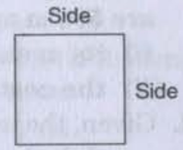
11 Perimeter and Area

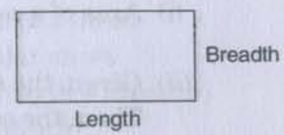
Learn and Remember

1. Perimeter is the distance around a closed figure. It is measured in unit.
2. Area is the part of plane occupied by the closed figure and it is measured in square unit.
   Standard unit of area and their relations:
   $$1 \text{ cm}^2 = 100 \text{ mm}^2$$
   $$1 \text{ m}^2 = 10000 \text{ cm}^2$$
   $$1 \text{ hactare} = 10000 \text{ m}^2$$
3. **Square:**

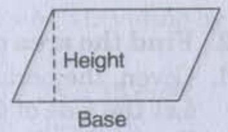


   1. Perimeter of a square = 4 × side
   2. Area of square = side × side

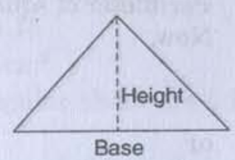
   Rectangle:



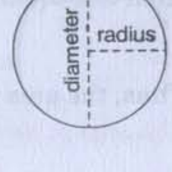
   1. Perimeter of a rectangle
      = 2(length + breadth)
   2. Area of a rectangle
      = length × breadth.



4. Area of parallelogram
   = base × height.



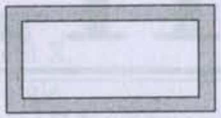
5. Area of triangle
   $= \dfrac{1}{2} \times \text{base} \times \text{height}.$
6. The distance around a circular region is known as its circumference.
   1. Circumference of circle = πd, where d is the diameter of a circle and



$\pi = \frac{22}{7}$ or 3.14 (approx.)

2. Area of circle $= \pi r^2$, where r is the radius of the circle.

7. Area of a rectangular path inside (or outside) a rectangular field
= Area of the outer rectangle
– area of the inner rectangle.



8. Area of cross paths
= Area of all rectangles making paths
– area of the common rectangle.

TEXTBOOK QUESTIONS SOLVED

Exercise 11.1 *(Page No. 208)*

Q1. The length and the breadth of a rectangular piece of land are 500 m and 300 m respectively. Find

(*i*) its area.

(*ii*) the cost of the land, if 1 m² of the land costs ₹ 10,000.

Sol. Given, the length of a rectangular piece of land = 500 m
and the breadth of a rectangular piece of land = 300 m

(*i*) Area of a rectangular piece of land = length × breadth
$= 500\text{ m} \times 300\text{ m} = 1{,}50{,}000\text{ m}^2$

(*ii*) Given, the cost of 1 m² land = ₹ 10,000
Then, the cost of 1,50,000 m² land = ₹ (10,000 × 1,50,000)
= ₹ 1,50,00,00,000.

Q2. Find the area of a square park whose perimeter is 320 m.

Sol. Given, the perimeter of a square park = 320 m.
Let the side of the square park be x m.
Perimeter of square park = 4 × side

Now, $320 = 4x$

$\Rightarrow$ $x = \frac{320}{4}$

or $x = 80$ m

Therefore, the side of the square park is 80 m.
Now, we know
Area of a square park = side × side
$= 80 \times 80$
$= 6{,}400\text{ m}^2$

Thus, the area of the square park is 6,400 m².

Q3. Find the breadth of a rectangular plot of land, if its area is 440 m² and the length is 22 m. Also find its perimeter.

Sol. Let the breadth of the rectangular plot be b m.
Given, area of a rectangular plot = 440 m²
and length of a rectangular plot = 22 m
We know, area of the rectangular plot = length × breadth

Now, $440 = 22 \times b$

$\Rightarrow$ $b = \frac{440}{22}$

or $b = 20$ m

Therefore, the breadth of the rectangular plot is 20 m.
Now, perimeter of the rectangular plot = 2(length + breadth)
$= 2(22 + 20)$
$= 2 \times 42 = 84$ m.

Thus, the perimeter of the rectangular plot is 84 m.

Q4. The perimeter of a rectangular sheet is 100 cm. If the length is 35 cm, find its breadth. Also find the area.

Sol. Let the breadth of the rectangular sheet be b cm.
Given, the perimeter of a rectangular sheet = 100 cm
and the length of a rectangular sheet = 35 cm
We know, the perimeter of the rectanglular sheet
= 2(length + breadth)

Now, $100 = 2(35 + b)$

$\Rightarrow$ $50 = 35 + b$ (Dividing by 2)

$\Rightarrow$ $35 + b = 50$

or $b = 50 - 35 = 15$ cm

And area of a rectangular sheet = length × breadth
$= 35 \times 15$
$= 525\text{ cm}^2$

Thus, breadth and area of the rectangular sheet are 15 cm and 525 cm² respectively.

Q5. The area of a square park is the same as of a rectangular park. If the side of the square park is 60 m and the length of the rectangular park is 90 m, find the breadth of the rectangular park.

Sol. Given, the side of the square park = 60 m
and the length of the rectangular park = 90 m

According to given condition,

Area of the square park = Area of the rectangular park

Now, side × side = length × breadth

$\Rightarrow$ $60 \times 60 = 90 \times b$

$\Rightarrow$ $b = \frac{60 \times 60}{90} = 20 \times 2 = 40$ m

Thus, the breadth of the rectangular park is 40 m.

Q6. A wire is in the shape of a rectangle. Its length is 40 cm and breadth is 22 cm. If the same wire is rebent in the shape of a square, what will be the measure of each side. Also, find which shape encloses more area?

Sol. Given, length of the rectangle = 40 cm

and breadth of the rectangle = 22 cm

Also given, perimeter of the square = perimeter of the rectangle

$\Rightarrow$ $4 \times \text{side} = 2\,(\text{length} + \text{breadth})$

$\Rightarrow$ $4 \times \text{side} = 2\,(40 + 22)$

$\Rightarrow$ $4 \times \text{side} = 2 \times 62$

$\Rightarrow$ $\text{side} = \frac{2 \times 62}{4}$

or $\text{side} = 31$ cm

Thus, the side of the square is 31 cm.

