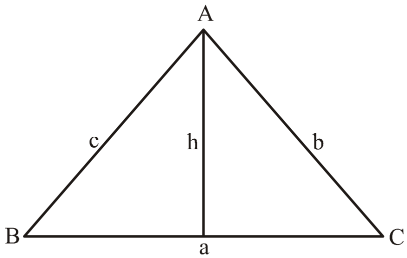
MENSURATION-I

The fundamental formulae on plane figures (Triangle, Rectangle, Square, Parallelogram, Trapezium, Rhombus, Circle) are reviewed below :

TRIANGLE



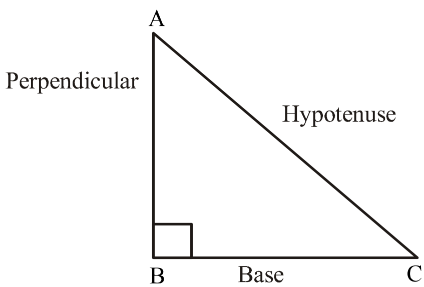
1. Area = $\frac{1}{2}$ × Base × Height

2. Area = $\sqrt{s(s-a)(s-b)(s-c)}$

Where a, b, c are the lengths of the sides of triangle and

$$s = \frac{a+b+c}{2}$$

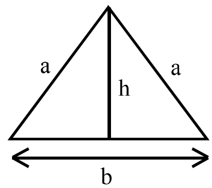
RIGHT ANGLED TRIANGLE



1. Area = $\frac{1}{2}$ × Base × Perpendicular

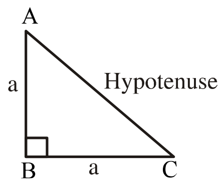
2. $(\text{Hypotenuse})^2 = (\text{Perpendicular})^2 + (\text{Base})^2$

ISOSCELES TRIANGLE



1. Area = $\frac{1}{4} b\sqrt{4a^2 - b^2}$

ISOSCELES RIGHT TRIANGLE

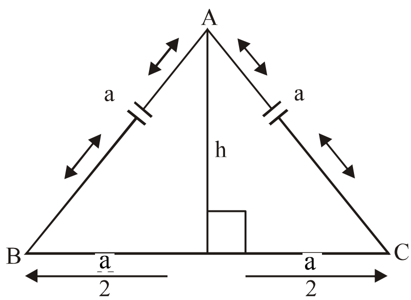


1. Area = $\frac{1}{2} \times (a)^2$

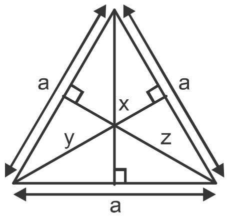
2. Hypotenuse = $a\sqrt{2}$

3. Perimeter = $\sqrt{2}a(\sqrt{2} + 1)$

EQUILATERAL TRIANGLE

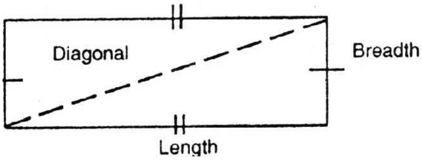


1. Perimeter = $3a$
2. Area = $\frac{\sqrt{3}\ a^2}{4}$
3. Height = $h = \frac{\sqrt{3}\ a}{2}$
4. Area = $\frac{(h)^2}{\sqrt{3}}$

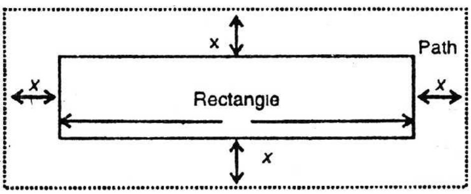


1. $a = \frac{2}{\sqrt{3}}\ (x + y + z)$
2. Area = $\frac{(x + y + z)^2}{\sqrt{3}}$

RECTANGLE



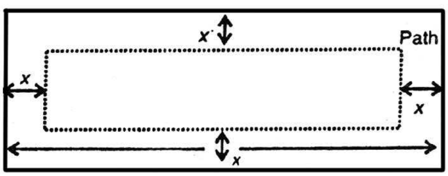
(I) 1. Area = Length $\times$ Breadth
2. Perimeter = 2 (Length + Breadth)
3. Diagonal = $\sqrt{(\text{Length})^2 + (\text{Breadth})^2}$



(II) Area of path = $2x\ (l + b + 2x)$

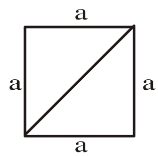
Note : Path is the outer side of the rectangle.

