

MATHEMATICS

Chapter 11: Perimeter and Area

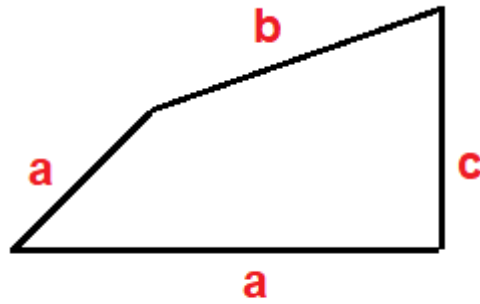


Perimeter and Area

1. Perimeter is the distance around a closed figure when we go around the figure once. So, perimeter = sum of lengths of all sides.
2. The measurement of the region enclosed by a plane figure is called the area of the figure.
3. Perimeter of a rectangle = $2 \times (\text{length} + \text{breadth})$
4. Perimeter of a square = $4 \times (\text{side})$
5. Area of rectangle = $(\text{length}) \times (\text{breadth})$
6. Area of a square = $(\text{side})^2$
7. Area of parallelogram = $\text{base} \times \text{height}$
8. Area of triangle = $\frac{1}{2} \times \text{base} \times \text{height}$
9. The perimeter of a circle is called its circumference. The length of the thread that winds tightly around the circle exactly once gives the circumference of the circle.
10. Circumference = $2\pi r = \pi d$, where r = radius and d = diameter. Here, π (pi) is a constant.
11. The ratio of the circumference of a circle and its diameter is always constant.
12. Area of a circle with radius r units is equal to πr^2 sq. units.
13. The region enclosed between two concentric circles of different radii is called the area of ring.
 Area of path formed = $(\pi R^2 - \pi r^2)$ sq units
 = $\pi(R^2 - r^2)$ sq units
 = $\pi(R + r)(R - r)$ sq units
14. Conversion of units:
 - 1 $\text{cm}^2 = 100 \text{ mm}^2$
 - 1 $\text{m}^2 = 10000 \text{ cm}^2$
 - 1 $\text{dm}^2 = 100 \text{ cm}^2$
 - 1 $\text{km}^2 = 1000000 \text{ m}^2$
 - 1 hectare = 10000 m^2

Perimeter

Perimeter is the total length or total distance covered along the boundary of a closed shape.



$$p = a + b + c + d$$

The perimeter of a Quadrilateral

Area

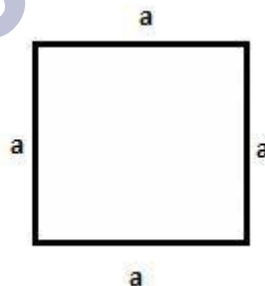
The area is the total amount of surface enclosed by a closed figureS.



Areas of a closed figure

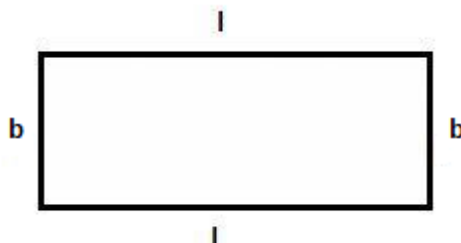
The perimeter of Square and Rectangle

Perimeter of a square = $a + a + a + a = 4a$, where a is the length of each side.



Square with side length 'a' units

Perimeter of a rectangle = $l + l + b + b = 2(l + b)$, where l and b are length and breadth, respectively.

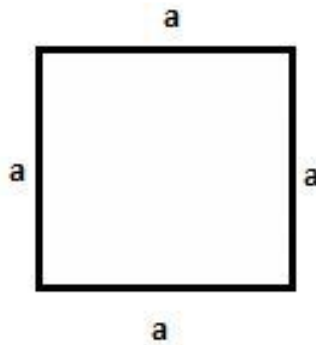


Rectangle with length 'l' units and breadth 'b' units

Area of Square & Rectangle

Area of square = $4a^2$

Here a is the length of each side



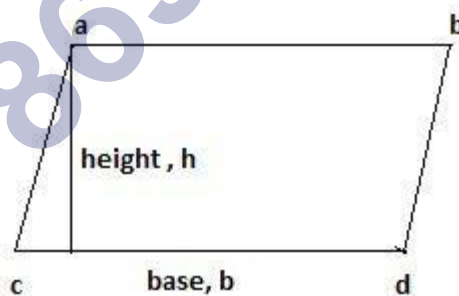
Square with the length of each side 'a' units

Area of rectangle = Length(l) × Breadth(b) = $l \times b$



Rectangle with length 'a' units and breadth 'b' units

Area of a Parallelogram



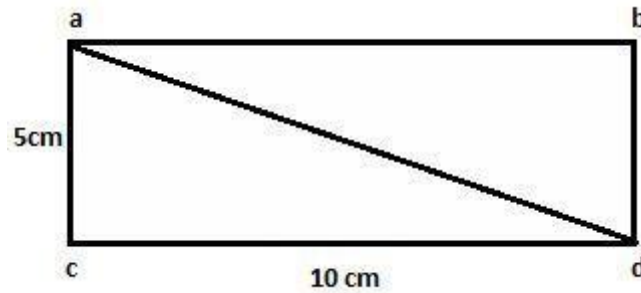
Area of parallelogram ABCD = (base × height)

Area of parallelogram ABCD = $(b \times h)$

Triangle as Part of Rectangle

The rectangle can be considered as a combination of two congruent triangles.

Consider a rectangle ABCD, it is divided into 2 triangles ACD and ABD.



Triangles as parts of Rectangle

Area of each triangle = $\frac{1}{2}$ (Area of the rectangle).