Now comparing their areas,

Area of the rectangle = length × breadth

$= 40 \times 22$

$= 880 \text{ cm}^2$ ...(*i*)

Area of the square = side × side

$= 31 \times 31$

$= 961 \text{ cm}^2$ ...(*ii*)

Now comparing equations (*i*) and (*ii*),

Thus, area of the square is greater than area of given rectangle.

Q7. The perimeter of a rectangle is 130 cm. If the breadth of the rectangle is 30 cm, find its length. Also, find the area of the rectangle.

Sol. Let the length of the rectangle be l cm.

Given, the perimeter of the rectangle = 130 cm

and breadth of the rectangle = 30 cm

Now, perimeter of the rectangle = 2(length + breadth)

$\Rightarrow$ $130 = 2(l + 30)$

$\Rightarrow$ $l + 30 = \frac{130}{2}$

$\Rightarrow$ $l + 30 = 65$

or $l = 65 - 30 = 35$ cm

Therefore, the length of the rectangle is 35 cm.

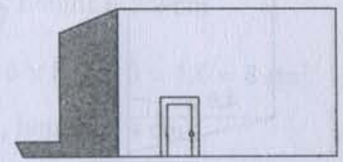
The area of the rectangle = length × breadth

$= 35 \times 30$

$= 1{,}050 \text{ cm}^2$

Thus, the area of the rectangle is 1,050 cm^2.

Q8. A door of length 2 m and breadth 1 m is fitted in a wall. The length of the wall is 4.5 m and the breadth is 3.6 m. Find the cost of white washing the wall, if the rate of white washing the wall is ₹ 20 per m^2.



Sol. White washing of the wall has to be white washed excluding the area of door.

Area of rectangular door = length × breadth

$= 2 \text{ m} \times 1 \text{ m} = 2 \text{ m}^2$

Area of wall including door = length × breadth

$= 4.5 \text{ m} \times 3.6 \text{ m}$

$= 16.2 \text{ m}^2$

Area of wall excluding door

= Area of wall including door – area of rectangular door

$= (16.2 - 2) \text{ m}^2$

$= 14.2 \text{ m}^2$.

Given,

The rate of white washing of 1 m^2 the wall = ₹ 20

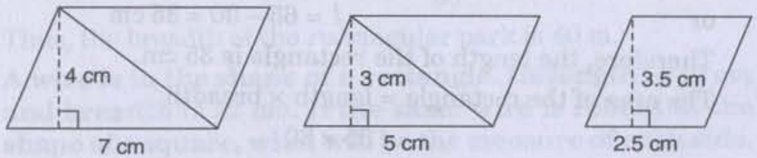
The rate of white washing 14.2 m^2 the wall = 20×14.2

= ₹ 284

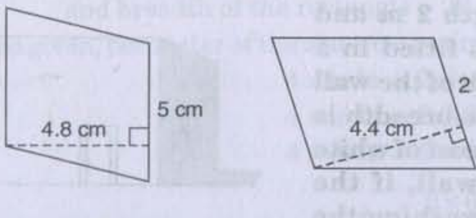
Thus, the cost of white washing the wall excluding door is ₹ 284.

Exercise 11.2 *(Page No. 216-217)*

Q1. Find the area of each of the following parallelograms:



(*a*) (*b*) (*c*)



(*d*) (*e*)

Sol. We know, the area of the parallelogram = base × height

From Fig. (*a*), base = 7 cm, height = 4 cm

Area of Fig. (*a*) = $7 \times 4 = 28$ cm^2

From Fig. (*b*), base = 5 cm, height = 3 cm

Area of Fig. (*b*) = $5 \times 3 = 15$ cm^2

From Fig. (*c*), base = 2.5 cm, height = 3.5 cm

Area of Fig. (*c*) = $2.5 \times 3.5 = 8.75$ cm^2

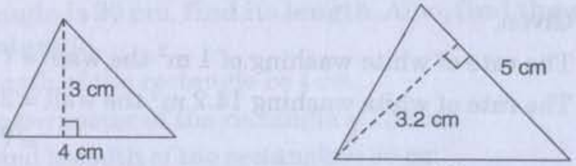
From Fig. (*d*), base = 5 cm, height = 4.8 cm

Area of Fig. (*d*) = $5 \times 4.8 = 24$ cm^2

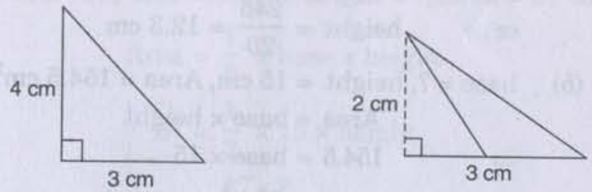
From Fig. (*e*), base = 2 cm, height = 4.4 cm

Area of Fig. (*e*) = $2 \times 4.4 = 8.8$ cm^2.

Q2. Find the area of each of the following triangles:



(*a*) (*b*)



(*c*) (*d*)

Sol. We know, area of triangle = $\frac{1}{2} \times$ base × height

From Fig. (*a*), base = 4 cm, height = 3 cm

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

From Fig. (*b*), base = 5 cm, height = 3.2 cm

Area of triangle = $\frac{1}{2} \times 5 \times 3.2 = 5 \times 1.6 = 8$ cm^2

From Fig. (*c*), base = 3 cm, height = 4 cm

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

From Fig. (*d*), base = 3 cm, height = 2 cm

Area of triangle = $\frac{1}{2} \times 3 \times 2 = 3 \times 1 = 3$ cm^2.

Q3. Find the missing values:

S.No.	Base	Height	Area of the parallelogram
a.	20 cm		246 cm^2
b.		15 cm	154.5 cm^2
c.		84 cm	48.72 cm^2
d.	15.6 cm		16.38 cm^2

Sol. We know that

Area of parallelogram = base × height

(*a*) base = 20 cm, height = ?, Area = 246 cm^2

Area = base × height

⇒ 246 = 20 × height

or $\quad \text{height} = \dfrac{246}{20} = 12.3 \text{ cm}$

(*b*) base = ?, height = 15 cm, Area = 154.5 cm^2

$$\text{Area} = \text{base} \times \text{height}$$

$\Rightarrow \quad 154.5 = \text{base} \times 15$

or $\quad \text{base} = \dfrac{154.5}{15} = 10.3 \text{ cm}$

(*c*) base = ?, height = 8.4 cm, Area = 48.72 cm^2

$$\text{Area} = \text{base} \times \text{height}$$

$\Rightarrow \quad 48.72 = \text{base} \times 8.4$

or $\quad \text{base} = \dfrac{48.72}{8.4} = 5.8 \text{ cm}$

(*d*) base = 15.6 cm, height = ?, Area = 16.38 cm^2

$$\text{Area} = \text{base} \times \text{height}$$

$\Rightarrow \quad 16.38 = 15.6 \times \text{height}$

or $\quad \text{height} = \dfrac{16.38}{15.6} = 1.05 \text{ cm.}$

Thus, the missing values are:

