EXERCISE 20.4 PAGE NO: 20.26

1. Find the area in square centimetres of a triangle whose base and altitude are as under:
(i) Base =18 cm, altitude = 3.5 cm
(ii) Base = 8 dm, altitude =15 cm

Solution:
(i) Given base = 18 cm and height = 3.5 cm
We know that the area of a triangle = ½ (Base x Height)
Therefore area of the triangle = ½ x 18 x 3.5
= 31.5 cm^2

(ii) Given base = 8 dm = (8 x 10) cm = 80 cm [Since 1 dm = 10 cm]
And height = 15 cm
We know that the area of a triangle = ½ (Base x Height)
Therefore area of the triangle = ½ x 80 x 15
= 600 cm^2

2. Find the altitude of a triangle whose area is 42 cm^2 and base is 12 cm.

Solution:
Given base = 12 cm and area = 42 cm^2
We know that the area of a triangle = ½ (Base x Height)
Therefore altitude of a triangle = (2 x Area)/Base
Altitude = (2 x 42)/12
= 7 cm

3. The area of a triangle is 50 cm^2. If the altitude is 8 cm, what is its base?

Solution:
Given, altitude = 8 cm and area = 50 cm^2
We know that the area of a triangle = ½ (Base x Height)
Therefore base of a triangle = (2 x Area)/ Altitude
Base = (2 x 50)/ 8
= 12.5 cm

4. Find the area of a right angled triangle whose sides containing the right angle are of lengths 20.8 m and 14.7 m.

Solution:
In a right-angled triangle,
The sides containing the right angles are of lengths 20.8 m and 14.7 m.
Let the base be 20.8 m and the height be 14.7 m.
Then,
Area of a triangle = 1/2 (Base x Height)
= 1/2 (20.8 × 14.7)
= 152.88 m^2

5. The area of a triangle, whose base and the corresponding altitude are 15 cm and 7 cm, is equal to area of a right triangle whose one of the sides containing the right angle is 10.5 cm. Find the other side of this triangle.

Solution:
For the first triangle, given that
Base = 15 cm and altitude = 7 cm
We know that area of a triangle = ½ (Base x Altitude)
= ½ (15 x 7)
= 52.5 cm^2
It is also given that the area of the first triangle and the second triangle are equal.
Area of the second triangle = 52.5 c m^2
One side of the second triangle = 10.5 cm
Therefore, The other side of the second triangle = (2 x Area)/One side of a triangle
= (2x 52.5)/10.5
=10 cm
Hence, the other side of the second triangle will be 10 cm.

6. A rectangular field is 48 m long and 20 m wide. How many right triangular flower beds, whose sides containing the right angle measure 12 m and 5 m can be laid in this field?

Solution:
Given length of the rectangular field = 48 m
Breadth of the rectangular field = 20 m

Area of the rectangular field = Length x Breadth
= 48 m x 20 m
= 960 m^2
Area of one right triangular flower bed = ½ (12 x 5) = 30 m^2
Therefore, required number of right triangular flower beds = area of the rectangular field/ area of one right triangular flower bed.
= 960/30
Number of right triangular flower beds = 32

7. In Fig. 29, ABCD is a quadrilateral in which diagonal AC = 84 cm; DL ⊥AC, BM ⊥ AC, DL = 16.5 cm and BM = 12 cm. Find the area of quadrilateral ABCD.

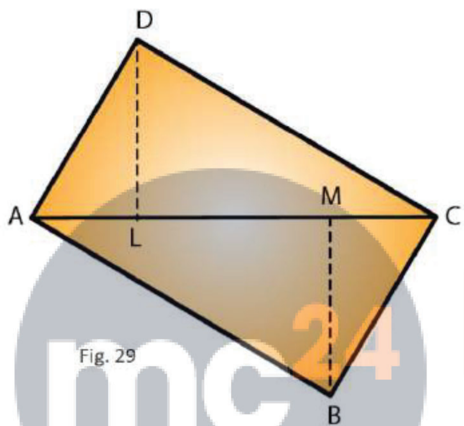


Fig. 29

Solution:
Given AC = 84 cm, DL = 16.5 cm and BM = 12 cm
We know that area of triangle = ½ x base x height
Area of triangle ADC = ½ (AC x DL)
= ½ (84 x 16.5)
= 693 cm^2
Area of triangle ABC = ½ (AC x BM)
= ½ (84 x 12) = 504 cm^2
Hence, Area of quadrilateral ABCD = Area of triangle ADC + Area of triangle ABC
= (693 + 504) cm^2
= 1197 cm^2

8. Find the area of the quadrilateral ABCD given in Fig. 30. The diagonals AC and BD measure 48 m and 32 m respectively and are perpendicular to each other.