= $\frac{1}{2}$ (length \times breadth)

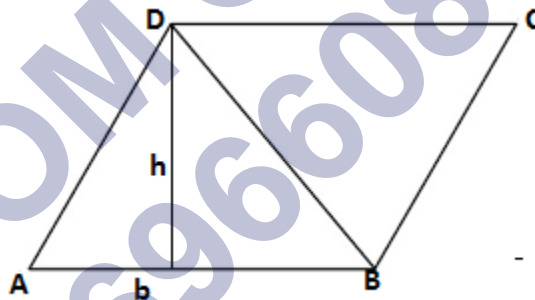
= $\frac{1}{2}$ (10cm \times 5cm)

= 25cm²

Area of a Triangle

Consider a parallelogram ABCD.

Draw a diagonal BD to divide the parallelogram into two congruent triangles.



Area of Triangle = $\frac{1}{2}$ (base \times height)

Area of triangle ABD = $\frac{1}{2}$ (Area of parallelogram ABCD)

Area of triangle ABD = $\frac{1}{2}$ (b \times h)

Conversion of Units

Kilometres, metres, centimetres, millimetres are units of length.

10 millimetres = 1 centimetre

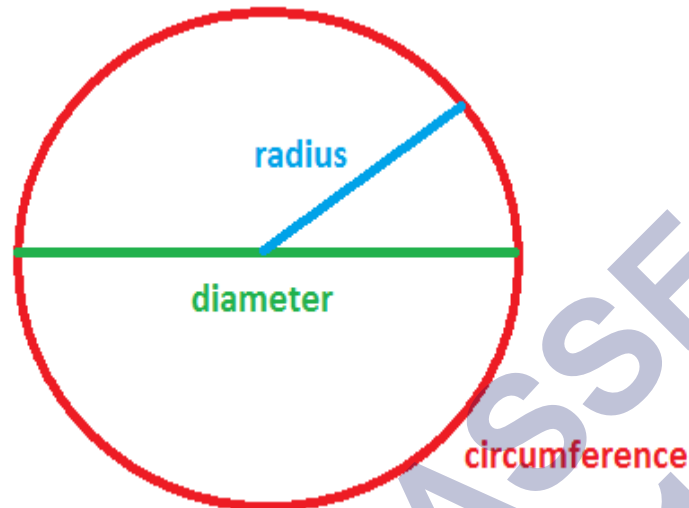
100 centimetres = 1 metre

1000 metres = 1 kilometre

Life of Pi

Terms Related to Circle

- A circle is a simple closed curve which is not a polygon.
- A circle is a collection of points which are equidistant from a fixed point.



- The fixed point in the middle is called the centre.
- The fixed distance is known as radius.
- The perimeter of a circle is also called as the circumference of the circle.

Circumference of a Circle

The circumference of a circle (C) is the total path or total distance covered by the circle. It is also called a perimeter of the circle.

Circumference of a circle = $2 \times \pi \times r$,

where r is the radius of the circle.

Visualising Area of a Circle

Area of Circle

Area of a circle is the total region enclosed by the circle.

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

Circle Definition

A circle is a closed two-dimensional figure in which the set of all the points in the plane is equidistant from a given point called "centre". Every line that passes through the circle forms the line of reflection symmetry. Also, it has rotational symmetry around the centre for every angle. The circle formula in the plane is given as:

$$(x-h)^2 + (y-k)^2 = r^2$$

where (x, y) are the coordinate points

(h, k) is the coordinate of the centre of a circle

and r is the radius of a circle.

Circle Shaped Objects

There are many objects we have seen in the real world that are circular in shape. Some of the examples are:

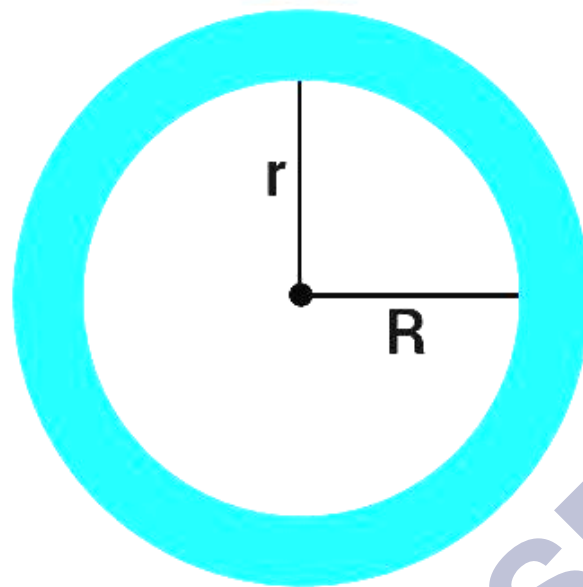
- Ring
- CD/Disc
- Bangles
- Coins
- Wheels
- Button
- Dartboard
- Hula hoop

We can observe many such examples in our day to day life.

Parts of Circle

A circle has different parts based on the positions and their properties. The different parts of a circle are explained below in detail.

Annulus-The region bounded by two concentric circles. It is basically a ring-shaped object. See the figure below.



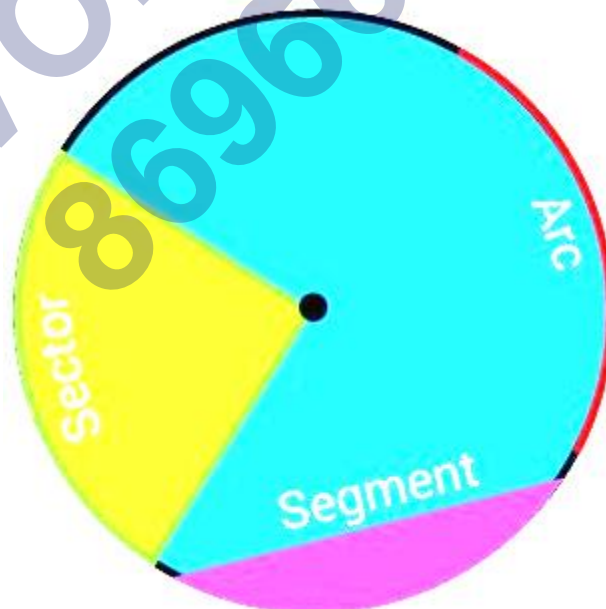
Annulus

Arc – It is basically the connected curve of a circle.