S.No.	Base	Height	Area of the parallelogram
a.	20 cm	**12.3 cm**	246 cm^2
b.	**10.3 cm**	15 cm	154.5 cm^2
c.	**5.8 cm**	8.4 cm	48.72 cm^2
d.	15.6 cm	**1.05 cm**	16.38 cm^2

Q4. Find the missing values:

Base	Height	Area of triangle
15 cm	—	**87 cm^2**
—	**31.4 mm**	**1256 mm^2**
22 cm	—	**170.5 cm^2**

Sol. We know that,

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

From first row, base = 15 cm, height = ?, Area = 87 cm^2

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

$\Rightarrow \quad 87 = \dfrac{1}{2} \times 15 \times \text{height}$

or $\quad \text{height} = \dfrac{87 \times 2}{15} = 11.6 \text{ cm}$

From second row, base = ?, height = 31.4 mm,
Area = 1256 mm^2

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

$\Rightarrow \quad 1256 = \dfrac{1}{2} \times \text{base} \times 31.4$

or $\quad \text{base} = \dfrac{1256 \times 2}{31.4} = 80 \text{ mm.}$

From third row, base = 22 cm, height = ?, Area = 170.5 cm^2

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

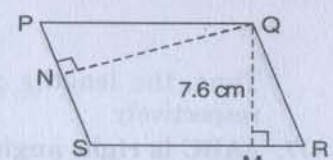
$\Rightarrow \quad 170.5 = \dfrac{1}{2} \times 22 \times \text{height}$

or $\quad \text{height} = \dfrac{170.5 \times 2}{22} = 15.5 \text{ cm}$

Thus, the missing values are:

Base	Height	Area of triangle
15 cm	**11.6 cm**	87 cm^2
80 mm	31.4 mm	1256 mm^2
22 cm	**15.5 cm**	170.5 cm^2

Q5. PQRS is a parallelogram. QM is the height from Q to SR and QN is the height from Q to PS. If SR = 12 cm and QM = 7.6 cm. Find:



(*a*) the area of the parallelogram PRS

(*b*) QN, if PS = 8 cm.

Sol. Given, base (SR) = 12 cm, height (QM) = 7.6 cm

(*a*) Therefore, area of parallelogram = base × height

$$= 12 \times 7.6 = 91.2 \text{ cm}^2$$

Thus, the area of the parallelogram is 91.2 cm^2.

(*b*) Now, base (PS) = 8 cm, height (QN) = ?, Area = 91.2 cm^2

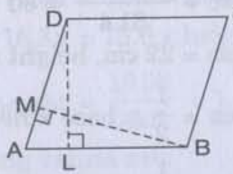
Area of parallelogram = base × height

$$\Rightarrow \quad 91.2 = 8 \times QN$$

$$\Rightarrow \quad QN = \frac{91.2}{8} = 11.4 \text{ cm}$$

Thus, the height (QN) is 11.4 cm.

Q6. DL and BM are the heights on sides AB and AD respectively of parallelogram ABCD. If the area of the parallelogram is 1470 cm², AB = 35 cm and AD = 49 cm, find the length of BM and DL.



Sol. Given, area of the parallelogram = 1470 cm^2,

base (AB) = 35 cm and base (AD) = 49 cm

We know, area of the parallelogram = base × height

$$\text{Now,} \quad 1470 = AB \times DL$$

$$\Rightarrow \quad 1470 = 35 \times DL$$

$$\Rightarrow \quad DL = \frac{1470}{35} = 42 \text{ cm}$$

Again, area of the parallelogram = base × height

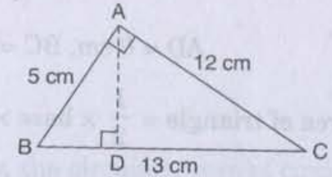
$$1470 = AD \times BM$$

$$\Rightarrow \quad 1470 = 49 \times BM$$

$$\Rightarrow \quad BM = \frac{1470}{49} = 30 \text{ cm}$$

Thus, the lengths of DL and BM are 42 cm and 30 cm respectively.

Q7. ΔABC is right angled at A. AD is perpendicular to BC. If AB = 5 cm, BC = 13 cm and AC = 12 cm, find the area of ΔABC. Also, find the length of AD.



Sol. In right-angled ΔBAC,

AB = 5 cm, AC = 12 cm

As we know, area of triangle = $\frac{1}{2}$ × base × height

$$\text{Area of right-angled } \Delta BAC = \frac{1}{2} \times AB \times AC$$

$$= \frac{1}{2} \times 5 \times 12$$

$$= 5 \times 6 = 30 \text{ cm}^2$$

Now, in ΔABC, BC = 13 cm

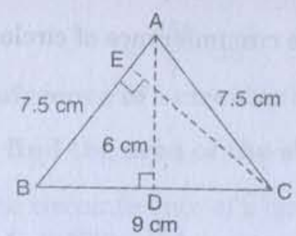
$$\text{Area of } \Delta ABC = \frac{1}{2} \times BC \times AD$$

$$\Rightarrow \quad 30 = \frac{1}{2} \times 13 \times AD$$

$$\Rightarrow \quad AD = \frac{30 \times 2}{13} = \frac{60}{13} \text{ cm}$$

Thus, the area of the triangle ABC is 30 cm^2 and the length of AD is $\frac{60}{13}$ cm.

Q8. ΔABC is isosceles with AB = AC = 7.5 cm and BC = 9 cm. The height AD from A to BC, is 6 cm. Find the area of ΔABC. What will be the height from C to AB *i.e.*, CE?



Sol. In ΔABC,

$$AD = 6 \text{ cm}, BC = 9 \text{ cm}$$

As we know, area of triangle $= \frac{1}{2} \times \text{base} \times \text{height}$

$$\text{Area of } \Delta ABC = \frac{1}{2} \times BC \times AD$$

$$= \frac{1}{2} \times 9 \times 6$$

$$= 3 \times 9 = 27 \text{ cm}^2.$$

Thus, area of the triangle is 27 cm^2.

