11

Area of Plane Figures

11.01 Introduction

We know that a closed figure bounded by three line segments is called a triangle and a closed figure bounded by four line segments is called quadrilateral. The part of the plane enclosed by a simple closed figure is called plane region.

In the previous classes we have studied about the area of plane figures such as triangles and quadrilaterals.

In this chapter, we will find the area of triangle, quadrilateral, rectangular paths and area of four walls, with the use of Heron's formula.

11.02 Area of Triangle

We know that, area of a triangle $= \frac{1}{2} \times$ base $\times$ height. Using this formula, we can find the base and height of a triangle as :

$$\text{Base of a triangle} = \frac{2 \times \text{Area}}{\text{Height}}$$

$$\text{Height of a triangle} = \frac{2 \times \text{Area}}{\text{Base}}$$

From the above formulae, height of triangle is compulsory to find the area of a triangle. If sides of a triangle are given and height is not given then the area of triangle can be found by using Heron's formula.

Heron's Formula

(1) If a, b, c are respective three sides of any triangle

then, area of the triangle $= \sqrt{s(s-a)(s-b)(s-c)}$

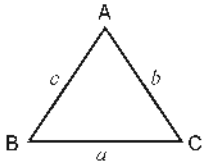

Fig. 11.01

where, $s = \frac{a+b+c}{2} = \frac{\text{Perimeter of triangle}}{2}$ =Semi-perimeter of the triangle

(2) Area of an Isosceles Triangle

If the length of two equal sides of an isosceles triangle is 'a' and length of third side is b, then semi-perimeter of isosceles triangle will be :

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

By Heron's formula

Area of isosceles triangle

$$= \sqrt{\left(\frac{2a+b}{2}\right)\left(\frac{2a+b}{2}-a\right)\left[\frac{2a+b}{2}-b\right]\left[\frac{2a+b}{2}-a\right]}$$

$$= \sqrt{\left(\frac{2a+b}{2}\right)\times\left(\frac{b}{2}\right)\times\left(\frac{2a-b}{2}\right)\times\left(\frac{b}{2}\right)}$$

$$= \frac{b}{4}\sqrt{(2a+b)(2a-b)}$$

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

$\therefore$ Area of isosceles triangle $= \frac{b}{4}\sqrt{4a^2-b^2}$ sq. units.

(3) Area of an Equilateral Triangle

If a is the side of an equilateral triangle, then its semi-perimeter will be :

$$s = \frac{a+a+a}{2} = \frac{3a}{2}$$

$\therefore$ By Heron's formula

Area of equilater triangle

$$= \sqrt{\frac{3a}{2}\left[\frac{3a}{2}-a\right]\left[\frac{3a}{2}-a\right]\left[\frac{3a}{2}-a\right]}$$

$$= \sqrt{\frac{3a}{2}\times\frac{a}{2}\times\frac{a}{2}\times\frac{a}{2}}$$

$$= \frac{a^2\sqrt{3}}{4} \text{ sq. units}$$

(4) Area of a Right-angled Triangle :

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

$= \frac{1}{2} \times$ (Product of sides containing a right angle)

$\therefore$ Area of right angled triangle $= \frac{1}{2} \times a \times b$ sq. units.

Illustrative Examples

Example 1. Find the area of a triangle whose sides are 8 cm, 15 cm and 17 cm.

Sol. Let a = 8 cm, b = 15 cm, c = 17 cm

$\therefore$ Semi perimeter $= s = \frac{a+b+c}{2} = \frac{8+15+17}{2} = \frac{40}{2} = 20\,\text{cm}$

$\therefore$ Area of a triangle $= \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{20(20-8)(20-15)(20-17)}$ sq. cm

$= \sqrt{20 \times 12 \times 5 \times 3}$ sq. cm

$= \sqrt{100 \times 36}$ sq. cm

$= 60$ sq. cm

$\therefore$ Area of a triangle = 60 sq. cm.

Example 2. Each of two equal sides of an isoscles triangle is 7 cm and the third side is 6 cm. Find the area of the triangle.

Sol. Let a = 7 cm, b = 6 cm

Area of triangle $= \frac{b}{4}\sqrt{4a^2 - b^2}$

$= \frac{6}{4}\sqrt{4 \times 49 - 36}$ sq. cm

$= \frac{6}{4}\sqrt{196 - 36}$ sq. cm

$= \frac{6}{4}\sqrt{160}$ sq. cm

$= \frac{6}{4} \times 4 \times \sqrt{10}$ sq. cm

$= 6\sqrt{10}$ sq. cm

Example 3. The base of a triangle is 24 cm and its height is 12 cm. Find the area of the triangle.

Sol. Base of the triangle = 24 cm and height = 12 cm

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

$$= \frac{1}{2} \times 24 \times 12$$

$$= 144 \text{ cm}^2.$$

Example 4. Find the area of an equilateral triangle whose one side is 8 cm.