Sector – A region bounded by two radii and an arc.

Segment- A region bounded by a chord and an arc lying between the chord's endpoints. It is to be noted that segments do not contain the centre.

See the figure below explaining the arc, sector and segment of a circle.



Centre – It is the midpoint of a circle.

Chord- A line segment whose endpoints lie on the circle.

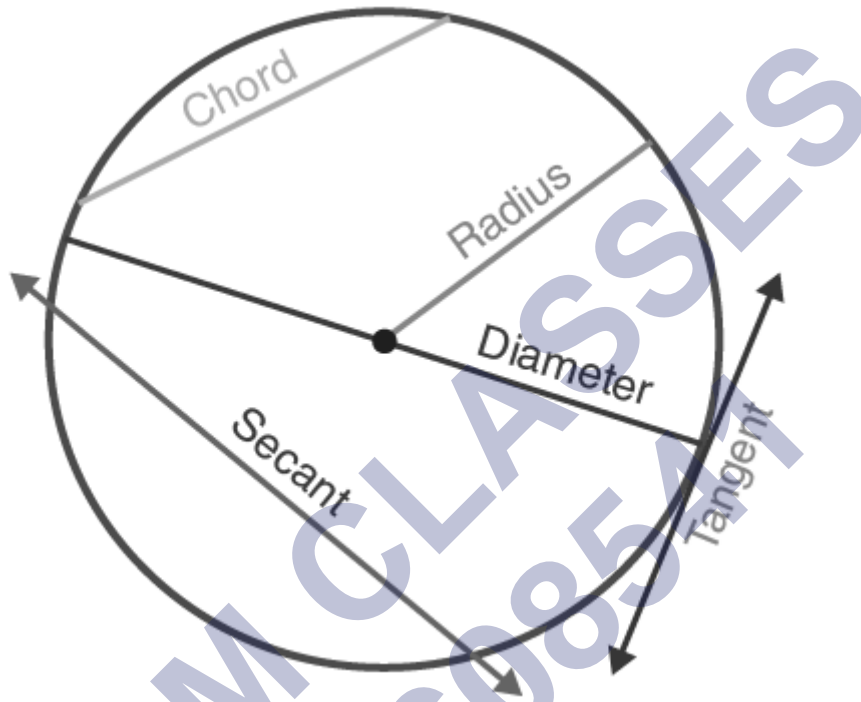
Diameter- A line segment having both the endpoints on the circle and is the largest chord of the circle.

Radius- A line segment connecting the centre of a circle to any point on the circle itself.

Secant- A straight line cutting the circle at two points. It is also called an extended chord.

Tangent- A coplanar straight line touching the circle at a single point.

See the figure below-representing the centre, chord, diameter, radius, secant and tangent of a circle.



Introduction and Value of Pi

Pi (π) is the constant which is defined as the ratio of a circle's circumference ($2\pi r$) to its diameter ($2r$).

$$\pi = \text{Circumference } (2\pi r) / \text{Diameter } (2r)$$

The value of pi is approximately equal to 3.14159 or $22/7$.

Problem Solving

Cost of Framing, Fencing

- Cost of framing or fencing a land is calculated by finding its perimeter.
- Example: A square-shaped land has length of its side 10m.

$$\text{Perimeter of the land} = 4 \times 10 = 40\text{m}$$

$$\text{Cost of fencing 1m} = \text{Rs } 10$$

$$\text{Cost of fencing the land} = 40 \text{ m} \times \text{Rs } 10 = \text{Rs } 400$$

Cost of Painting, Laminating

- Cost of painting a surface depends on the area of the surface.
- Example: A wall has dimensions 5m×4m.

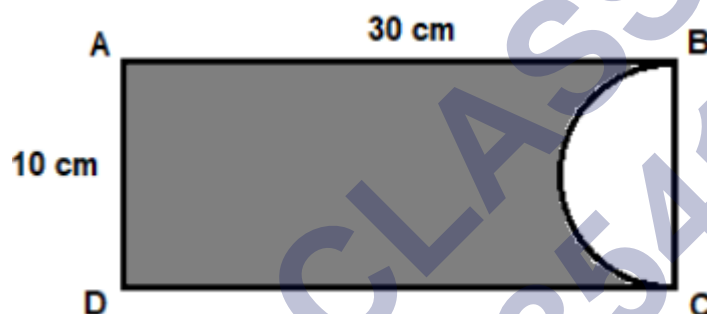
$$\text{Area of the wall} = 5\text{m} \times 4\text{m} = 20\text{m}^2$$

$$\text{Cost of painting } 1\text{m}^2 \text{ of area is Rs } 20.$$

$$\text{Cost of painting the wall} = 20\text{m}^2 \times \text{Rs } 20 = \text{Rs } 400$$

Area of Mixed Shapes

Find the area of the shaded portion using the given information.