Given, in ΔABC, Base (AB) = 7.5 cm and Area = 27 cm^2.

$$\text{Area of } \Delta ABC = \frac{1}{2} \times AB \times CE$$

$$\Rightarrow \quad 27 = \frac{1}{2} \times 7.5 \times CE$$

$$\Rightarrow \quad CE = \frac{27 \times 2}{7.5}$$

or $\quad CE = 7.2$ cm

Thus, height from C to AB *i.e.*, CE is 7.2 cm.

Exercise 11.3 *(Page No. 223-224)*

Q1. Find the circumference of the circles with the following radius: $\left(\textbf{Take } \pi = \frac{22}{7}\right)$

(*a*) 14 cm **(*b*) 28 mm** **(*c*) 21 cm**

Sol. (*a*) 14 cm

We know, the circumference of circle = $2\pi r$

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

$$= 2 \times 22 \times 2 = 88 \text{ cm}.$$

(*b*) 28 mm

We know, the circumference of circle = $2\pi r$

$$= 2 \times \frac{22}{7} \times 28$$

$$= 2 \times 22 \times 4 = 176 \text{ mm}.$$

(*c*) 21 cm

We know, the circumference of circle = $2\pi r$

$$= 2 \times \frac{22}{7} \times 21$$

$$= 2 \times 22 \times 3 = 132 \text{ cm}.$$

Q2. Find the area of the following circles, given that:

(*a*) radius = 14 mm **(*b*) diameter = 49 m**

(*c*) radius = 5 cm $\left(\textbf{Take } \pi = \frac{22}{7}\right)$

Sol. (*a*) radius (r) = 14 mm

Now, area of circle = πr^2

$$= \frac{22}{7} \times 14 \times 14$$

$$= 22 \times 2 \times 14 = 616 \text{ mm}^2.$$

(*b*) diameter = 49 m

$\because$ radius (r) = $\frac{\text{Diameter}}{2} = \frac{49}{2} = 24.5$ m

Now, area of circle = πr^2

$$= \frac{22}{7} \times 24.5 \times 24.5$$

$$= 22 \times 3.5 \times 24.5 = 1886.5 \text{ m}^2.$$

(*c*) radius (r) = 5 cm

Now, area of circle = πr^2

$$= \frac{22}{7} \times 5 \times 5$$

$$= \frac{550}{7} \text{ cm}^2.$$

Q3. If the circumference of a circular sheet is 154 m, find its radius. Also find the area of the sheet. $\left(\textbf{Take } \pi = \frac{22}{7}\right)$

Sol. Given that, the circumference of a circular sheet = 154 m.

Now, $\quad 2\pi r = 154$

$$\Rightarrow \quad r = \frac{154}{2\pi}$$

$$\text{or} \quad r = \frac{154 \times 7}{2 \times 22} = \frac{1078}{44} = 24.5 \text{ m}$$

Radius of circular sheet = 24.5 m.

We know, area of circular sheet = πr^2

$$= \frac{22}{7} \times (24.5)^2$$

$$= \frac{22 \times 24.5 \times 24.5}{7}$$

$$= 1886.5 \text{ m}^2$$

Thus, the radius and area of the circular sheet are 24.5 m and 1886.5 m^2 respectively.

Q4. A gardener wants to fence a circular garden of diameter 21 m. Find the length of the rope he needs to purchase, if he makes 2 rounds of fence. Also, find the costs of the rope, if it cost ₹ 4 per metre $\left(\text{Take } \pi = \frac{22}{7}\right)$

Sol. Diameter of the circular garden = 21 m

Radius of the circular garden = $\frac{21}{2}$ m.

Now, circumference of circular garden = $2\pi r$

$$= 2 \times \frac{22}{7} \times \frac{21}{2}$$

$$= 22 \times 3 = 66 \text{ m}$$

But, he makes 2 rounds of fence so the total length of the rope of fencing

$$= 2 \times 66 = 132 \text{ m.}$$

Therefore, the length of the rope, he needs, is 132 m.

Then, the cost of 1 metre rope = ₹ 4

The cost of 132 metre rope = 132 × 4 = ₹ 528

Thus, the cost of the rope is ₹ 528.

Q5. From a circular sheet of radius 4 cm, a circle of radius 3 cm is removed. Find the area of the remaining sheet. (Take $\pi = 3.14$.)

Sol. Radius of circular sheet (R) = 4 cm and radius of removed circle (r) = 3 cm.

Area of remaining sheet = area of circular sheet − area of removed circle

$$= \pi R^2 - \pi r^2$$

$$= \pi(R^2 - r^2)$$

$$= \pi(4^2 - 3^2)$$

$$= \pi \times (16 - 9)$$

$$= 3.14 \times 7 \qquad (\text{Take } \pi = 3.14)$$

$$= 21.98 \text{ cm}^2$$

Therefore, the area of remaining sheet is 21.98 cm^2.

Q6. Saima wants to put a lace on the edge of a circular table cover of diameter 1.5 m. Find the length of the lace required and also find its cost if one metre of the lace costs ₹ 15. (Take $\pi = 3.14$.)

Sol. Given, the diameter of the circular table cover = 1.5 m

Then, the radius of the circular table cover = $\frac{1.5}{2}$ m

Now, circumference of the circular table cover

$$= 2\pi r$$

$$= 2 \times 3.14 \times \frac{1.5}{2} \qquad (\text{Take } \pi = 3.14)$$

$$= 3.14 \times 1.5 = 4.71 \text{ m}$$

Therefore, the length of the required lace is 4.71 m.

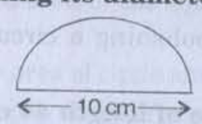
The cost of 1 m lace = ₹ 15

The cost of 4.71 m lace = ₹ 15 × 4.71

= ₹ 70.65

Thus, the cost of the total lace is ₹ 70.65.

Q7. Find the perimeter of the adjoining figure, which is a semicircle including its diameter.