Sol. Let a = 8 cm

$$\therefore \quad \text{Area of equilateral triangle} = \frac{\sqrt{3}}{4} a^2$$

$$= \frac{\sqrt{3}}{4} \times (8)^2$$

$$= \frac{\sqrt{3}}{4} \times 64 = 16\sqrt{3} \text{ cm}^2$$

Example 5. Two sides of a triangle are 7 cm and 8 cm respectively. If the perimeter of the triangle is 24 cm, then find the area of the triangle.

Sol. Let a = 7 cm, b = 8 cm

$$\text{Perimeter} = a + b + c = 24 \text{ cm}$$

$$\therefore \quad \text{Third side, } c = 24 - 7 - 8 = 9 \text{ cm}$$

$$\therefore \quad s = \frac{a+b+c}{2} = \frac{24}{2} = 12 \text{ cm}$$

$$\therefore \quad \text{Area of the triangle}$$

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

$$= \sqrt{12(12-7)(12-8)(12-9)} \text{ cm}^2$$

$$= \sqrt{12 \times 5 \times 4 \times 3}$$

$$= \sqrt{12 \times 5 \times 4 \times 3}$$

$$= 12\sqrt{5} \text{ cm}^2$$

Exercise 11.1

1. If the base of a triangle is 20 cm and its height is 6 cm then find the area of the triangle.
2. A triangle whose sides are 15 cm, 25cm and 30cm respectively, then find the area of the triangle.
3. In an isoscels triangle each equal side is of 8 cm and third side is 4 cm, then find its area.
4. An equilateral triangle whose side is 20 cm, then find its area.
5. A triangle whose two sides are 8 cm and 15 cm and its perimeter is 40 cm then find the area of the triangle.
6. A triangular table whose sides are in the ratio 3 : 4 : 5 and perimeter is 36 m then find the area of the table.
7. A field whose shape is triangular. Its sides are 20m, 51m and 37m, then how many small beds of measure of 2×3 m^2 can be plotted in the field?

11.03 Area of a Quadrilateral

A plane figure enclosed by four line segments is called quadrilateral. Any quadrilateral can be divided into two triangles by drawing its diagonals. In Fig 11.02 diagonal AC of a quadrilateral ABCD divides it into two triangles ABC and ACD. Therefore, area of quadrilateral ABCD will be the sum of the areas of both the triangles. From vertices B and D draw perpendicular BE and DF on diagonal AC respectively of quadrilateral ABCD.

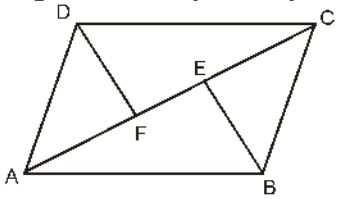

Fig. 11.02

$\therefore$ Area of $\Delta ABC = \frac{1}{2} \times AC \times BE$

and Area of $\Delta ACD = \frac{1}{2} \times AC \times DF$

$\therefore$ Area of Quadrilateral ABCD = Area of Δ ABC + Area of Δ ACD

$$= \frac{1}{2} \times AC \times BE + \frac{1}{2} \times AC \times DF$$

$$= \frac{1}{2} \times AC \times (BE + DF)$$

$\therefore$ Area of a quadrilateral $= \frac{1}{2} \times$ diagonal $\times$ (Sum of perpendiculars drawn on the diagonal)

Area of a Parallelogram

A quadrilateral whose opposite sides are equal and parallel to each other is called parallelogram.

(a) Area of parallelogram
= base $\times$ height = AB $\times$ DE

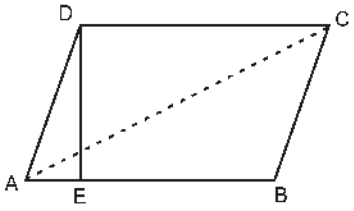

Fig. 11.03

(b) Diagonal AC divides parallelogram ABCD into two triangles ABC and ADC of equal areas.

$\therefore$ Area of parallelogram = 2 × (Area of ΔABC)

Illustrative Examples

Example 6. A diagonal of a quadrilateral is 10 cm and length of perpendiculars drawn of quadrilateral on diagonal from opposite vertices are 6 cm and 4 cm respectively, then find the area of the quadrilateral.

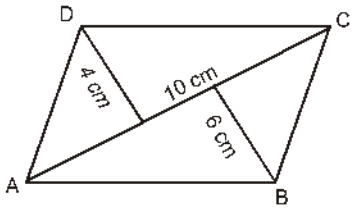

Fig. 11.04

Sol. Area of quadrilateral

$= \frac{1}{2} \times$ diagonal $\times$ (Sum of perpendicular drawn on the diagonal)

$= \frac{1}{2} \times 10 \times (6+4)$ sq. cm.

$= \frac{1}{2} \times 10 \times 10$ sq. cm.

= 50 sq. cm.

Example 7. Find the area of a parallelogram whose height is 15 m and base is 10 m.