Where length and breadth is denoted by l and b respectively.

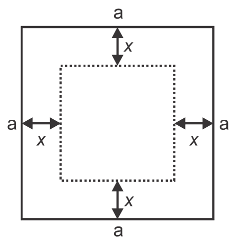


(III) Area of path which is inside of the rectangle $= 2x\ (l + b - 2x)$

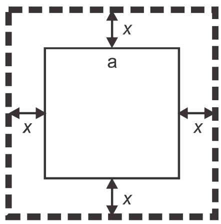
SQUARE



(I)
1. Perimeter = $4a$ = 4 × side
2. Area = a^2 = $(\text{side})^2$
3. Diagonal = $a\ \sqrt{2}$ = side × $\sqrt{2}$



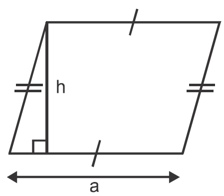
(II) Area of path (which is inside of square) $= 4x\ (a - x)$



(III) Area of path (which is outside of the square) $= 4x\ (a + x)$

PARALLELOGRAM

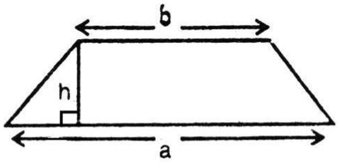
A quadrilateral, whose opposite sides are parallel, is called a parallelogram. The opposite sides of a parallelogram are equal and the two diagonals bisect each other.



Area = Base × Height = $a \times h$

TRAPEZIUM

It is a quadrilateral whose one pair of opposite sides are parallel and other pair of opposite sides are not parallel.



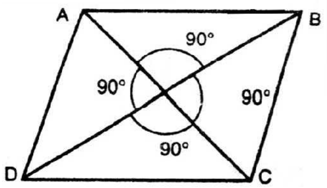
Area $= \frac{1}{2} \times$ height $\times$ (sum of parallel sides)

$= \frac{1}{2} h\,(a + b)$

where h is the distance between the two parallel sides.

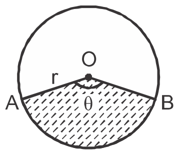
RHOMBUS

It is a parallelogram whose all sides are equal. Its diagonals bisect each other at right angles.

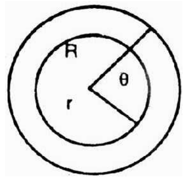


1. Area $= \frac{1}{2} \times$ product of diagonals $= \frac{1}{2} \times AC \times BD$
2. Side $= \sqrt{\left(\frac{AC}{2}\right)^2 + \left(\frac{BD}{2}\right)^2}$
3. Perimeter $= 4 \times$ one side

CIRCLE



1. Diameter $= 2 \times$ radius $= 2\,r$
2. Area $= \pi r^2$
3. Circumference $= 2\pi r = \pi d$
4. Radius $= \frac{\text{Circumference}}{2\pi} = \sqrt{\frac{\text{Area}}{\pi}}$
5. Area of sector $AOB = \frac{\theta \times \pi\, r^2}{360°}$
6. Length of the arc $AB = \frac{\theta \times 2\,\pi\, r}{360°}$



$$\frac{C_1}{C_2} = \frac{R}{r} = \frac{A_1}{A_2} = \frac{R^2 - r^2}{r^2}$$

Where C_1 = outer circumference
C_2 = inner circumference
A_1 = Area of the ring portion
A_2 = Area of inner circle
If $A_1 = A_2$ then
$R = 2r$

Area of the ring $= \pi(R + r)(R - r) = \pi(R^2 - r^2)$

SOME TRICKS FOR PLANE FIGURES

***Type* 1 :**

If each area of related side is increasing by $a\%$ then,

(I) Percentage increase in the area $= 2\,a + \frac{a}{100}$

(II) $\frac{\text{New Area}}{\text{Old Area}} = \left(1 + \frac{a}{100}\right)^2$

***Type* 2 :**

If each area of related side is decreasing by $a\%$ then,

(I) Percentage decrease in area $= 2\,a - \frac{a}{100}$

(II) $\frac{\text{New Area}}{\text{Old Area}} = \left(1 - \frac{a}{100}\right)^2$