Area of the shaded portion

Solution: Diameter of the semicircle = 10cm

Radius of semicircle = 5cm

Area of the shaded portion = Area of rectangle ABCD – Area of semicircle

$$\text{Area of the shaded portion} = (l \times b) - (\pi r^2/2)$$

$$= 30 \times 10 - (\pi \times 5^2/2)$$

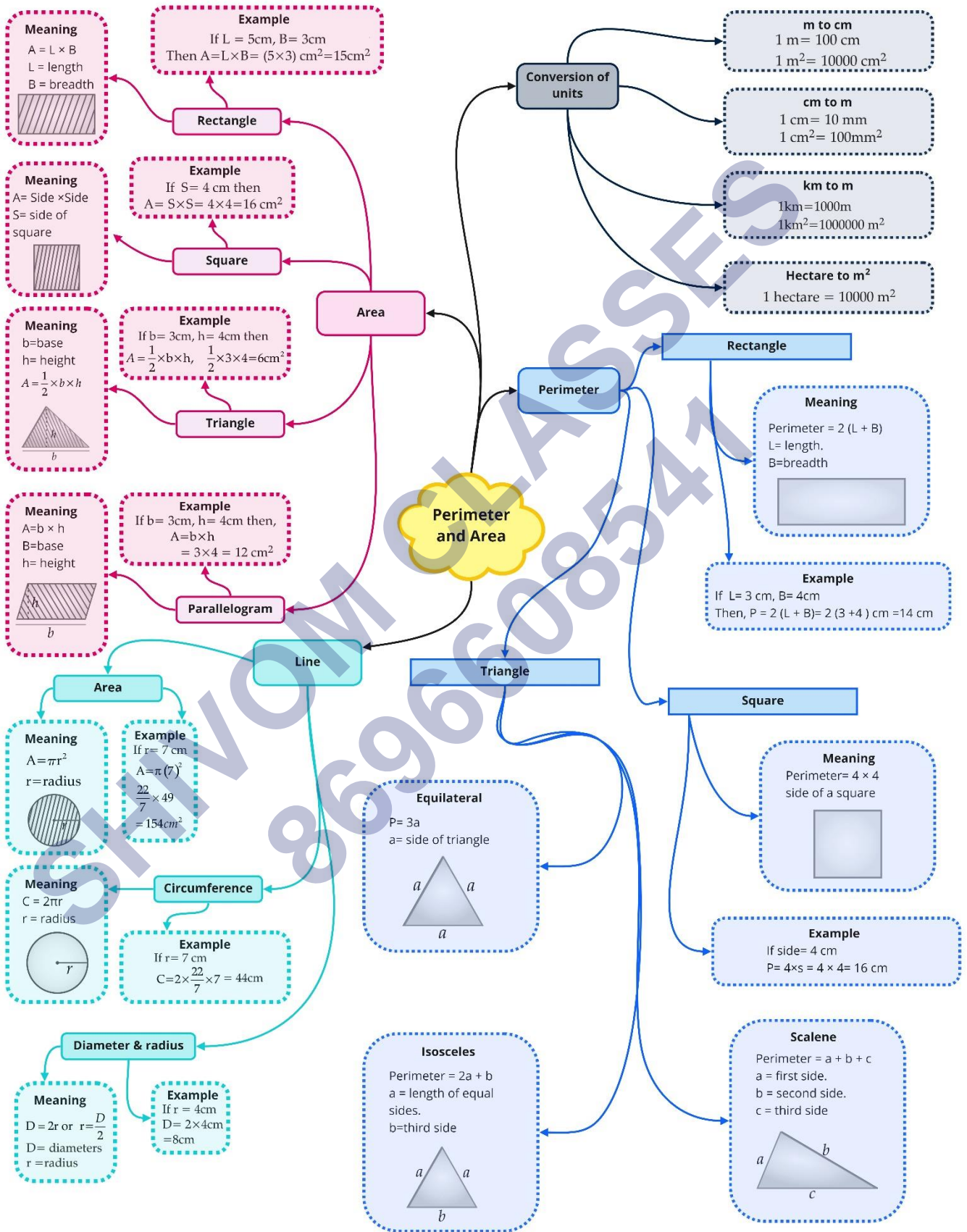
$$= 300 - (\pi \times 25/2)$$

$$= (600 - 25\pi)/2$$

$$= (600 - 78.5)/2$$

$$= 260.7 \text{ cm}^2$$

Class : 7th mathematics
Chapter-11 : Perimeter and Area



Important Questions

Multiple Choice Questions-

Question 1. Perimeter of a square =

- (a) side \times side
- (b) $3 \times$ side
- (c) $4 \times$ side
- (d) $2 \times$ side

Question 2. Perimeter of a rectangle of length l and breadth b is

- (a) $l + b$
- (b) $2 \times (l + b)$
- (c) $3 \times (l + b)$
- (d) $l \times b$

Question 3. Area of a square =

- (a) side \times side
- (b) $2 \times$ side
- (c) $3 \times$ side
- (d) $4 \times$ side

Question 4. Area of a rectangle of length l and breadth b is

- (a) $l \times b$
- (b) $l + b$
- (c) $2 \times (l + b)$
- (d) $6 \times (l + b)$

Question 5. Area of a parallelogram =

- (a) base \times height
- (b) $\frac{1}{2} \times$ base \times height
- (c) $\frac{1}{3} \times$ base \times height
- (d) $\frac{1}{4} \times$ base \times height

Question 6. Area of a triangle =

- (a) base \times height
- (b) $\frac{1}{2} \times$ base \times height
- (c) $\frac{1}{3} \times$ base \times height

(d) $\frac{1}{4} \times \text{base} \times \text{height}$

Question 7. The circumference of a circle of radius r is

(a) πr

(b) $2\pi r$

(c) πr^2

(d) $\frac{1}{4} \pi r^2$

Question 8. The circumference of a circle of diameter d is

(a) πd

(b) $2\pi d$

(c) $\frac{1}{2} \pi d$

(d) πd^2

Question 9. If r and d are the radius and diameter of a circle respectively, then