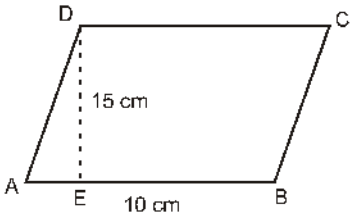

Fig. 11.05

Sol. Base = 10 m

Height = 15 m

Area of parallelogram = base × height

= 10 × 15

= 150 m^2

Example 8. Find the area of a quadrilateral ABCD whose diagonal AC = 15 cm and sides AB = 7 cm, BC = 12cm, CD = 12 cm and DA = 9 cm.

Sol. According to figure

Area of quadritateral

ABCD = ar (ΔABC) + ar (ΔACD)

In ΔABC, AB = 7 cm, BC = 12 cm

and AC = 15 cm

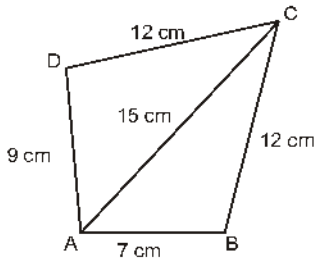

Fig. 11.06

$\therefore$ Semi-perimeter, $s = \frac{7+12+15}{2} = 17$ cm

$\therefore$ Area of $\Delta ABC = \sqrt{17 \times (17-7) \times (17-12) \times (17-15)}$

$= \sqrt{17 \times 10 \times 5 \times 2}$

$= \sqrt{1700}$

$= 10\sqrt{17}$

$= 10 \times 4.12 = 41.2 \text{ cm}^2$

In ΔACD, AC = 15 cm, CD = 12 cm and DA = 9 cm

$\therefore \quad s = \frac{15+12+9}{2} = \frac{36}{2} = 18 \text{ cm}$

$\therefore \quad$ Area of $\Delta ACD = \sqrt{18(18-15)\times(18-12)(18-9)}$

$= \sqrt{18 \times 3 \times 6 \times 9}$

$= 54 \text{ cm}^2$

$\therefore \quad$ Area of quadrilateral = (41.2 + 54.0)

$= 95.2 \text{ cm}^2$

Example 9. Two adjacent sides of a parallelogram are 5 cm and 4 cm repectively and diagonal is 7 cm. Find the area of the parallelogram.

Sol. According to figure 11.07, area of quadrilateral ABCD = 2 × (Area of ΔABC)

In ΔABC

AB = 5 cm, BC = 4 cm, AC = 7 cm

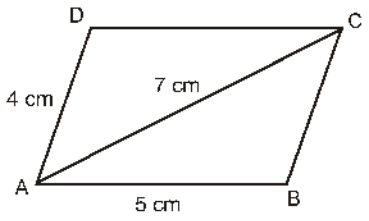

Fig. 11.07

$\therefore \quad s = \frac{5+4+7}{2} = \frac{16}{2} = 8 \text{ cm}$

From Heron's formula, area of ΔABC

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

$= \sqrt{8(8-5)(8-4)(8-7)}$

$= \sqrt{8 \times 3 \times 4 \times 1}$

$= 4\sqrt{6} \text{ cm}^2$

$\therefore \quad$ Area of parallelogram = 2 × area of ΔABC

$= 2 \times 4\sqrt{6} \text{ cm}^2$

$= 8\sqrt{6} \text{ cm}^2$

Exercise 11.2

1. Find the area of the quadrilateral whose diagonal is 12 cm and lengths of perpendiculars drawn from opposite vertices to the diagonal are 7 cm and 8 cm respectively.
2. Area of a parallelogram shaped play ground is 2000 m^2. If its base is 50m, then find the breadth of the play ground.
3. Find the area of a quadrilateral whose sides are AB = 3 cm, BC = 4 cm, CD = 6 cm and DA = 5 cm and diagonal is AC = 5 cm.
4. Find the area of quadrilateral whose sides are 9 cm, 40 cm, 28 cm and 15 cm and angle between first two side is a right angle.

5. Find the area of a parallelogram whose two adjacent sides are 50 cm and 40 cm respectively and diagonal is 30 cm.
6. Find the area of a parallelogram whose a diagonal is 5.2 cm and the length of each perpendicular from the opposite vertices to the diagonal is 3.5 cm.
7. A plot of land has a shape of a parallelogram. It is to be covered by mud. Find the cost of spreading mud at the rate of ₹ 100 per square metre while the adjacent sides of the plot are 39 m and 25 m and the diagonal is 56 m.

11.04 Area of different Quadrilaterals

(1) Area of a cyclic Quadrilateral

A quadrilateral whose all four vertics are on the circumference of a circle is called cyclic quadrilateral. Opposite angles of a cyclic quadrilateral are supplementary from figure 11.08. ABCD is a cyclic quadrilateral whose sides ae a, b, c and d respectively.