List of important formulae

1. (*i*) Area of a rectangle = Length × Breadth
   (*ii*) Length $= \frac{\text{Area}}{\text{Breadth}}$; Breadth $= \frac{\text{Area}}{\text{Length}}$
   (*iii*) $(\text{Diagonal})^2 = (\text{Length})^2 + (\text{Breadth})^2$
2. Area of a square $= (\text{side})^2 = 1/2\,(\text{diagonal})^2$
3. Area of 4 walls of a room = 2(Length + Breadth) × Height
4. Area of a parallelogram = (Base × Height)
5. Area of a rhombus
   $= \frac{1}{2} \times$ (product of diagonals)

When d_1 and d_2 are the two diagonals then side of rhombus

$$= \frac{1}{2}\sqrt{d_1^2 + d_2^2}$$

6. Area of an equilateral triangle = $\frac{\sqrt{3}}{4} \times (\text{side})^2$
7. If a, b, c are the lengths of the sides of a triangle and $s = \frac{1}{2}(a + b + c)$
8. Area of a triangle = $\frac{1}{2} \times \text{base} \times \text{height}$.
9. Area of a trapezium
$= \frac{1}{2}$ (sum of parallel sides) × distance between them
10. (*i*) Circumference of a circle = $2\pi r$
(*ii*) length of arc $AB = \frac{\theta 2\pi r}{360°}$ where $\angle AOB = \theta$ and O is the centre
(*iii*) Area of sector $AOB = \frac{\pi r^2 \theta}{360°}$
(*iv*) Area of sector $AOB = \frac{1}{2} \times \text{Arc } AB \times r$

SOLVED QUESTIONS ON AREAS

The formulae given above are sufficient for solving various questions on areas. But in some typical cases we can develop quicker methods for solving questions. We shall explain both these possibilities by way of a few examples.

Problems on Rectangles and Squares :

Type I : Simple questions requiring direct application of formula.

Example 1 : Find the diagonal of a rectangle whose sides are 12 metres and 5 metres.

Solution : The length of the diagonal

$= \sqrt{12^2 + 5^2} = \sqrt{169} = 13$ metres

Type II : Carpeting a floor.

Example 2 : How many metres of a carpet 75 cm wide will be required to cover the floor of a room which is 20 metres long and 12 metres broad?

Solution : Length of carpet

$$= \frac{\text{Length of room} \times \text{breadth of room}}{\text{width of carpet}}$$

$$= \frac{20 \times 12}{0.75} = 320 \text{ m.}$$

What amount needs to be spent in carpeting the floor if the carpet is available at ₹20 per metre?

Quicker method :

Amount required =

$$\text{Rate per metre} \times \frac{\text{length of room} \times \text{breadth of room}}{\text{width of carpet}}$$

$$= 20 \times \frac{20 \times 12}{0.75} = ₹\,6400$$

Type III : **Paving a courtyard with tiles.**

Example 3 : How many paving tiles each measuring 2.5m × 2m are required to pave a rectangular courtyard 30 m long and 16.5 m wide?

Solution : ***Quicker method***

Number of tiles required

$$= \frac{\text{length} \times \text{breadth of courtyard}}{\text{length} \times \text{breadth of each tile}} = \frac{30 \times 16.5}{2.5 \times 2} = 99$$

What amount needs to be spent if the tiles of the aforesaid dimension are available at ₹1 per piece?

Quicker method : Amount required

$$= \text{Price per tile} \times \frac{\text{length} \times \text{breadth of courtyard}}{\text{length} \times \text{breadth of each tile}}$$

$$= 1 \times \frac{30 \times 16.5}{2.5 \times 2} = 99$$

Type IV : **Paving with square tiles : largest tile**

Example 4 : A hall-room 39 m 10 cm long and 35 m 70 cm broad is to be paved with equal square tiles. Find the largest tile so that the tiles exactly fit and also find the number of tiles required.

Solution : ***Quicker Method :***

Side of largest possible tile

= HCF of length and breadth of the room

= HCF of 39.10 and 35.70 = 1.70

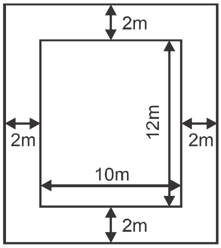
Also, number of tiles required

$$= \frac{\text{length} \times \text{breadth of room}}{(\text{HCF of length and breadth of room})^2}$$

$$= \frac{39.10 \times 35.70}{1.70 \times 1.70} = 483$$

Type V : Path around a garden and verandah around a room

Example 5 : A rectangular hall 12 m long and 10 m broad, is surrounded by a verandah 2 metres wide. Find the area of the verandah.