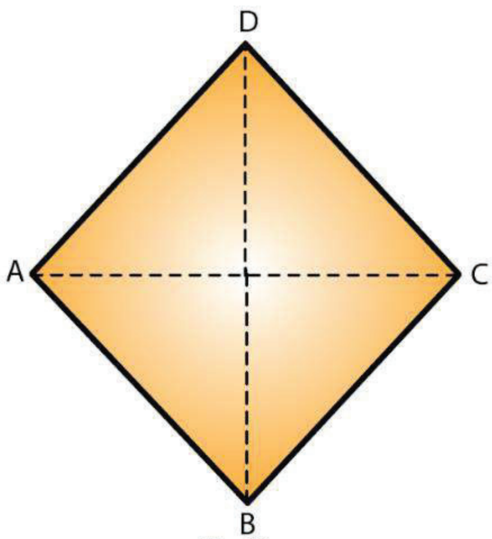


Fig. 30

Solution:

Given diagonal AC = 48 m and diagonal BD = 32 m

Area of a quadrilateral = ½ (Product of diagonals)

= ½ (AC x BD)

= ½ (48 x 32) m^2

= 768 m^2

9. In Fig 31, ABCD is a rectangle with dimensions 32 m by 18 m. ADE is a triangle such that EF⊥ AD and EF= 14 cm. Calculate the area of the shaded region.

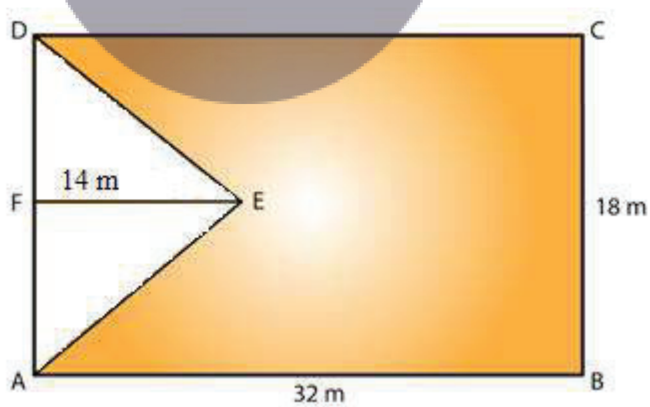


Fig. 31

Solution:

Given length of rectangle = 32m and breadth = 18m

We know that area of rectangle = length x breadth

Therefore area of the rectangle = AB x BC

= 32 m x 18 m

= 576 m^2

Also given that base of triangle = 18m and height = 14m and EF⊥ AD
We know that area of triangle = ½ x base x height
Area of the triangle = ½ (AD x FE)
= ½ (BC x FE) [Since AD = BC]
= ½ (18 m x 14 m)
= 126 m^2
Area of the shaded region = Area of the rectangle – Area of the triangle
= (576 – 126) m^2
= 450 m^2

10. In Fig. 32, ABCD is a rectangle of length AB = 40 cm and breadth BC = 25 cm. If P, Q, R, S be the mid-points of the sides AB, BC, CD and DA respectively, find the area of the shaded region.