Sol. From the figure, diameter = 10 cm

$$\text{Radius} = \frac{10}{2} \text{ cm} = 5 \text{ cm}$$

We know, the circumference of circle = $2\pi r$

and the circumference of semicircle = $\frac{2\pi r}{2} = \pi r$

Now, total perimeter of given figure

= circumference area of semicircle + its diameter

$= \pi r + d$

$= \frac{22}{7} \times 5 + 10 = \frac{110}{7} + 10$

$= \frac{110 + 70}{7} = \frac{180}{7}$

= 25.71 cm

Thus, the perimeter of the given figure is 25.71 cm.

Q8. Find the cost of polishing a circular table-top of diameter 1.6 m, if the rate of polishing is ₹ 15/m². (Take π = 3.14)

Sol. Given, the diameter of the circular table-top = 1.6 m

Then, radius of the circular table-top = $\frac{1.6}{2}$ m = 0.8 m

Now, we have to find the area of a circular table-top to polishing.

Area of a circular table-top = πr^2

$= 3.14 \times (0.8)^2$ [$\because$ Using $\pi = 3.14$]

$= 3.14 \times 0.8 \times 0.8$

$= 2.0096\ m^2$

Now, the cost of 1 m^2 polishing = ₹ 15

The cost of 2.0096 m^2 polishing = 15×2.0096

= 30.144

= ₹ 30.14 (approx.)

Thus, the cost of polishing a circular table-top is ₹ 30.14 (approx.).

Q9. Shazli took a wire of length 44 cm and bent it into the shape of a circle. Find the radius of that circle. Also find its area. If the same wire is bent into the shape of a square, what will be the length of each of its sides? Which figure encloses more area, the circle or the square? (Take π = $\frac{22}{7}$)

Sol. Given, the total length of the wire is 44 cm,

Converting into circle:

So, the circumference of a circle = $2\pi r$

$\Rightarrow \quad 44 = 2 \times \frac{22}{7} \times r$

$\Rightarrow \quad 44 = \frac{44}{7} \times r$

$\Rightarrow \quad \frac{44 \times 7}{44} = r$

or $\quad r = 7$ cm

Now, area of circle = πr^2

$= \frac{22}{7} \times (7)^2 = \frac{22}{7} \times 7 \times 7$

$= 22 \times 7 = 154\ cm^2$

Thus, the radius and area of circle are 7 cm and 154 cm^2 respectively.

Converting into square:

So, the perimeter of square = $4a$ (where a is side of square)

$44 = 4a$

$\Rightarrow \quad a = \frac{44}{4} = 11$

$\Rightarrow \quad$ side (a) = 11 cm

Now, area of square = side × side

$= 11 \times 11$

$= 121\ cm^2$

Thus, the side and area of the square are 11 cm and 121 cm^2 respectively.

On comparing the area of circle and square: 154 cm^2 > 121 cm^2

area of circle > area of square

Therefore, the circle enclosed more area.

Q10. From a circular card sheet of radius 14 cm, two circles of radius 3.5 cm and a rectangle of length 3 cm and

breadth 1 cm are removed (as shown in the adjoining figure.) Find the area of the remaining sheet. $\left(\textbf{Take } \pi = \frac{22}{7}\right)$

Sol. Given, the radius of the circular card sheet (R) = 14 cm,

Radius of small circles (r) = 3.5 cm,

Length of rectangle (l) = 3 cm and breadth of rectangle (b) = 1 cm.

Now, area of remaining sheet = Area of circular card sheet – (area of two circles + area of rectangle)

$$= \pi R^2 - [2(\pi r^2) + (l \times b)]$$

$$= \frac{22}{7} \times (14)^2 - \left[\left(2 \times \frac{22}{7} \times 3.5 \times 3.5\right) + (3 \times 1)\right]$$

$$= 22 \times 14 \times 2 - [44 \times 0.5 \times 3.5 + 3]$$

$$= (616 - 80) = 536 \text{ cm}^2$$

Therefore, the area of remaining sheet is 536 cm^2.

Q11. A circle of radius 2 cm is cut out from a square piece of an aluminium sheet of side 6 cm. What is the area of the left over aluminium sheet? (Take π = 3.14)

Sol. Given, radius of circle = 2 cm

and side of aluminium square sheet = 6 cm

Then,

Area of left over aluminium sheet

= Total area of square aluminium sheet – area of circle

$$= (\text{side})^2 - (\pi r^2)$$

$$= (6)^2 - \frac{22}{7} \times 2 \times 2$$

$$= 36 - 12.56$$

$$= 23.44 \text{ cm}^2$$

Therefore, the area of the left over aluminium sheet is 23.44 cm^2.

Q12. The circumference of a circle is 31.4 cm. Find the radius and the area of the circle (Take π = 3.14).

Sol. Given, circumference of the circle = 31.4 cm

Now, $2\pi r = 31.4$

$\Rightarrow$ $2 \times 3.14 \times r = 31.4$

$\Rightarrow$ $r = \dfrac{31.4}{3.14 \times 2}$

or $r = \dfrac{10}{2} = 5$ cm

Then, area of circle $= \pi r^2$

$$= (3.14 \times 5 \times 5) \text{ cm}^2$$

$$= 78.5 \text{ cm}^2$$

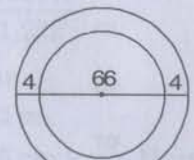
Thus, the radius and area of circle are 5 cm and 78.5 cm^2 respectively.

Q13. A circular flower bed is surrounded by a path 4 m wide. The diameter of the flower bed is 66 m. What is the area of this path? (π = 3.14).

Sol. Given, the diameter of circular flower bed = 66 m

Radius of the circular flower bed (r) $= \dfrac{66}{2}$ m = 33 m

Now, this bed is surrounded by a path of 4 m wide.



So, the diameter of circular flower bed with path

$$= (66 + 4 + 4) \text{ m}$$

$$= 74 \text{ m}$$

Radius of circular flower bed with path (R) $= \dfrac{74}{2}$ m = 37 m.

Therefore, area of path = area of the circular flower bed with path – area of the circular flower bed

$$= \pi R^2 - \pi r^2$$

$$= \pi(R^2 - r^2)$$

$$= \pi[(37)^2 - (33)^2]$$

$$= 3.14(1369 - 1089)$$

$= 3.14 \times 280$

$= 879.20 \text{ m}^2$

Thus, the area of this path is 879.20 m^2.

Q14. A circular flower garden has an area of 314 m^2. A sprinkler at the centre of the garden can cover an area that has a radius of 12 m. Will the sprinkler water the entire garden? (Take $\pi = 3.14$)

Sol. First we find the area of garden which is circular area by the sprinkler has radius (r) 12 m.