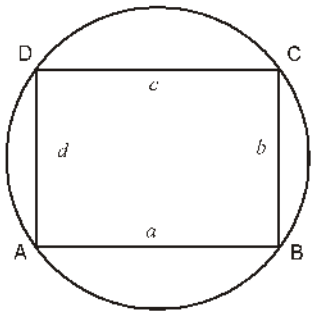

Fig. 11.08

$\therefore$ Semi perimeter $s = \dfrac{a+b+c+d}{2}$

$\therefore$ Area of cyclic quadrilateral $= \sqrt{(s-a)(s-b)(s-c)(s-d)}$

(2) Area of a Rhombus

A quadrilateral whose all four sides are equal and diagonals bisect each other at right angle, is called a rhombus.

$\therefore$ Area of Rhombus $= \dfrac{1}{2} \times$ (Product of diagonals)

(3) Area of a Trapezium

A quadrilateral whose only two sides are parallel, is called trapezium. In fig. 11.09, ABCD is a trapezium whose sides AB and CD are parallel and distance between the parallel sides is DE. Here, DE is perpendicular on AB and DB is the diagonal.

Therefore, area of trapezium ABCD

$=$ Area of $\Delta ABD +$ Area of ΔBCD

$= \dfrac{1}{2} AB \times DE + \dfrac{1}{2} \times DC \times DE$

$= \dfrac{1}{2} \times DE \times (AB + DC)$

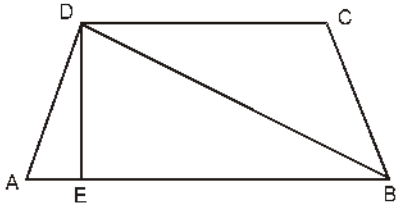

Fig. 11.09

Area of trapezium $= \dfrac{1}{2} \times$ sum of parallel sides $\times$ distance between parallel sides

Illustrative Examples

Example 10. Find the area of a cyclic quadrilateral whose sides are 36 cm, 77 cm, 75 cm

and 40 cm.

Sol. Let a = 36 cm, b = 77 cm, c = 75 cm and d = 40 cm

$\therefore$ Semi perimeter is a cyclic quadrilateral

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

$$= \frac{36+77+75+40}{2}$$

$$= \frac{228}{2}$$

= 114 cm

$\therefore$ Area of a cyclic quadrilateral

$$= \sqrt{(s-a)(s-b)(s-c)(s-d)}$$

$$= \sqrt{(114-36)(114-77)(114-75)(114-40)}$$

$$= \sqrt{78\times 37\times 39\times 74}$$

$$= \sqrt{2\times 39\times 39\times 37\times 37\times 2}$$

= 2 × 39 × 37

= 2886 cm^2

Example 11. The length of diagonals of a rhombus are 20 cm and 30 cm respectively, then find its area.

Sol. Area of rhombus = $\frac{1}{2}$ × (product of length of diagonals)

$$= \frac{1}{2}\times 20\times 30$$

= 300 cm^2

Example 12. Find the area of a trapezium whose parallel sides are 65 cm and 50 cm respectively and non-parallel sides are 20 cm and 25 cm respectively.

Sol. In fig. 11.10 ABCD is a trapezium whose parallel sides are AB = 65 cm and DC = 50 cm and non-prallel sides are AD = 20 cm and BC = 25 cm

Here EB = AB – AE = AB – DC

= (65 – 50) cm

= 15 cm

$\therefore$ Semi perimeter of ΔBEC

$$s = \frac{15+20+25}{2} = 30cm$$

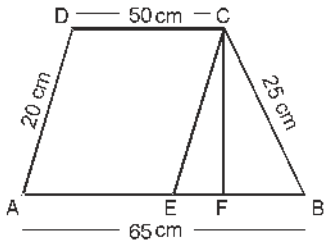

Fig. 11.10

$\therefore$ Area of ΔBEC

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

$= \sqrt{30(30-15)(30-20)(30-25)}$

$= \sqrt{30 \times 15 \times 10 \times 5}$

$= \sqrt{22500}$

$= 150 \text{ cm}^2$

Height of $\Delta BEC = CF = \dfrac{2 \times Area\,of\ \Delta BCE}{base\ BE}$

$= \dfrac{2 \times 150}{15} = 20\,cm$

$\therefore$ Area of parallelogram AECD = AE × CF

$= 50 \times 20$

$= 1000 \text{ cm}^2$

$\therefore$ Area of trapezium ABCD = area of parallelogram AECD + area of ΔEBC

$= 1000 \text{ cm}^2 + 150 \text{ cm}^2$

$= 1150 \text{ cm}^2$

Example 13. Find the area of trapezium whose parallel sides are 32 cm and 37 cm respectively and the distance between parallel sides is 20 cm.