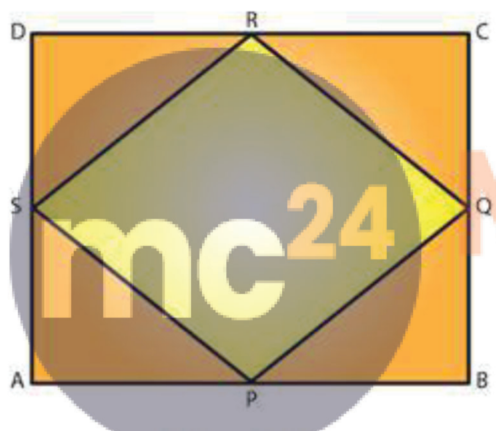
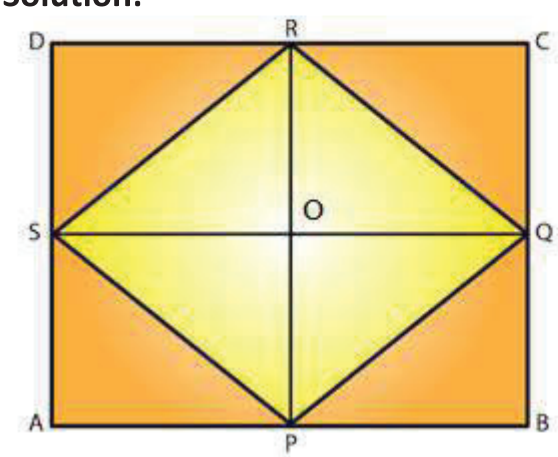


Fig. 32

Solution:



Given ABCD is a rectangle of length AB = 40 cm and breadth BC = 25 cm.
Join PR and SQ so that these two lines bisect each other at point O

Also OP = OR = RP/2
= 25/2
= 12.5 cm
From the given figure it is clear that,
Area of Triangle SPQ = Area of Triangle SRQ
Hence, area of the shaded region = 2 x (Area of SPQ)
= 2 x (1/2 (SQ x OP))
= 2 x (1/2 (40 x 12.5))
= 500 cm^2

11. Calculate the area of the quadrilateral ABCD as shown in Fig.33, given that BD = 42 cm, AC = 28 cm, OD = 12 cm and AC ⊥ BO.

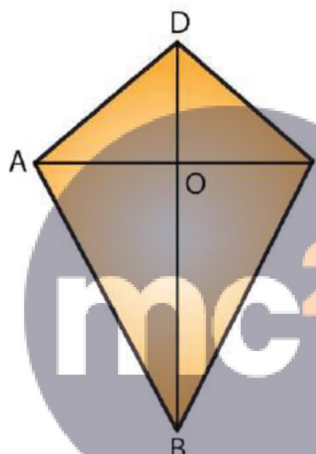
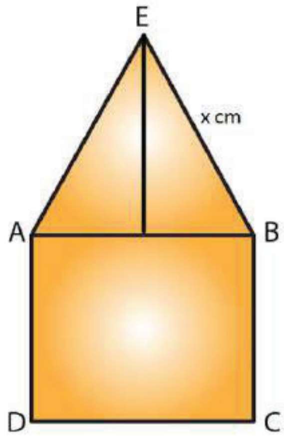


Fig. 33

Solution:
BD = 42 cm, AC = 28 cm, OD= 12 cm
Area of Triangle ABC = 1/2 (AC x OB)
= 1/2 (AC x (BD – OD))
= 1/2 (28 cm x (42 cm – 12 cm))
= 1/2 (28 cm x 30 cm)
= 14 cm x 30 cm
= 420 cm^2
Area of Triangle ADC = 1/2 (AC x OD) = 1/2 (28 cm x 12 cm)
= 14 cm x 12 cm
= 168 cm^2
Hence, Area of the quadrilateral ABCD = Area of triangle ABC + Area of triangle ADC
= (420 + 168) cm^2
= 588 cm^2

12. Find the area of figure formed by a square of side 8 cm and an isosceles triangle with base as one side of the square and perimeter as 18 cm.

Solution:



Let x cm be one of the equal sides of an isosceles triangle.
Given that the perimeter of the isosceles triangle = 18 cm
Then, x + x + 8 =18
2x = (18 – 8) = 10 cm
2x = 10
x = 5 cm
Area of the figure formed = Area of the square + Area of the isosceles triangle
= $(\text{side of square})^2 + ½ (\text{base} \times \sqrt{[(\text{equal side})^2 – ¼ \times (\text{base})^2]}$
= $8^2 + ½ (8) \times \sqrt{[5^2 – ¼ \times 8^2]}$
= 64 + 4 x √ [25 – ¼ x 64]
= 64 + 4 x √ (25 – 16)
= 64 + 4 x √9
= 64 + 4 x 3
= 64 + 12
= 76 cm^2