(a) $d = 2r$

(b) $d = r$

(c) $d = \frac{1}{2} r$

(d) $d = r^2$

Question 10. The area of a circle of radius r is

(a) πr^2

(b) $2\pi r^2$

(c) $2\pi r$

(d) $4\pi r^2$

Question 11. The area of a circle of diameter d is

(a) πd^2

(b) $2\pi d^2$

(c) $\frac{1}{4} \pi d^2$

(d) $2\pi d$

Question 12. $1 \text{ cm}^2 =$

(a) 10 mm^2

(b) 100 mm^2

(c) 1000 mm^2

(d) 10000 mm^2

Question 13. $1 \text{ m}^2 =$

- (a) 10 cm^2
- (b) 100 cm^2
- (c) 1000 cm^2
- (d) 10000 cm^2

Question 14. 1 hectare =

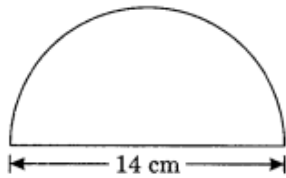
- (a) 10 m^2
- (b) 100 m^2
- (c) 1000 m^2
- (d) 10000 m^2

Question 15. 1 are =

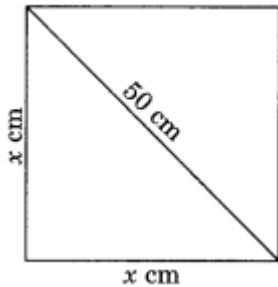
- (a) 10 m^2
- (b) 100 m^2
- (c) 1000 m^2
- (d) 10000 m^2

Very Short Questions:

1. The side of a square is 2.5 cm. Find its perimeter and area.
2. If the perimeter of a square is 24 cm. Find its area.
3. If the length and breadth of a rectangle are 36 cm and 24 cm respectively. Find
 - (i) Perimeter
 - (ii) Area of the rectangle.
4. The perimeter of a rectangular field is 240 m. If its length is 90 m, find:
 - (i) it's breadth
 - (ii) it's are
5. The length and breadth of a rectangular field are equal to 600 m and 400 m respectively. Find the cost of the grass to be planted in it at the rate of ₹ 2.50 per m^2 .
6. The perimeter of a circle is 176 cm, find its radius.
7. The radius of a circle is 3.5 cm, find its circumference and area.
8. Area of a circle is 154 cm^2 , find its circumference.
9. Find the perimeter of the figure given below.

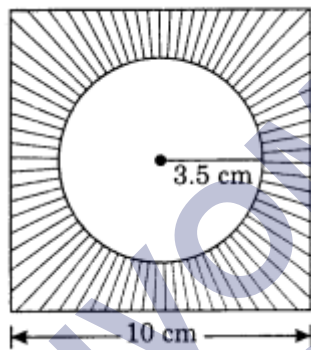


10. The length of the diagonal of a square is 50 cm, find the perimeter of the square.

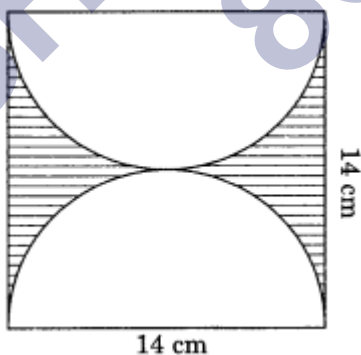


Short Questions:

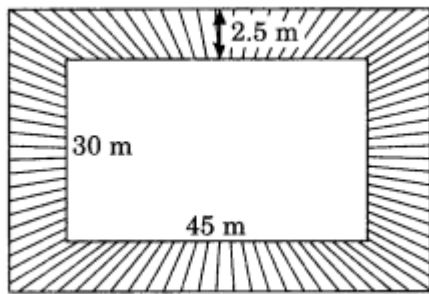
1. A wire of length 176 cm is first bent into a square and then into a circle. Which one will have more area?
2. In the given figure, find the area of the shaded portion.



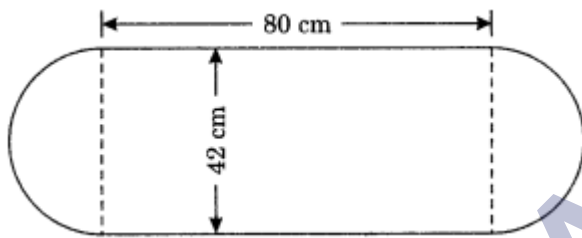
3. Find the area of the shaded portion in the figure given below.



4. A rectangle park is 45 m long and 30 m wide. A path 2.5 m wide is constructed outside the park. Find the area of the path.



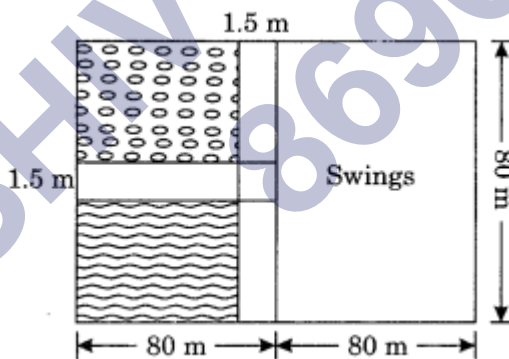
5. In the given figure, calculate:
- the area of the whole figure.
 - the total length of the boundary of the field.