Solution : ***Quicker Method***

In such cases,

(I) When the verandah is outside the room, surrounding it
Area of verandah = 2 (width of verandah) × [Length + breadth of room + 2 (width of verandah)]

(II) When the path is within the garden, surrounded by it
Area of path = 2 (width of path) × [length + breadth of garden – 2(width of path)]

Now in the given question , by formula I, (since the verandah is outside the room, formula I will be applied)

Area of verandah = $2 \times 2 \times (10 + 12 + 2 \times 2)$
$= 4 \times 26 = 104\ m^2$

Some more cases on paths :

A. When area of the path is given, to find the area of the garden enclosed (the garden is square in shape).

Example 6 : A path 2 m wide running all round a square garden has an area of 9680 sq m. Find the area of the garden enclosed by the path.

Solution : (*Quicker Method*) :

Area of the square garden

$$= \left[\frac{\text{Area of path} - 4 \times (\text{width of path})^2}{4 \times \text{width of path}}\right]^2$$

So, here in the given question,

$$\text{Area of garden} = \left[\frac{9680 - 4 \times (2)^2}{4 \times 2}\right]^2$$

$$= \left[\frac{9664}{8}\right]^2 = (1208)^2 = 1459264 \text{ sqm}$$

B. When area of the path be given, to find the width of the path.

Example 7 : A path all around the inside of a rectangular park 37 m by 30 m occupies 570 sq m. Find the width of the path.

Solution : Area of path
= 2 × width of path × [length + breadth of park – 2 × (width of path)]

$\Rightarrow$ $570 = 2 \times x \times [37 + 30 - 2x]$
(x is the width of path)

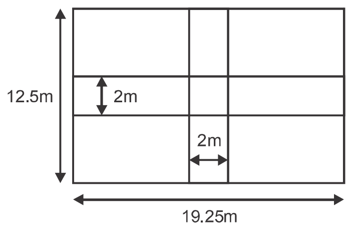
$\Rightarrow$ $570 = 134x - 4x^2$

$\Rightarrow$ $4x^2 - 134x + 570 = 0$

On solving this equation we get, $x = 5$ m.

C. Paths crossing each other (important).

Example 8 : An oblong piece of ground measures 19 m 2.5 dm by 12 metres 5 dm. From the centre of each side a path 2m wide goes across to the centre of the opposite side. What is the area of the path? Find the cost of paving these paths at the rate of ₹ 1.32 per sq metre.



Solution : ***Quicker Method***

In such problems, use the formula given below :

1. **Area of the path**
= (width of path) (length + breadth of park – width of path)
2. **Area of the park minus the path =**
(length of park – width of path) × (breadth of park – width of path)

Now, for the given question,

Area of path $= 2 \times (19.25 + 12.5 - 2)$
$= 2 \times 29.75 = 59.5$ sq m

So, cost = rate × area = ₹ (59.5 × 1.32)
= ₹ 78.54.

Type VI : Area and ratio

Example 9 : The sides of a rectangular field of 726 sq m are in the ratio of 3:2, find the sides.

Solution : ***Quicker Method***

Side

$$= \text{One of the given ratios} \times \sqrt{\frac{\text{area}}{\text{product of given ratios}}}$$

So, In the given question,

$$\text{First side} = 3 \times \sqrt{\frac{726}{3 \times 2}} = 3 \times 11 = 33 \text{ m}$$

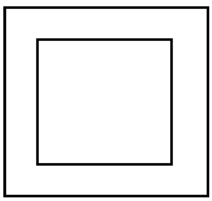
$$\text{And second side} = 2 \times \sqrt{\frac{726}{3 \times 2}} = 2 \times 11 = 22 \text{ m}$$

Type VII : Some Miscellaneous Cases

Turkey carpet and oilcloth

Example 10 : In the centre of a room 10 square metres, there is a square of turkey carpet, and the rest of the floor is covered with oilcloth. The carpet, and the oilcloth cost ₹ 15 and ₹ 6.50 per square metre respectively, and the total cost of the carpet and the oilcloth is ₹ 1338.50. Find the width of the oilcloth border.