Now, circular area by the sprinkler $= \pi r^2$

$= 3.14 \times (12)^2$

$= 3.14 \times 12 \times 12$

$= 452.16 \text{ m}^2$

And the area of the circular flower garden is given 314 m^2 which is smaller than the sprinkled circular area.

Thus, yes, the sprinkler will water the entire garden.

Or

Given, the area of circular garden = 314 m^2

Now, $\pi r^2 = 314$

$\Rightarrow \quad 3.14 \times r^2 = 314$

$\Rightarrow \quad r^2 = \dfrac{314}{3.14}$

$\Rightarrow \quad r^2 = 100$

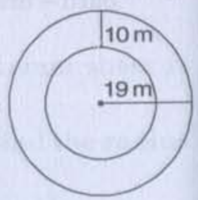
or $\quad r = \sqrt{100} = 10 \text{ m}$

Therefore, the radius of circular garden = 10 m.

And radius of the sprinkler at the centre of garden can cover an area = 12 m which is greater.

Thus, the sprinkler will water the entire garden.

Q15. Find the circumference of the inner and the outer circles, shown in the adjoining figure? (Take $\pi = 3.14$)



Sol. Given, radius of outer circle = 19 m

Circumference of outer circle $= 2\pi r$

$= 2 \times 3.14 \times 19$

$= 119.32 \text{ m}$

Now, radius of inner circle = 19 m – 10 m

$= 9 \text{ m}$

Circumference of inner circle $= 2\pi r$

$= 2 \times 3.14 \times 9$

$= 56.52 \text{ m}$

Therefore, the circumferences of the inner and outer circles are 56.52 m and 119.32 m respectively.

Q16. How many times a wheel of radius 28 cm must rotate to go 352 m? $\left(\text{Take } \pi = \dfrac{22}{7}\right)$

Sol. Let wheel must be rotate n times of its circumference.

Given that radius of wheel = 28 cm, distance = 352 m

$= 35200 \text{ cm}$

We know, distance covered by wheel

$= n \times$ circumference of wheel

Now, $\quad 35200 = n \times 2\pi r$

$\Rightarrow \quad 35200 = n \times 2 \times \dfrac{22}{7} \times 28$

$\Rightarrow \quad n = \dfrac{35200 \times 7}{44 \times 28} = \dfrac{246400}{1{,}232}$

or $\quad n = 200$ revolutions

Thus, wheel must rotate 200 times to go 352 m.

Q17. The minute hand of a circular clock is 15 cm long. How far does the tip of the minute hand move in 1 hour. (Take $\pi = 3.14$)

Sol. In 1 hour, the minute hand completes one round means makes a circle. Radius of circle (r) = 15 cm.

So, circumference of circular clock $= 2\pi r$

$= 2 \times 3.14 \times 15$

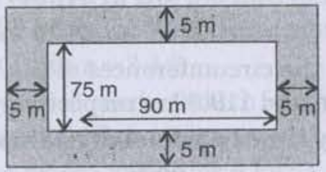
$= 94.2 \text{ cm}$

Therefore, the tip of the minute hand moves 94.2 cm in 1 hour.

Exercise 11.4 *(Page No. 226-227)*

Q1. A garden is 90 m long and 75 m broad. A path 5 m wide is to be built outside and around it. Find the area of the path. Also find the area of the garden in hectars.

Sol.



Given, length of rectangular garden = 90 m

and breadth of rectangular garden = 75 m.

Outer length of rectangular garden with path

$= 90 + 5 + 5 = 100$ m.

Outer breadth of rectangular garden with path

$= 75 + 5 + 5 = 85$ m.

Outer area of rectangular garden with path = length × breadth

$= 100 \times 85 = 8{,}500 \text{ m}^2$

Inner area of garden without path = length × breadth

$= 90 \times 75$

$= 6{,}750 \text{ m}^2$

Thus, area of the path = area of garden with path

– area of garden without path

$= 8{,}500 - 6{,}750$

$= 1{,}750 \text{ m}^2$

Therefore, the area of path is $1{,}750 \text{ m}^2$.

Area of garden in hectare:

Area of garden $= 6{,}750 \text{ m}^2$

We know, $1 \text{ m}^2 = \dfrac{1}{10{,}000}$ ha

$6{,}750 \text{ m}^2 = \dfrac{6750}{10{,}000}$ ha

$= 0.675$ ha.

Q2. A 3 m wide path runs outside and around a rectangular park of length 125 m and breadth 65 m. Find the area of the path.

Sol. Given, length of rectangular park = 125 m,

breadth of rectangular park = 65 m.

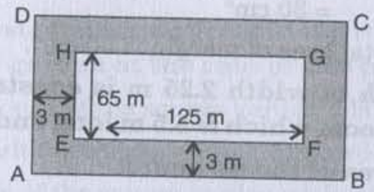
and width of the path = 3 m

So, total length of rectangular park with path

$= 125 + 3 + 3 = 131$ m

Total breadth of rectangular park with path

$= 65 + 3 + 3 = 71$ m



Therefore, area of path = area of park with path (ABCD)

– area of park without path (EFGH)

$= (AB \times AD) - (EF \times EH)$

$= (131 \times 71) - (125 \times 65)$

$= 9{,}301 - 8{,}125$

$= 1{,}176 \text{ m}^2$

Thus, the area of path around the park is $1{,}176 \text{ m}^2$.

Q3. A picture is painted on a cardboard 8 cm long and 5 cm wide such that there is a margin of 1.5 cm along each of its sides. Find the total area of the margin.

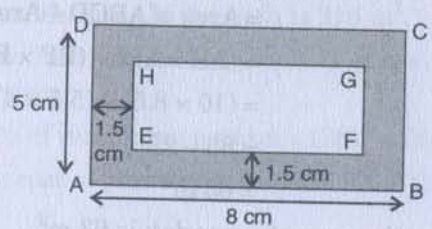
Sol. Length of painted cardboard = 8 cm

and breadth of painted cardboard = 5 cm

There is a margin of 1.5 cm long from each of its side

Now, reduced length $= 8 - (1.5 + 1.5)$

$= 8 - 3 = 5$ cm



Reduced breadth $= 5 - (1.5 + 1.5)$

$= 5 - 3 = 2$ cm

Area of margin = area of cardboard (ABCD)

– area of cardboard without margin (EFGH)

$= (AB \times AD) - (EF \times EH)$

$= (8 \times 5) - (5 \times 2)$

$= 40 - 10$

$= 30\ cm^2$

Thus, the total area of margin is $30\ cm^2$.