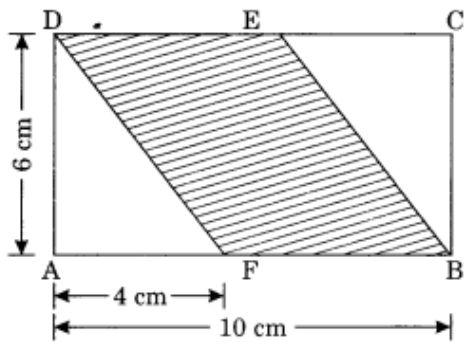
6. How many times a wheel of radius 28 cm must rotate to cover a distance of 352 m? (Take $\pi = \frac{22}{7}$)

Long Questions:

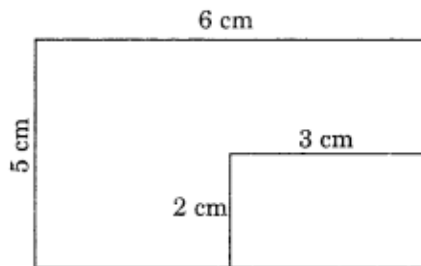
1. A nursery school playground is 160 m long and 80 m wide. In it 80 m \times 80 m is kept for swings and in the remaining portion, there are 1.5 m wide path parallel to its width and parallel to its remaining length as shown in Figure. The remaining area is covered by grass. Find the area covered by grass.



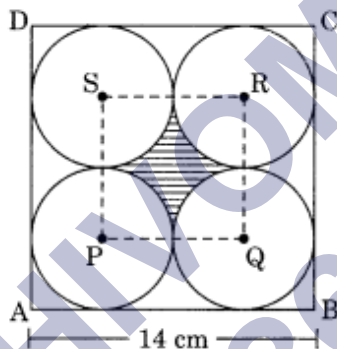
- Rectangle ABCD is formed in a circle as shown in Figure. If $AE = 8$ cm and $AD = 5$ cm, find the perimeter of the rectangle.
- Find the area of a parallelogram-shaped shaded region. Also, find the area of each triangle. What is the ratio of the area of shaded portion to the remaining area of the rectangle?



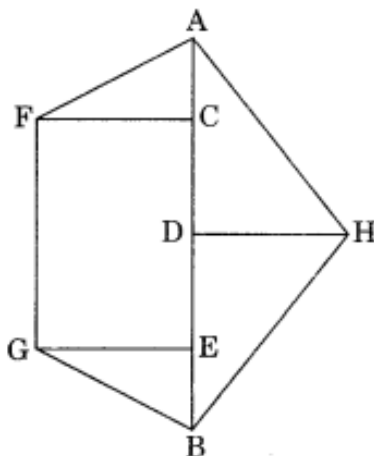
4. A rectangular piece of dimension 3 cm \times 2 cm was cut from a rectangular sheet of paper of dimensions 6 cm \times 5 cm. Find the ratio of the areas of the two rectangles.



5. In the given figure, ABCD is a square of side 14 cm. Find the area of the shaded region. (Take $\pi = \frac{22}{7}$)



6. Find the area of the following polygon if AB = 12 cm, AC = 2.4 cm, CE = 6 cm, AD = 4.8 cm, CF = GE = 3.6 cm, DH = 2.4 cm.



Answer Key-**Multiple Choice questions-**

1. (c) $4 \times \text{side}$
2. (b) $2 \times (l + b)$
3. (a) $\text{side} \times \text{side}$
4. (a) $l \times b$
5. (a) $\text{base} \times \text{height}$
6. (b) $\frac{1}{2} \times \text{base} \times \text{height}$
7. (b) $2\pi r$
8. (a) πd
9. (a) $d = 2r$
10. (a) πr^2
11. (c) $\frac{1}{4} \pi d^2$
12. (b) 100 mm^2
13. (d) 10000 cm^2
14. (d) 10000 m^2
15. (b) 100 m^2

Very Short Answer:

1. Side of the square = 2.5 cm
 Perimeter = $4 \times \text{Side} = 4 \times 2.5 = 10 \text{ cm}$
 Area = $(\text{side})^2 = (2.5)^2 = 6.25 \text{ cm}^2$
2. Perimeter of the square = 24 cm
 Side of the square = $\frac{24}{4} \text{ cm} = 6 \text{ cm}$
 Area of the square = $(\text{Side})^2 = (6)^2 \text{ cm}^2 = 36 \text{ cm}^2$
3. Length = 36 cm, Breadth = 24 cm
 (i) Perimeter = $2(l + b) = 2(36 + 24) = 2 \times 60 = 120 \text{ cm}$
 (ii) Area of the rectangle = $l \times b = 36 \text{ cm} \times 24 \text{ cm} = 864 \text{ cm}^2$
4. (i) Perimeter of the rectangular field = 240 m
 $2(l + b) = 240 \text{ m}$
 $l + b = 120 \text{ m}$
 $90 \text{ m} + b = 120 \text{ m}$

$$b = 120 \text{ m} - 90 \text{ m} = 30 \text{ m}$$

So, the breadth = 30 m.

$$(ii) \text{ Area of the rectangular field} = l \times b = 90 \text{ m} \times 30 \text{ m} = 2700 \text{ m}^2$$

So, the required area = 2700 m²

5. Length = 600 m, Breadth = 400 m

$$\text{Area of the field} = l \times b = 600 \text{ m} \times 400 \text{ m} = 240000 \text{ m}^2$$

$$\text{Cost of planting the grass} = ₹ 2.50 \times 240000 = ₹ 6,00,000$$

Hence, the required cost = ₹ 6,00,000.

6. The perimeter of the circle = 176 cm

$$2\pi r = 176$$

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

$$\therefore r = \frac{176 \times 7}{2 \times 22} = 4 \times 7 = 28 \text{ cm}$$

7. Radius = 3.5 cm

$$\text{Circumference} = 2\pi r$$

$$= 2 \times \frac{22}{7} \times 3.5 = 22 \text{ cm}$$

$$\text{Area} = \pi r^2$$

$$= \frac{22}{7} \times 3.5 \times 3.5$$

$$= \frac{77}{2} = 38.5 \text{ cm}^2$$

8. Area of the circle = 154 cm²

$$\pi r^2 = 154$$

$$\frac{22}{7} \times r^2 = 154$$

$$r^2 = 154 \times \frac{7}{22}$$

$$r^2 = 7 \times 7$$

$$r^2 = (7)^2$$

$$r^2 = (7)^2$$

$$\Rightarrow r = 7 \text{ cm}$$

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

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

9. Perimeter of the given figure = Circumference of the semicircle + diameter
= $\pi r + 2r$

$$\begin{aligned}
 &= \frac{22}{7} \times 7 + 2 \times 7 \\
 &= 22 + 14 \\
 &= 36 \text{ cm}
 \end{aligned}$$

Hence, the required perimeter = 36 cm.