Sol. Area of trapezium = $\dfrac{1}{2}$ × (Sum of parallel lines) × (distance between parallel lines)

$= \dfrac{1}{2} \times (32 + 37) \times 20$

$= \dfrac{1}{2} \times 69 \times 20$

$= 690 \text{ cm}^2$

Exerice 11.3

1. Sides of a cyclic quadrilateral shaped ground are 72 m, 154 m 80m and 150m respectively. Find its area. Find the total expenditure of the cost of tiling is ₹ 5 per square metre.
2. Diagonals of a rhombus are 25 cm and 42 cm. Find its area and perimeter.
3. Perimeter of a rhombus is 40 m and length of its diagonal is 12m, then find its area.
4. A trapezium shaped field whose parallel sides are 42 m and 30 m and the other sides are 18 m and 18m. Find its area.
5. If the area of a trapezium is 350 cm^2 and lengths of its parallel sides are 26 cm and 44 cm, then find the distance between the parallel sides.

6. A table has a shape of a trapezium. The parallel side of the table are 8 m and 16 m. If area of the table is 108 m^2 then find the width (distance between parallel sides) of the table.

11.5 Area of a Rectangle, Square and four walls

1. In fig. 11.11 length of the rectangular is a and breadth is b, therefore perimeter of rectangle = total length of all four sides

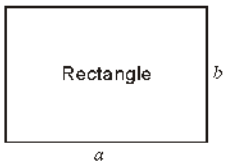

Fig. 11.11

= 2 × (length + breadth)

= 2 (a + b)

Area of rectangle = length × breadth

= a × b

2. If side of a square is 'a', then perimeter of square = 4 × side = 4a

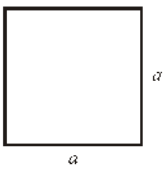

Fig. 11.12

area of square = $(side)^2 = a^2$

3. Area of four walls of a room or rectangular tank = 2 × (length + breadth) × height

∴ Area of four walls of a room = Peremeter × height

Perimeter of floor of a room = 2 × (length + breadth)

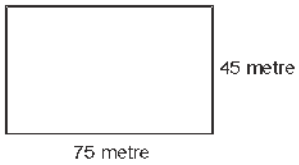

Fig. 11.13

Illustrative Examples

Example 14. The length of a rectangular ground is 75 m and breadth is 45 m, then find the area and perimeter of the ground.

Sol. Length = 75 cm and breadth = 45 m

∴ Area of a rectangular ground

= length × breadth

= 75 × 45

= 3375 m^2

Perimeter of rectangular ground = 2 (length + breadth)

= 2 (75 + 45)

= 2 × 120

= 240 m

Example 15. Distance covered to take 5 rounds of a rectangular field is 600 m. If the breadth of the field is 25 m, then find its length.

Sol. Perimeter of field = $\frac{600}{5} m$

= 120 m

or $2(a + b) = 120$

or $2(a + 25) = 120$

or $a + 25 = 60$

or $a = 60 - 25$

or $a = 35$ m

$\therefore$ Length of field = 35 m.

Example 16. Length of a square field is 120 m. Find its perimeter and area.

Sol. Side of a square field = 120 m

$\therefore$ Perimeter of field = 4 × side

$= 4 \times 120$

$= 480$ m

Area of field = $(\text{side})^2$

$= (120)^2$

$= 14400 m^2$

Example 17. Length of a rectangular field is 35 m and breadth is 20m. It is to be tiled. If the measures of a tile is 7 cm × 5cm then how many tiles will be required?

Sol. Length of rectangular field = 35 m

Breadth of rectangular field = 20 m

$\therefore$ Area of field = 35 × 20

$= 700 m^2$

Length of tile = 7 cm = 0.07 m

Breadth of tile = 5 cm = 0.05 m

$\therefore$ Area of a tile = 0.07 × 0.05

$= 0.0035 m^2$

$\therefore$ Required number of tiles

$$= \frac{area\ of\ field}{are\ of\ tile}$$

$$= \frac{700}{0.0035}$$

$$= \frac{7000000}{35}$$

$= 200000.$

Example 18. Area of a square ground is 625 m^2. There is 2.5 m wide path outside around it. Find the area of the path. If 50 cm long square pieces are to be paved in the path, then find how many square pieces are required.

Sol. As per question

Area of square ground = 625 m^2

$\therefore$ Length of the ground $= \sqrt{Area} = \sqrt{625} = 25$ m

In Fig. 11.14, there is 2.5 m path surrounding the ground outside

$\therefore$ Outer length with path = 25 + 2.5 + 2.5 = 30 m

$\therefore$ Area of ground with path = $(30)^2$ 900 m^2

$\therefore$ Area of path = Area of ground with path – Area of ground

= 900 – 625

= 275 m^2

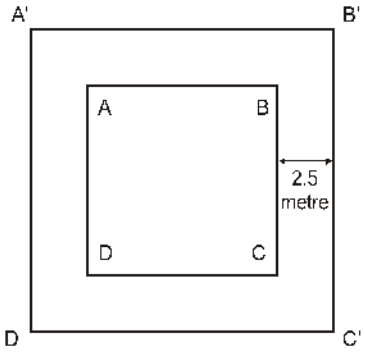

Fig. 11.14

Length of the square piece to be paved in path = 50 cm = 0.50 m

$\therefore$ Area of a square piece = 0.50 × 0.50 = 0.2500 m^2

$\therefore$ Required number of square pieces

$$= \frac{area\ of\ path}{area\ of\ a\ square\ piece}$$

$$= \frac{275}{0.25} = \frac{27500}{25}$$

= 1100

Example 19. A rectangular ground is 40 m long and 30 m wide. A 3m wide path, parallel to its length and width, is made is the middle of the ground. find the expenditure of paving the concrete on this path at the rate of Rs 200 per square meter.