Q4. A *verandah* of width 2.25 m is constructed all along outside a room which is 5.5 m long and 4 m wide. Find:

(*i*) the area of the *verandah*.

(*ii*) the cost of cementing the floor of the *verandah* at the rate of ₹ 200 per m^2.

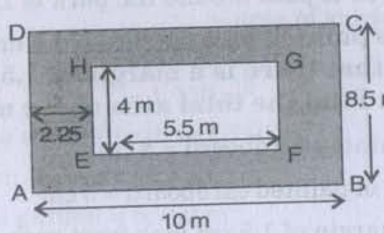
Sol. (*i*) Given that,

the length of room = 5.5 m and the width of room = 4 m,

the length of room with *verandah* = 5.5 + 2.25 + 2.25

= 10 m,

the width of room with *verandah* = 4 + 2.25 + 2.25 = 8.5 m.



Area of *verandah* = Area of room with *verandah*

– Area of room without *verandah*

= Area of ABCD – Area of EFGH

$= (AB \times AD) - (EF \times EH)$

$= (10 \times 8.5) - (5.5 \times 4)$

$= 85 - 22$

$= 63\ m^2$

Thus, the area of *verandah* is $63\ m^2$.

(*ii*) The cost of cementing $1\ m^2$ the floor of *verandah*

= ₹ 200

The cost of cementing $63\ m^2$ the floor of *verandah*

$= 63 \times 200$

= ₹ 12,600.

Q5. A path 1 m wide is built along the border and inside a square garden of side 30 m. Find:

(*i*) the area of the path.

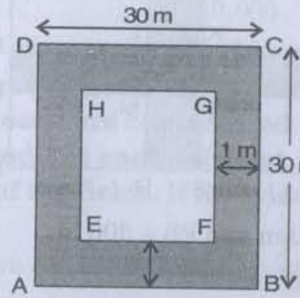
(*ii*) the cost of planting grass in the remaining portion of the garden at the rate of ₹ 40 per m^2.

Sol. (*i*) Given, side of the square garden = 30 m

and width of the path along the border = 1 m.

So, side of the square garden without path $= 30 - 1 - 1$

= 28 m



Now, area of the path = area of garden with path (ABCD)

– area of garden without path (EFGH)

$= (AB \times AD) - (EF \times EH)$

$= (30 \times 30) - 28 \times 28$

$= 900 - 784$

$= 116\ m^2$

Thus, the area of the path is $116\ m^2$.

(*ii*) Now, find the cost of planting grass in the remaining portion.

Area of remaining portion $= (28)^2 = 784\ m^2$

The cost of planting grass in $1\ m^2$ of the garden = ₹ 40

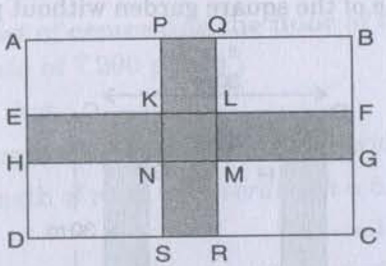
The cost of planting grass in 784 m^2 of the garden

$$= ₹ (784 \times 40)$$
$$= ₹ 31,360$$

Thus, the cost of planting grass is ₹ 31,360.

Q6. Two cross roads, each of width 10 m, cut at right angles through the centre of a rectangular park of length 700 m and breadth 300 m and parallel to its sides. Find the area of the roads. Also find the area of the park excluding cross roads. Give the answer in hectares.

Sol. Area of the cross roads is the area of shaded portion, *i.e.*, the area of the rectangle PQRS and the area of the rectangle EFGH. But while doing this the area of the square KLMN is taken twice, which is to be subtracted.



Now, PQ = 10 m and PS = 300 m

EH = 10 m and EF = 700 m

KL = 10 m and KN = 10 m

Area of the roads

= area of rectangle PQRS + area of the rectangle EFGH − area of the square KLMN

$= PS \times PQ + EF \times EH - KL \times KN$
$= (300 \times 10) + (700 \times 10) - (10 \times 10)$
$= 3000 + 7000 - 100$
$= 10,000 - 100$
$= 9,900 \text{ m}^2$

Area of the road in hectare:

$$1 \text{ m}^2 = \frac{1}{10,000} \text{ ha}$$

$$\Rightarrow \quad 9,900 \text{ m}^2 = \frac{9,900}{10,000} \text{ ha}$$
$$= 0.99 \text{ ha.}$$

Thus, the area of the road in hectare is 0.99 ha.

Area of park excluding cross roads

= Area of park − area of road
$= (AB \times AD) - 9,900$
$= (700 \times 300) - 9,900$
$= (2,10,000 - 9,900) \text{ m}^2$
$= 2,00,100 \text{ m}^2$

Area (in hectare) of park excluding cross roads:

We know, $1 \text{ m}^2 = \frac{1}{10,000}$ ha

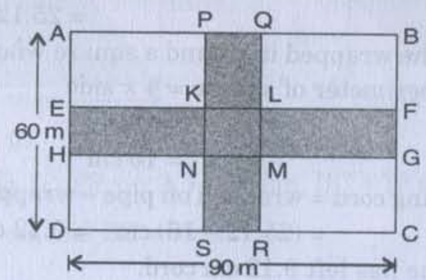
$$\Rightarrow \quad 2,00,100 \text{ m}^2 = \frac{2,00,100}{10,000} \text{ ha}$$
$$= 20.01 \text{ ha.}$$

Q7. Through a rectangular field of length 90 m and breadth 60 m, two roads are constructed which are parallel to the sides and cut each other at right angles through the centre of the fields. If the width of each road is 3 m, find:

(*i*) the area covered by the roads.

(*ii*) the cost of constructing the roads at the rate of ₹ 110 per m^2.

Sol. (*i*) Area of shaded portion, of cross roads *i.e.*, the area of the rectangle PQRS and the area of the rectangle EFGH. But while doing this, the area of the square KLMN is taken twice which is to be subtracted.