10. Let each side of the square be x cm.

$$x^2 + x^2 = (50)^2 \text{ [Using Pythagoras Theorem]}$$

$$2x^2 = 2500$$

$$x^2 = 1250$$

2	1250
5	625
5	125
5	25
5	5
	1

$$x = \sqrt{1250} = \sqrt{2 \times 5 \times 5 \times 5 \times 5}$$

$$x = 5 \times 5 \times \sqrt{2} = 25\sqrt{2}$$

The side of the square = $25\sqrt{2}$ cm

Perimeter of the square = $4 \times \text{side} = 4 \times 25\sqrt{2} = 100\sqrt{2}$ cm

Short Answer:

1. Length of the wire = 176 cm

Side of the square = $176 \div 4$ cm = 44 cm

Area of the square = $(\text{Side})^2 = (44)^2 \text{ cm}^2 = 1936 \text{ cm}^2$

Circumference of the circle = 176 cm

$$2\pi r = 176 \text{ cm}$$

$$2 \times \frac{22}{7} \times r = 176 \text{ cm}$$

$$r = \frac{176 \times 7}{2 \times 22} = 28 \text{ cm}$$

\therefore Area of the circle = πr^2

$$= \frac{22}{7} \times 28 \times 28 = 2464 \text{ cm}^2$$

Since $2464 \text{ cm}^2 > 1936 \text{ cm}^2$

Hence, the circle will have more area.

2. Area of the square = (Side)² = 10 cm × 10 cm = 100 cm²

Area of the circle = πr^2

$$= \frac{22}{7} \times 3.5 \times 3.5$$

$$= \frac{77}{2} \text{ cm}^2$$

$$= 38.5 \text{ cm}^2$$

Area of the shaded portion = 100 cm² – 38.5 cm² = 61.5 cm²

3. Area of the rectangle = l × b = 14 cm × 14 cm = 196 cm²

Radius of the semicircle = $\frac{14}{2} = 7 \text{ cm}$

Area of two equal semicircle = $2 \times \frac{1}{2} \pi r^2$

$$= \pi r^2$$

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

$$= 154 \text{ cm}^2$$

Area of the shaded portion = 196 cm² – 154 cm² = 42 cm²

4. Length of the rectangular park = 45 m

Breadth of the park = 30 m

Area of the park = l × b = 45m × 30m = 1350 m²

Length of the park including the path = 45 m + 2 × 2.5 m = 50 m

Breadth of the park including the path = 30 m + 2 × 2.5 m = 30m + 5m = 35m

Area of the park including the path = 50 m × 35 m = 1750 m²

Area of the path = 1750 m² – 1350 m² = 400 m²

Hence, the required area = 400 m².

5. Area of the rectangular portions = l × b = 80 cm × 42 cm = 3360 cm²

Area of two semicircles = $2 \times \frac{1}{2} \pi r^2 = \pi r^2$

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

$$= 22 \times 3 \times 21$$

$$= 1386 \text{ cm}^2$$

Total area = 3360 cm² + 1386 cm² = 4746 cm²

Total length of the boundary of field = (2 × 80 + πr + πr) cm

$$= (160 + \frac{22}{7} \times 21 + \frac{22}{7} \times 21)$$

$$= (160 + 132) \text{ cm}$$

$$= 292 \text{ cm}$$

Hence, the required (i) area = 4746 cm^2 and (ii) length of boundary = 292 cm .

6. Radius of the wheel = 28 cm

$$\text{Circumference} = 2\pi r = 2 \times \frac{22}{7} \times 28 = 176 \text{ cm}$$

$$\text{Distance to be covered} = 352 \text{ m or } 352 \times 100 = 35200 \text{ m}$$

$$\text{Number of rotation made by the wheel to cover the given distance} = \frac{35200}{176} = 200$$

Hence, the required number of rotations = 200 .

Long Answer:

- Area of the playground = $l \times b = 160 \text{ m} \times 80 \text{ m} = 12800 \text{ m}^2$
 Area left for swings = $l \times b = 80 \text{ m} \times 80 \text{ m} = 6400 \text{ m}^2$
 Area of the remaining portion = $12800 \text{ m}^2 - 6400 \text{ m}^2 = 6400 \text{ m}^2$
 Area of the vertical road = $80 \text{ m} \times 1.5 \text{ m} = 120 \text{ m}^2$
 Area of the horizontal road = $80 \text{ m} \times 1.5 \text{ m} = 120 \text{ m}^2$
 Area of the common portion = $1.5 \times 1.5 = 2.25 \text{ m}^2$
 Area of the two roads = $120 \text{ m}^2 + 120 \text{ m}^2 - 2.25 \text{ m}^2 = (240 - 2.25) \text{ m}^2 = 237.75 \text{ m}^2$
 Area of the portion to be planted by grass = $6400 \text{ m}^2 - 237.75 \text{ m}^2 = 6162.25 \text{ m}^2$
 Hence, the required area = 6162.25 m^2 .
- DE (Radius) = $AE + AD = 8 \text{ cm} + 5 \text{ cm} = 13 \text{ cm}$
 $DB = AC = 13 \text{ cm}$ (Diagonal of a rectangle are equal)
 In right $\triangle ADC$,
 $AD^2 + DC^2 = AC^2$ (By Pythagoras Theorem)
 $\Rightarrow (5)^2 + DC^2 = (13)^2$
 $\Rightarrow 25 + DC^2 = 169$
 $\Rightarrow DC^2 = 169 - 25 = 144$
 $\Rightarrow DC = \sqrt{144} = 12 \text{ cm}$
 Perimeter of rectangle ABCD = $2(AD + DC)$
 $= 2(5 \text{ cm} + 12 \text{ cm})$
 $= 2 \times 17 \text{ cm}$
 $= 34 \text{ cm}$
- Here, $AB = 10 \text{ cm}$

