Perimeter of square = 4 × side
Side of square = Perimeter / 4 = 2000/4 = 500
So, Side of square = 500 m
We know that, Area of square = $side^2$
Area of square = 500 × 500 = 250000 m^2
Cost of reaping = (250000 × 0.5) / 100 = 1250
∴ Cost of reaping the field is Rs 1250

18. In exchange of a square plot one of whose sides is 84 m, a man wants to buy a rectangular plot 144 m long and of the same area as of the square plot. Find the width of the rectangular plot.
Solution:
Area of square = $side^2$
Area of square = 84 × 84 = 7056
Since, Area of square = Area of rectangle
7056 = 144 × width
Width = 7056/144 = 49
∴ Width of rectangle = 49 m

19. The area of a rhombus is 84 m^2. If its perimeter is 40 m, then find its altitude.
Solution:
Given that,
Area of rhombus = 84 m^2
Perimeter = 40 m
We know that,
Perimeter of rhombus = 4 × side
∴ Side of rhombus = Perimeter / 4 = 40/4 = 10
So, Side of rhombus = 10 m
Since rhombus is a parallelogram, therefore Area of parallelogram = base × altitude

84 = 10 × altitude
Altitude = 84/10 = 8.4
So, Altitude of rhombus = 8.4 m

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 per m^2.
Solution:
Given that,
Side of rhombus = 30 m
Altitude of rhombus = 16 m
Since rhombus is a parallelogram, therefore Area of parallelogram = base × altitude
Area of parallelogram = 30 × 16 = 480 m^2
Cost of levelling the garden = area × rate
Cost of levelling the garden = 480 × 2 = 960
So, Cost of levelling the garden is Rs 960

21. A field in the form of a rhombus has each side of length 64 m and altitude 16 m. What is the side of a square field which has the same area as that of a rhombus?
Solution:
Given that,
Side of rhombus = 64 m
Altitude of rhombus = 16 m
Since rhombus is a parallelogram, therefore Area of parallelogram = base × altitude
Area of parallelogram = 64 × 16 = 1024 m^2
Since Area of rhombus = Area of square
Therefore, Area of square = $side^2$
Or $side^2$ = Area of square
Side of a square = √square
Side of square = √1024 = 32
∴ Side of square = 32 m

22. The area of a rhombus is equal to the area of a triangle whose base and the corresponding altitude are 24.8 cm and 16.5 cm respectively. If one of the diagonals of the rhombus is 22 cm, find the length of the other diagonal.
Solution:
Given that,
Length of base of triangle = 24.8 cm
Length of altitude of triangle= 16.5 cm

∴ Area of triangle = 1/2 × base × altitude
Area of triangle = 1/2 × 24.8 × 16.5 = 204.6
So, Area of triangle = 204.6 cm
Since, Area of triangle = Area of rhombus
∴ Area of rhombus = 1/2 × d1 × d2
204.6 = 1/2 × 22 × d2
204.6 = 11 × d2
d2 = 204.6/11 = 18.6
∴ The length of other diagonal is 18.6 cm