Sol. As per question

Length of ground = 40 m

Width of ground = 30 m

$\therefore$ Area of ground = 40 × 30 = 1200 m^2

In fig. 11.15

Area of path IJKL parallel to length 40 × 3

= 120 m^2

Area of path EFGH parallel to breadth = 30 × 3 = 90 m^2

Area of shaded part PQRS = 3 × 3 = 9 m^2

Area of total path = 120 + 90 – 9 = 201 m^2

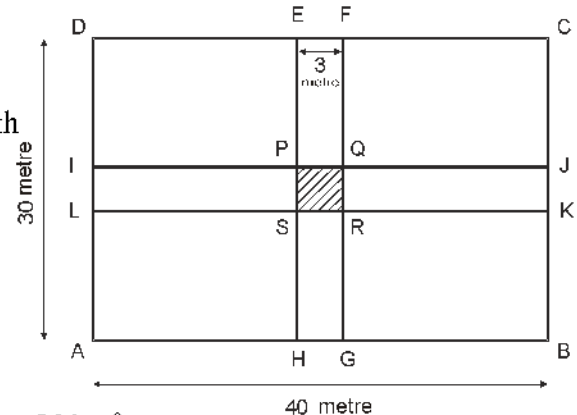

Fig. 11.15

$\therefore$ Expenditure at the rate of ₹ 200 per square metre of paving concrete
= ₹ 200 × 201
= ₹ 40200

$\therefore$ Expenditure = ₹ 40200

Example 20. Find the area of a field based on given measure in figure.

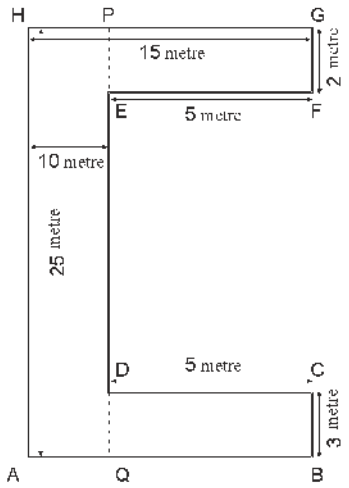

Fig. 11.16

Sol. We can divide the given figure in the form of rectangular, therefore

(i) Area of rectangle GFEP = EF × GF
= 5 × 2
= 10 m^2

(ii) Area of rectangle BCDQ = QB × BC
= 5 × 3
= 15 m^2

(iii) Area of rectangle HPQA = HA × HP
= 25 × 10
= 250 m^2

$\therefore$ Area of given field = area GFEP + area BCDQ + area HPQA
= (10 + 15 + 250) m^2
= 275 m^2.

Example 21. A rectangular room is 7m long, 6 m wide and 3.5m high. If there are 3 doors of size 2m × 1.5m and 4 windows of size 1.25m × 1m then find the expenditure of colouring of the walls at the rate of ₹ 4 and 45 paise per square metre.

Sol. Length of room = 7 m
Breadth of room = 6 m
and height of the room = 3.5m

$\therefore$ Area of four walls of room = 2 (l + b) × h
= 2(7 + 6) × 3.5 m^2
= 91 m^2

Area of one door = 2 × 1.5 = 3 m^2
Area of 3 door = 3 × 3 m^2
= 9 m^2

Area of one window = 1.25 × 1 m^2
Area of 4 windows = 1.25 x 4 m^2
= 5.00 m^2

$\therefore$ Remaining area of four walls excluding doors and windows
= [91 – (9+5)]
= (91 – 9 – 5)

$= (91 - 14)$

$= 77\ m^2$

$\therefore$ Expenditure of colouring of the walls

$= ₹\ 77 \times 4.50$

$= ₹\ 346.50$

Example 22. A rectangular tank of water is 12 m long, 6 m wide and 2 m deep. Find the cost of repairing its four walls and floor at the rate of ₹ 15 per square metre.