Now, $PQ = 3$ m and $PS = 60$ m

$EH = 3$ m and $EF = 90$ m

$KL = 3$ m and $KN = 3$ m

Area of the roads = area of rectangle PQRS + area of the rectangle EFGH – area of the square KLMN

$= PS \times PQ + EF \times EH - KL \times KN$

$= (60 \times 3) + (90 \times 3) - (3 \times 3)$

$= 180 + 270 - 9$

$= 441 \text{ m}^2$

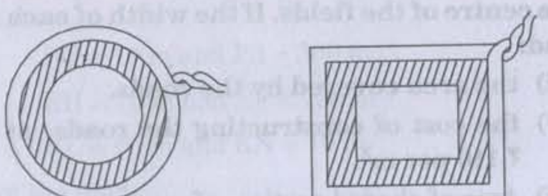
Thus, the area of cross roads is 441 m^2.

(*ii*) Given, the cost of 1 m^2 constructing the roads = ₹ 110

The cost of 441 m^2 constructing the roads = 441×110

Therefore, the cost of constructing roads = ₹ 48,510.

Q8. Pragya wrapped a cord around a circular pipe of radius 4 cm (adjoining figure) and cut off the length required of the cord. Then she wrapped it around a square box of side 4 cm (also shown). Did she have any cord left? ($\pi = 3.14$)



Sol. Given, radius of pipe = 4 cm

Wrapping cord around circular pipe = $2\pi r$

$= 2 \times 3.14 \times 4$

$= 25.12$ cm

Again, she wrapped it around a square whose side is 4 cm.

So, the perimeter of square = $4 \times$ side

$= 4 \times 4$

$= 16$ cm

Remaining cord = wrapped on pipe – wrapped on square

$= (25.12 - 16)$ cm $= 9.12$ cm

Thus, she has left 9.12 cm cord.

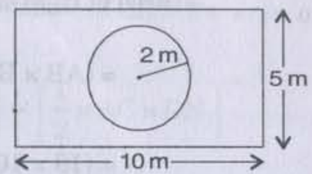
Q9. The adjoining figure represent a rectangular lawn with a circular flower bed in the middle. Find:

(*i*) the area of the whole land.

(*ii*) the area of the flower bed.

(*iii*) the area of the lawn excluding the area of the flower bed.

(*iv*) the circumference of the flower bed.



Sol. According to the adjoining figure.

Length of the rectangular lawn = 10 m

Breadth of the rectangular lawn = 5 m

Radius of the circular flower bed = 2 m

(*i*) Area of the whole land = length × breadth

$= 10 \times 5 = 50 \text{ m}^2$

(*ii*) Area of the flower bed $= \pi r^2$

$= 3.14 \times 2 \times 2 = 12.56 \text{ m}^2$

(*iii*) Area of lawn excluding the area of the flower bed

= area of lawn – area of flower bed

$= 50 \text{ m}^2 - 12.56 \text{ m}^2$

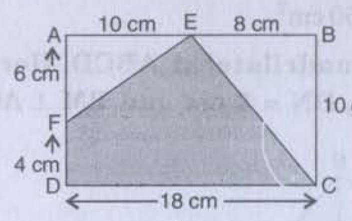
$= 37.44 \text{ m}^2$

(*iv*) The circumference of the flower bed $= 2\pi r$

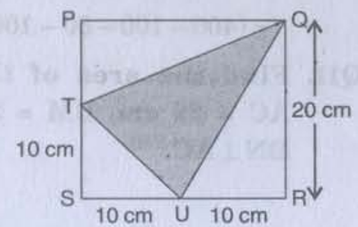
$= 2 \times 3.14 \times 2$

$= 12.56$ m.

Q10. In the following figures, find the area of the shaded portions:



(*i*)



(*ii*)

Sol. From Fig. (*i*): Given, AB = 18 cm, BC = 10 cm, AF = 6 cm, AE = 10 cm and BE = 8 cm.

Area of shaded portion (FECD) = area of rectangle ABCD

– (area of right-angled ΔFAE + area of right-angled ΔEBC)

$$= (AB \times BC) - \left(\frac{1}{2} \times AE \times AF\right) - \left(\frac{1}{2} \times BE \times BC\right)$$

$$= (18 \times 10) - \left(\frac{1}{2} \times 10 \times 6\right) - \left(\frac{1}{2} \times 8 \times 10\right)$$

$$= 180 - 30 - 40$$

$$= 110 \text{ cm}^2$$

From Fig. (*ii*): Given, SR = SU + UR = 10 + 10 = 20 cm,

QR = 20 cm,

PQ = SR = 20 cm, PT = PS – TS = 20 – 10 = 10 cm,

TS = 10 cm, SU = 10 cm, QR = 20 cm and UR = 10 cm

Area of shaded portion of ΔTQU = Area of square PQRS

– area of right-angled ΔQPT – area of right-angled ΔTSU

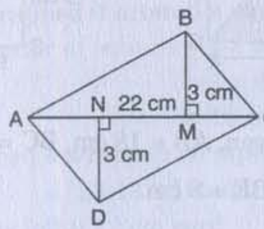
– area of right-angled ΔUQR

$$= (SR \times QR) - \left(\frac{1}{2} \times PQ \times PT\right) - \left(\frac{1}{2} \times ST \times SU\right) - \left(\frac{1}{2} \times QR \times UR\right)$$

$$= 20 \times 20 - \left(\frac{1}{2} \times 20 \times 10\right) - \left(\frac{1}{2} \times 10 \times 10\right) - \left(\frac{1}{2} \times 20 \times 10\right)$$

$$= (400 - 100 - 50 - 100) = 150 \text{ cm}^2.$$

Q11. Find the area of the quadrilateral ABCD. Here, AC = 22 cm, BM = 3 cm, DN = 3 cm and BM $\perp$ AC, DN $\perp$ AC.



Sol. Given, AC = 22 cm, BM = 3 cm, DN = 3 cm

Area of the quadrilateral ABCD = area of ΔABC + area of ΔADC

$$= \left(\frac{1}{2} \times AC \times BM\right) + \left(\frac{1}{2} \times AC \times DN\right)$$

$$= \left(\frac{1}{2} \times 22 \times 3\right) + \left(\frac{1}{2} \times 22 \times 3\right)$$

$$= 3 \times 11 + 3 \times 11$$

$$= 33 + 33$$

$$= 66 \text{ cm}^2$$

Thus, the area of quadrilateral ABCD is 66 cm^2.

□□