Solution : The area of the square room = 100 sq metres



$$\text{The mean cost per sq metre} = ₹\frac{1338.50}{100}$$

$$= ₹\ 13.385$$

Carpet Oilcloth

15 6.50

13.385

6.885 1.615

= 81 : 19

By the Alligation Rule, the area of the square is 81 sq metres.

Therefore, the carpet is 9 metres both in length and breadth.

But the room is 10 metres in length and breadth.

Hence, double the width of the border is (10 – 9) or 1 metre.

So, the width of the border = 1/2 metre = 5 dm.

Problems on Triangles :

Type I : Simple Application of Formula

Example 11 : The base of a triangular field is 880 metres and its height 550 metres. Find the area of the field. Also calculate the charges for supplying water to the field at the rate of ₹ 24.25 per sq hectometre.

Solution : Area of the field $= \frac{\text{Base} \times \text{Height}}{2}$

$= \frac{880 \times 550}{2}$ sq metres

$= \frac{440 \times 550}{100 \times 100}$ sq hectometre

= 24.20 sq hectometres.

Cost of supplying water to 1 sq hectometre = ₹ 24.25

So, cost of supplying water to the whole field = ₹ 24.20 × 24.25 = ₹ 586.85

Problems on Parallelogram, Rhombus and Trapezium:

Type I : Question Requiring Direct Application of Formulae

Example 12 : Find the area of a rhombus one of whose diagonals measures 8 cm and the other 10 cm.

Solution : Area = Product of diagonals

= 8 × 10 = 80 sq cm.

Type II : Some Quicker Methods

A : To find the area of a rhombus with one side and one diagonal given

Example 13 : Find the area of a rhombus one side of which measures 20 cm and one diagonal 24 cm.

Solution : ***Quicker Method***

$$\text{Area of a rhombus} = d_1 \times \sqrt{(\text{side})^2 - \left(\frac{d_2}{2}\right)^2}$$

So, In the given question,

$$\text{Area} = 24 \times \sqrt{(20)^2 - \left(\frac{24}{2}\right)^2}$$

$$= 24 \times \sqrt{400 - 144} = 24 \times 16 = 384 \text{ cm}^2$$

Problems on Regular Polygons :

A regular polygon is a polygon (triangle, quadrilateral, pentagon, hexagon, octagon etc.) which has all sides equal.

The following formula may prove useful :

A. Area of a regular polygon $= \frac{1}{2} \times n \times a \times r$

where, n = number of sides

a = length of side

r = radius of the inscribed circle

and also, $r = \frac{a}{2}\cot\left(\frac{180°}{n}\right)$

B. Area of a hexagon = $\frac{3\sqrt{3}}{2} \times (\text{side})^2$

C. Area of an octagon = $2(\sqrt{2}+1)(\text{side})^2$

Example 14 : Find the area of a regular hexagon whose side measures 9 cm.

Solution : Area of a regular hexagon = $\frac{3\sqrt{3}}{2} a^2$

Here, $a = 9$ cm

So, area = $\frac{3\sqrt{3}}{2} \times 9^2$ sq cm

= 210.4 sq cm approximate.

Problems on Rooms and Walls :

Papering the walls and allowing for doors etc.

Example 15 : A room 8 metres long, 6 metres broad and 3 metres high has two windows each measures $1\frac{1}{2}$ m × 1 m and a door measures 2 m × $1\frac{1}{2}$ m

Find the cost of papering the walls with paper 50 cm wide at 25 p. per metre.

Solution : Area of walls = 2(8 + 6) 3 = 84 sq m

Area of two windows and door

$= 2 \times 1\frac{1}{2} \times 1 + 2 \times 1\frac{1}{2} = 6$ sq m

Area to be covered = 84 – 6 = 78 sq m

So, length of paper = $\frac{78 \times 100}{50} = 156$ m

Total cost of papering the walls with paper

$= \frac{156 \times 25}{100} =$ ₹ 39

Lining a box with metal

Example 16 : A closed box measures externally 9 dm long, 6 dm broad, $4\frac{1}{2}$ dm high, and is made of wood $2\frac{1}{2}$ cm thick. Find the cost of lining it on the inside with metal at 6 P per sq m.

Solution : The internal dimensions are $8\frac{1}{2}$ dm, $5\frac{1}{2}$ dm, 4 dm.