Sol. Length of rectangular tank = 12 m

Breadth of rectangular tank = 6 m

Deapth of rectangular tank = 2 m

$\therefore$ Area of four walls of tank

$= 2 \times (\text{length} + \text{breadth}) \times \text{deapth}$

$= 2 \times (12 + 6) \times 2$

$= 72\ m^2$

Area of floor of tank = length × breadth

$= 12 \times 6\ m^2$

$= 72\ m^2$

$\therefore$ Total area of four walls and floor

$= (72 + 72)\ m^2$

$= 144\ m^2$

$\therefore$ Cost of repairing the four walls and floor = 144×15

$= ₹\ 2160$

Exercise - 11.4

1. Find the area and perimeter of rectangles of following measure:
   (i) length = 9.5 m, breadth = 7.5 m
   (ii) length = 125 m, breadth = 75 m
   (iii) length = 12.5 cm, breadth = 7.5 cm
2. Find the area and perimeter of the square of following measure of a side :
   (i) 5.3 m (ii) 8.5 m (iii) 9.6 m
3. After running 4 rounds to a square field, a distance covered is 16 km. Find the length and area of the ground.
4. A rectangular field is 75 m long and 45 m wide. How many beds 5 m long and 3 m wide can be made in it?
5. The length of a room is 10 m and breadth is 5 m. How many square pieces of area 50 cm^2 are required on its floor? Find the expenditure of paving the square pieces on the floor at the rate of ₹ 20 per piece.

6. Area of a square ground is 2025 m^2. There is 3.5 m wide path outside around it then find the area of the path.
7. A rectangular room is 40 m long and 25 m wide. There is a road 2.5 m wide around it. Tiles of size 50 cm × 70 cm are to be paved on it. Find the number of pieces.
8. A rectangular ground is 60 m long and 40 m wide. There is a 4 m wide path parallel to its length and width in side the ground. find the expenditure of spreading mud on the path at the rate of ₹100 per square metre.
9. Find the area and perimeter of the given diagram

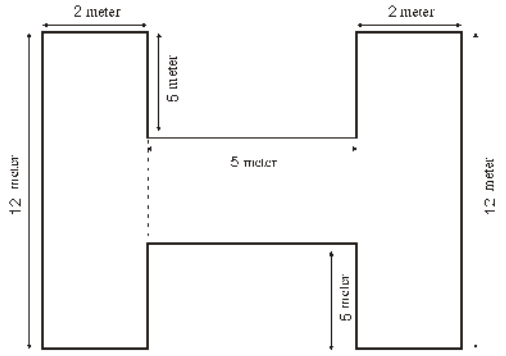

Fig. 11.17

10. The length, breadth and height of a room are respectively 15.35 m, 4.65 m and 6.50 m. If there are 4 doors of size 1.5m × 1.3 m and 3 windows of size 1.5m × 1.2m, then find the expenditure on whitewashing the room at the rate of ₹ 4.30 per square metre.
11. A water tank is 10m long, 8m wide and 2m deep. Find the expenditure of repairing its four walls and floor at the rate of ₹ 15 per square metre.

Important Points

1. Area of triangle $= \frac{1}{2} \times$ base $\times$ height
2. Area of triangle by Heron's formula

   $= \sqrt{s(s-a)(s-b)(s-c)}$ sq. units

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

   $= \frac{perimeter\ of\ triangle}{2}$

   = semi perimeter, where a, b, c are side of a triangle.
3. Area of an isosceles triangle $= \frac{b}{4}\sqrt{4a^2 - b^2}$ sq. units

   Where a is one of the equal sides of a triangle and b is other side.
4. Area of an equilateral triangle $= \frac{a^2\sqrt{3}}{4}$ sq. units, where a is the side of triangle.
5. Area of right angled triangle $= \frac{1}{2} \times$ (product of sides containing a right angle)

   $= \frac{1}{2} \times$ base $\times$ height
6. Area of quadrilateral $= \frac{1}{2} \times$ diagonal $\times$ (Sum of perpendiculars drawn on diagonal)
7. Area of parallelogram = base $\times$ height
8. Area of a cyclic quadrilateral $= \sqrt{(s-a)(s-b)(s-c)(s-d)}$

   where a, b, c, d are sides and $s = \frac{a+b+c+d}{2}$
9. Area of rhombus $= \frac{1}{2} \times$ Products of lengths of diagonals
10. Area of trapezium $= \frac{1}{2} \times$ (Sum of parallel sides) $\times$ distance between two parallel sides.
11. Area of rectangle = length $\times$ breadth
12. Area of a square = $(\text{side})^2$
13. Area of four walls = 2 $\times$ (length + breadth) $\times$ height

Miscelleneous Exercise - II

1. If the side of an equilateral triangle is 8 cm, then area of the triangle will be :

   (A) $16\sqrt{3}$ cm^2 (B) $8\sqrt{3}$ cm^2

   (C) $64\sqrt{3}$ cm^2 (D) $4\sqrt{3}$ cm^2 ( )

2. The sides of a triangle are 40 cm, 70 cm and 90 cm, area of triangle will be :

   (A) $600\sqrt{5}$ cm^2 (B) $500\sqrt{6}$ cm^2

   (C) $482\sqrt{5}$ cm^2 (D) $60\sqrt{5}$ cm^2 ( )

3. Each equal side of an issoceles triangle is 6 cm and the other sides is 8 cm, then area of triangle will be :

   (A) $8\sqrt{5}$ cm^2 (B) $5\sqrt{8}$ cm^2

   (C) $3\sqrt{55}$ cm^2 (D) $3\sqrt{8}$ cm^2 ( )