$$AF = 4 \text{ cm}$$

$$FB = 10 \text{ cm} - 4 \text{ cm} = 6 \text{ cm}$$

$$\text{Area of the parallelogram} = \text{Base} \times \text{Height} = FB \times AD = 6 \text{ cm} \times 6 \text{ cm} = 36 \text{ cm}^2$$

Hence, the required area of shaded region = 36 cm^2 .

$$\text{Area } \triangle DEF = \frac{1}{2} \times b \times h$$

$$= \frac{1}{2} \times AF \times AD$$

$$= \frac{1}{2} \times 4 \times 6$$

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

$$\text{Area } \triangle BEC = \frac{1}{2} \times b \times h$$

$$= \frac{1}{2} \times GC \times BC$$

$$= \frac{1}{2} \times 4 \times 6$$

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

$$\text{Area of Rectangle ABCD} = l \times b = 10 \text{ cm} \times 6 \text{ cm} = 60 \text{ cm}^2$$

$$\text{Remaining area of Rectangle} = 60 \text{ cm}^2 - 36 \text{ cm}^2 = 24 \text{ cm}^2$$

$$\text{Required Ratio} = 36 : 24 = 3 : 2$$

4. Length of the rectangular piece = 6 cm

$$\text{Breadth} = 5 \text{ cm}$$

$$\text{Area of the sheet} = l \times b = 6 \text{ cm} \times 5 \text{ cm} = 30 \text{ cm}^2$$

$$\text{Area of the smaller rectangular piece} = 3 \text{ cm} \times 2 \text{ cm} = 6 \text{ cm}^2$$

$$\text{Ratio of areas of two rectangles} = 30 \text{ cm}^2 : 6 \text{ cm}^2 = 5 : 1$$

5. $PQ = \frac{1}{2} AB = \frac{1}{2} \times 14 = 7 \text{ cm}$

PQRS is a square with each side 7 cm

$$\text{Radius of each circle} = \frac{7}{2} \text{ cm}$$

$$\text{Area of the quadrants of each circle} = \frac{1}{4} \times \pi r^2$$

Area of the four quadrants of all circles

$$= 4 \times \frac{1}{4} \pi r^2 = \pi r^2 = \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2}$$

$$= \frac{77}{2} \text{ cm}^2 = 38.5 \text{ cm}^2$$

$$\text{Area of the square PQRS} = \text{Side} \times \text{Side} = 7 \text{ cm} \times 7 \text{ cm} = 49 \text{ cm}^2$$

$$\text{Area of the shaded portion} = 49 \text{ cm}^2 - 38.5 \text{ cm}^2 = 10.5 \text{ cm}^2$$

Hence, the required area = 10.5 cm^2 .

$$\begin{aligned}
 6. \quad BE &= AB - AE \\
 &= 12 \text{ cm} - (AC + CE) \\
 &= 12 \text{ cm} - (2.4 \text{ cm} + 6 \text{ cm}) \\
 &= 12 \text{ cm} - 8.4 \text{ cm} \\
 &= 3.6 \text{ cm}
 \end{aligned}$$

$$= \frac{1}{2} \times 3.6 \times 3.6 = 6.48 \text{ cm}^2$$

$$\begin{aligned}
 \text{Area of } \triangle ABH &= \frac{1}{2} \times b \times h = \frac{1}{2} \times AB \times DH \\
 &= \frac{1}{2} \times 12 \times 2.4 \text{ cm} = 14.4 \text{ cm}^2
 \end{aligned}$$

$$\begin{aligned}
 \text{Area of } \triangle ACF &= \frac{1}{2} \times b \times h = \frac{1}{2} \times CF \times AC \\
 &= \frac{1}{2} \times 3.6 \times 2.4 = 4.32 \text{ cm}^2
 \end{aligned}$$

$$\begin{aligned}
 \text{Area of the rectangle FCEG} &= l \times b \\
 &= CE \times CF \\
 &= 6 \text{ cm} \times 3.6 = 21.6 \text{ cm}^2
 \end{aligned}$$

$$\begin{aligned}
 \text{Area of } \triangle GEB &= \frac{1}{2} \times b \times h = \frac{1}{2} \times BE \times GE \\
 &= \frac{1}{2} \times 3.6 \times 3.6 = 6.48 \text{ cm}^2
 \end{aligned}$$

$$\begin{aligned}
 \text{Area of } \triangle ABH &= \frac{1}{2} \times b \times h = \frac{1}{2} \times AB \times DH \\
 &= \frac{1}{2} \times 12 \times 2.4 \text{ cm} = 14.4 \text{ cm}^2
 \end{aligned}$$

Area of the polygon AFGBH = Area of $\triangle ACF$ + Area of rectangle FCEG + Area of $\triangle GEB$ + Area of $\triangle ABH$

$$= 3.6 \text{ cm}^2 + 4.32 \text{ cm}^2 + 21.6 \text{ cm}^2 + 6.48 \text{ cm}^2 + 14.4 \text{ cm}^2$$

$$= 50.40 \text{ cm}^2$$

Hence, the required area = 50.40 cm^2 .