Area of the 4 sides $2(8\frac{1}{2} + 5\frac{1}{2}) \times 4$ sq dm

= 112 sq dm

Area of bottom and top = $2 \times 8\frac{1}{2} \times 5\frac{1}{2}$ sq dm

$= \frac{187}{2}$ sq dm

Total area to be lined = $\left(112 + \frac{187}{2}\right)$ sq dm

= 205.5 sq dm = 2.055 m^2

So, cost = 2.055 × 6P = ₹ 12.33.

Problems on Circles :

I . Simple Application of Formula

Example 17 : (*a*) Find the circumference of a circle whose radius is 42 metres.

(*b*) Find the radius of a circular field whose circumference measures 5 1/2 km. (Take π = 22/7)

Solution : (*a*) $C = 2\pi r$

So, required circumference = $2 \times \frac{22}{7} \times 42$ metres

= 264 metres

(*b*) $r = C/2\pi$

So, required radius = $\frac{\frac{11}{2} \times 1000\, m \times 7}{2 \times 22}$

$= \frac{11 \times 1000 \times 7}{2 \times 2 \times 22} = 875$ m

II. Some Quicker Methods

A . Area of a ring :

Example 18 : The circumference of a circular garden is 1012 m. Find the area. Outside the garden, a road of 3.5 m width runs around it. Calculate the area of this road and find the cost of gravelling at the rate of 32 paise per sq m.

Solution : Circumference = $2\pi r$

$r = \frac{1012 \times 7}{2 \times 22} = 161$ m

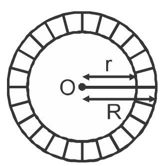
Outer radius (R) = 161 + 3.5 = 164.5 m

Area of road = $\pi(R^2 - r^2)$

$= \frac{22}{7}\left[(164.5)^2 - 161^2\right]$

$= \frac{22}{7} \times 325.5 \times 3.5$

$= \frac{22}{7} \times 1139.25 = 3580.5$ m^2

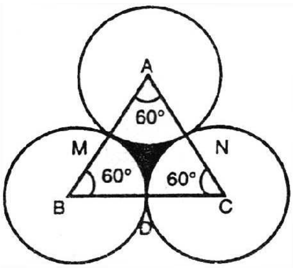


Cost of gravelling the road = ₹ $\frac{3580.5 \times 32}{100}$

= ₹ 1145.76

B. Identical circles placed together :

Example 19 : There is an equilateral triangle of which each side is 2 m. With all the three corners as centres of circles each of radius 1 m. (*i*) Calculate the area common to all the circles and the triangle. (*ii*) Find the area of the remaining portion of the triangle. (Take $\pi = 3.1416$)



Solution : When the side of the equilateral triangle is double the radius of the circles, all circles touch each other and in such cases the following formula may be used :

$$\text{Area of each sector} = \frac{1}{6}\pi r^2 = \frac{1}{6} \times \pi \times 1^2 = \frac{1}{6}\pi$$

$$\text{Area of 3 sectors} = 3 \times \frac{1}{6}\pi = \frac{\pi}{2}$$

$$= \frac{3.1416}{2} = 1.5708 \text{ m}^2$$

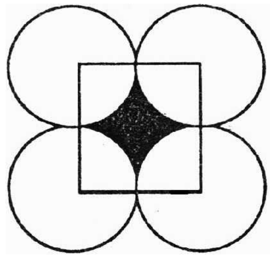
(*i*) So, the area common to all circles and triangle = 1.5708 m^2

(*ii*) Area of remaining portion

= area of equilateral triangle – area of 3 sectors

$$= \frac{\sqrt{3}}{4} \times 2^2 - 1.5708 = 1.732 - 1.5708 = 0.161 \text{ m}^2.$$

Example 20 : The diameter of a coin is 1 cm. If four of these coins be placed on a table so that the rim of each touches that of the other two, find the area of the unoccupied space between them. (Take $\pi = 3.1416$)



Solution : (*Quicker Method*)

Again, if the circles be placed in such a way that they touch each other and the square's side is double the radius. In such cases the following formula may be used :

$$\text{Area of each sector} = \frac{1}{4}\pi r^2 = \frac{1}{4} \times \pi \times \left(\frac{1}{2}\right)^2$$

$$= \frac{1}{4} \times \pi \frac{1}{4} = \frac{1}{16}\pi$$

Area of unoccupied portion

= area of square – [4 × area of each sector]

$$= 1^2 - \left[4 \times \frac{1}{16}\pi\right] = 1 - \frac{1}{4} \times 3.141$$

= 1 – 0.7854 = 0.2146 cm^2.