4. The perimeter of an equilateral triangle is 60 cm, then its area will be :

   (A) $400\sqrt{3}$ cm^2 (B) $100\sqrt{3}$ cm^2

   (C) $50\sqrt{3}$ cm^2 (D) $200\sqrt{3}$ cm^2 ( )

5. Area of a right- triangle is 6 cm^2 and its base is 9 cm, then the length of perpendicular will be :

   (A) 8cm (B) 4 cm (C) 16 cm (D) 32 cm ( )

6. If the side of a square is 10 cm, then its perimeter will be :

   (A) 20 cm (B) 10 cm (C) 40 cm (D) 30 cm ( )

7. If the diagonals of a rhombus are 8 cm and 6 cm, then its area will be :

   (A) 48 cm^2 (B) 24 cm^2 (C) 12 cm^2 (D) 96 cm^2 ( )

8. If the perimeter of room is 40 m and height is 4m, then area of its four walls will be:

   (A) 40 m^2 (B) 80 m^2 (C) 120 m^2 (D) 160 m^2 ( )

9. What will be the length of side of an equilateral triangle whose area is $9\sqrt{3}$ cm^2

   _____

10. Write the formula to find the area of cyclic quadrilateral.

    _____

11. Area of a square is 144 m^2 are, then write its perimeter.

    _____

12. If the base of a parallelogram is 18m and area is 174.60 m^2, then write its height.

    _____

13. Write the area of a quadrilateral whose diagonal is 6 cm and the sum of internal perpendiculars is 12 cm.

14. The ratio of the sides of a triangle is 25 : 17 : 12 and perimeter is 540 m, then find the area of triangle.

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15. Area of an issoceles triangle is 12 cm^2 Find its base, if the length of its equal sides is 5 cm.

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16. The perimeter of any triangle is 40 cm. If its two sides are 8 cm and 15 cm respectively, then find its area and also find the length of perpendicular, drawn from a vertex to the longest side.

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17. The perimeter of a rhombus is 146 cm and length of a diagonal is 55 cm, then find the area of the rhombus.

18. There is sufficient grass for eating in a rhombus shaped grass field for 18 cows. If each side of this rhombus is 30 m and longest diagonal is 48 m, how much area of this field will be available for each cow to eat grass?

19. An umbrella is made by joining 10 triangular pieces of two different coloured cloths. The measures of each piece is 20 cm, 50 cm and 50 cm. How much cloth is used in umbrella.

20. Ratio of two parallel sides of a trapezium is 16 : 5. Which is cut out of a rectangle whose sides are 63 m and 5m. If the area of a trapezium is $\frac{4}{15}$ th part of the area of a rectangle trapezium.

21. Area of a rectangular field is 4356 m^2 and length of the ground is 99m. There is a 4.5 m wide road in the middle of the ground parallel to length and breadth. How many square pieces of side 1.50 m will be required to cover the road.

22. A room is 8m50 cm long and 6m 50cm wide. How long a carpet 25 cm wide required to cover its floor? Find the cost of carpet at the rate of Rs. 20 per meter.

Answer

Exercise 11.1

1. 60 square cm

2. $50\sqrt{14}$ cm^2

3. $4\sqrt{15}$ square cm

4. $100\sqrt{3}$ cm^2

5. 60 cm^2

6. 54 m^2

7. 51 beds

Exercise 11.2

1. 90 square cm

2. 40 m

3. 18 square cm

4. 306 square cm

5. 1200 square cm

6. 18.2 cm^2

7. ₹ 84000

Exercise 11.3

1. 11544 m^2, ₹ 57720

2. 525 cm^2, 97.72 cm

3. 96 m^2

4. 610.9 m^2

5. 10 cm

6. 9 m

Exercise 11.4

1. (i) 71.25 m^2, 34 m

(ii) 9375 m^2, 400 m

(iii) 93.75 cm^2, 40 cm

2. (i) 28.09 m^2, 21.2 m

(ii) 72.25 m^2, 34 m

(iii) 92.16 m^2, 38.4 m

3. 250 m, 62500 m^2

4. 225 beds

5. 1000 square piece, ₹ 20000

6. 679 m^2

7. 1000 square piece

8. ₹ 38400

9. 58 m^2

10. ₹ 839.12

11. ₹ 2280

Miscellaneous Exercise - 11

1. (A)

2. (A)

3. (A)

4. (B)

5. (A)

6. (C)

7. (B)

8. (D)

9. 6 cm

11. 480 m

12. 9.7 m

13. 36 cm^2

14. 9000 m^2

15. 8 cm

16. 60 cm^2, $7\frac{1}{17}$ cm

17. 1320 cm^2

18. 48 m^2

19. $2000\sqrt{6}$ cm^2

20. 25.6 m, 8 m

21. 277 square pieces

22. 221 m, ₹ 4420