EXERCISE

1. The length and breadth of a room are in the ratio 2 : 1. If the cost of cementing the floor at 75 paise per sq metre comes to be ₹ 864 and the cost of polishing the walls at ₹ 3.25 per sq metre comes to be ₹ 884, then the height of the room is :

(*a*) $2\frac{8}{9}$ m (*b*) $1\frac{8}{9}$ m

(*c*) $1\frac{2}{9}$ m (*d*) $1\frac{7}{9}$ m

(*e*) None of these

2. The area of the greatest circle, which can be inscribed in a square, whose perimeter is 120 cm, is:

(*a*) $\pi \times \left(\frac{7}{2}\right)^2$ cm^2 (*b*) $\pi \times \left(\frac{9}{2}\right)^2$ cm^2

(*c*) $\pi \times \left(\frac{15}{2}\right)^2$ cm^2 (*d*) $\pi \times (15)^2$ cm^2

(*e*) None of these

3. The lengths of the perpendiculars drawn from any point in the interior of an equilateral triangle to the respective sides are p_1, p_2 and p_3. The length of each side of the triangle is:

(*a*) $\frac{1}{3}(p_1 + p_2 + p_3)$ (*b*) $\frac{1}{\sqrt{3}}(p_1 + p_2 + p_3)$

(*c*) $\frac{2}{\sqrt{3}}(p_1 + p_2 + p_3)$ (*d*) $\frac{4}{\sqrt{3}}(p_1 + p_2 + p_3)$

(*e*) None of these

4. A rectangular garden is 100 m long, 80 m wide. It is surrounded on its outside by a uniformly broad path. If the area of the path is 1900 m^2, then what is its width?

(*a*) 2m (*b*) 3m
(*c*) 4m (*d*) 5m
(*e*) None of these

5. A piece of wire of 78 cm long is bent in the form of an isosceles triangle. If the ratio of one of the equal sides to the base is 5 : 3, then length of the base is:

(*a*) 16 cm (*b*) 17 cm
(*c*) 18 cm (*d*) 19 cm
(*e*) None of these

6. What will be the cost of gardening 1m broad boundary around a rectangular plot having perimeter of 340 m at the rate of ₹ 10 per m^2?

(*a*) ₹ 1720 (*b*) ₹ 3400
(*c*) ₹ 3440 (*d*) ₹ 3540
(*e*) None of these

7. What is the least number of square tiles required to pave the floor of a room 15m 17 cm long and 9m 2cm broad?

(*a*) 794 (*b*) 800
(*c*) 804 (*d*) 814
(*e*) None of these

8. A park square in shape has a 3m wide road inside it running along its sides. The area occupied by the road is 1764 m^2. Find the perimeter along the outer edge of the road.

(*a*) 500 m (*b*) 525 m
(*c*) 550 m (*d*) 600 m
(*e*) None of these

9. A circular park has a path of uniform width around it. The difference between outer and inner circumferences of the circular path is 132 m. Find its width.

(*a*) 21m (*b*) 22 m
(*c*) 23 m (*d*) 24 m
(*e*) None of these

10. The circumference of a circle is 100 cm. The side of a square inscribed in the circle is:

(*a*) $\frac{25\sqrt{2}}{\pi}$ cm (*b*) $\frac{50\sqrt{2}}{\pi}$ cm

(*c*) $\frac{75\sqrt{2}}{\pi}$ cm (*d*) $\frac{100\sqrt{2}}{\pi}$ cm

(*e*) None of these

EXPLANATORY ANSWERS

1. (*b*) : Suppose the length and the breadth of the room are $2x$ metres and x metres respectively.

$\therefore$ Area of the floor $= 2x \times x = 2x^2$ sq metres

Area of the floor $= \frac{864}{75/100} = \frac{864 \times 100}{75}$
$= 1152$ sq. metre

Now, $2x^2 = 1152 \Rightarrow x^2 = \frac{1152}{2} = 576$

Hence, $x = 24$

$\therefore$ Length of the room $= 2 \times 24 = 48$ m

Breadth of the room = 24 m

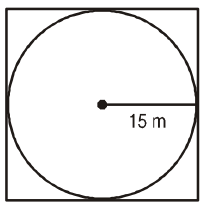
Now, area of the four walls $= \frac{884}{3.25}$
$= 272$ sq. metre

Hence, $2 \times h(l + b) = 272$

$\Rightarrow 2 \times h\,(48 + 24) = 272$

$\therefore h = \frac{272}{2 \times 72} = 1\frac{8}{9}$ m

2. (*d*) :



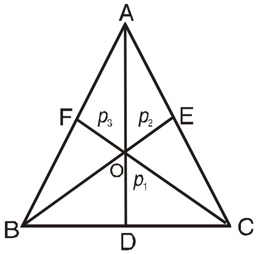
Side of square $= \frac{120}{4} = 30$ cm

Hence, radius of the required circle = $\frac{30}{2}$

= 15 cm

Since, area of the circle = $\pi \times (15)^2$ cm^2

3. (*c*) : Let side of the equilateral triangle be x. From the figure,



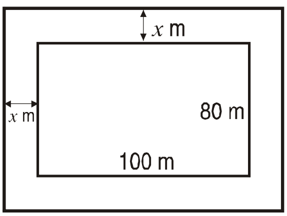
Area of the equilateral triangle ABC
= Area of Δ BOC + Area of Δ AOC + Area of Δ AOB

$$\Rightarrow \frac{\sqrt{3}}{4}x^2 = \frac{1}{2}\times x\times p_1 + \frac{1}{2}\times x\times p_2 + \frac{1}{2}\times x\times p_3$$

$$\Rightarrow \frac{\sqrt{3}}{2}x = p_1 + p_2 + p_3$$

$$\therefore x = \frac{2}{\sqrt{3}}(p_1 + p_2 + p_3)$$

4. (*d*) :



Let width of the road be x m; then,

$(100 + 2x)(80 + 2x) - 100 \times 80 = 1900$

$\Rightarrow 4x^2 + 360x - 1900 = 0$

$\Rightarrow x^2 + 90x - 475 = 0$

$\Rightarrow x^2 + 95x - 5x - 475 = 0$

$\Rightarrow x(x + 95) - 5(x + 95) = 0$

Then, $x = 5$ m

5. (*c*) : Let one of the equal side and base of the isosceles triangle be $5x$ and $3x$ m respectively.

Then, $5x + 5x + 3x = 78 \Rightarrow 13x = 78$

$\therefore x = 6$

Hence, perimeter = $3 \times 6 = 18$ cm.

6. (*c*) : Here, $2(x + y) = 340$ m

Again, area of boundary

$= [(x + 2)(y + 2)] - xy = xy + 2(x + y) + 4 - xy$

$= 2(x + y) + 4 = 340 + 4 = 344$ m^2

Hence, cost of gardening

= 344 × ₹ 10 = ₹ 3440

7. (*d*) : Length = 15m 17cm = 1517 cm; breadth = 9m 2cm = 902 cm

H.C.F. of 1517 and 902 = 41

Hence, required number of square tiles

$$= \frac{1517 \times 902}{41 \times 41} = 814$$

8. (*d*) : Area of the road = $x^2 - (x - 6)^2 = 1764$

$\Rightarrow 12x - 36 = 1764$

$\Rightarrow 12x = 1800$

$$\therefore x = \frac{1800}{12} = 150 \text{ m}$$

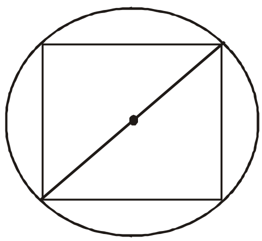
Hence, required perimeter = $4 \times 150 = 600$ m

9. (*a*) : Here, $2\pi R - 2\pi r = 132$ m

$$\therefore R - r = \frac{132 \times 7}{2 \times 22} = 21 \text{ m}$$

Hence, width of the circular path = 21 m

10. (*b*) :



Diameter of the circle = $\frac{100}{\pi}$ cm

So, diagonal of the inscribed square

$$= \frac{100}{\pi} \text{ cm}$$

And, side of the inscribed square

$$= \frac{100}{\sqrt{2}\pi} = \frac{50\sqrt{2}}{\pi} \text{ cm}$$