13. Find the area of Fig. 34, in the following ways: (i) Sum of the areas of three triangles (ii) Area of a rectangle — sum of the areas of five triangles

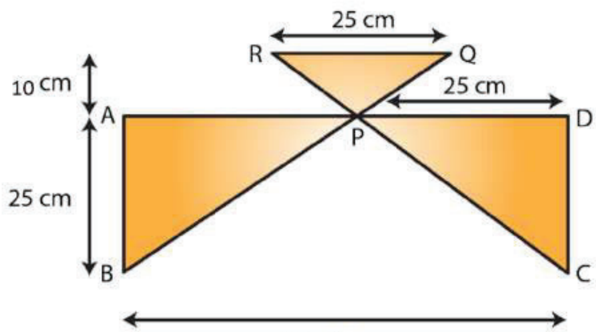


Fig. 34

Solution:

(i) From the figure, P is the midpoint of AD.

Thus AP = PD = 25 cm and AB = CD = 20 cm

From the figure, we observed that,

Area of Triangle APB = Area of Triangle PDC

Area of Triangle APB = ½ (AB x AP)

= ½ (20 x 25)

= 250 cm^2

Area of Triangle PDC = Area of Triangle APB = 250 c m^2

Area of Triangle RPQ = ½ (Base x Height)

= ½ (25 cm x 10 cm)

= 125 cm^2

Hence, Sum of the three triangles = (250 + 250 + 125) cm^2

= 625 cm^2

(ii) From the figure, area of the rectangle ABCD = 50 cm x 20 cm

= 1000 cm^2

Thus, Area of the rectangle – Sum of the areas of three triangles

= (1000 – 625) cm^2

= 375 cm^2

14. Calculate the area of quadrilateral field ABCD as shown in Fig.35, by dividing it into a rectangle and a triangle.

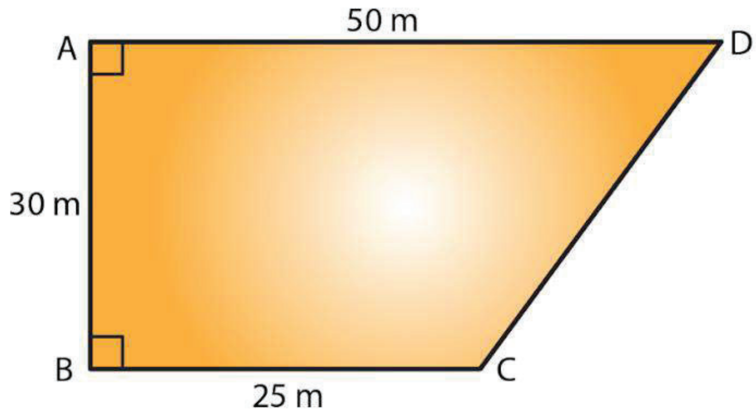
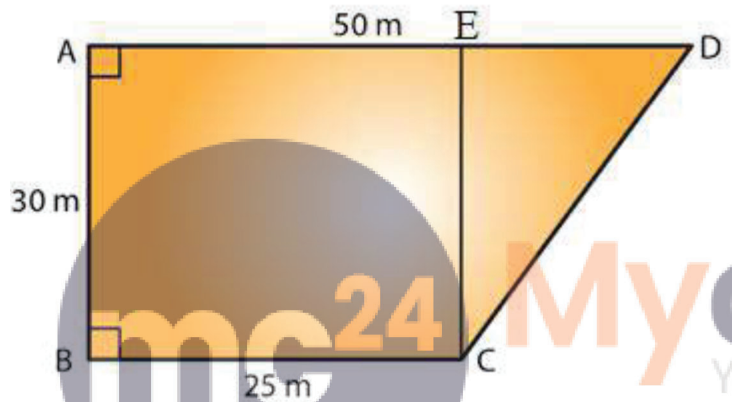


Fig. 35

Solution:



Join CE, so that which intersect AD at point E.

Given AE = ED = BC = 25 m and EC = AB = 30 m

Area of rectangle = length x breadth

Area of the rectangle ABCE = AB x BC

= 30 m x 25 m

= 750 m^2

Area of triangle = ½ x base x height

Area of Triangle CED = ½ (EC x ED)

= ½ (30 m x 25 m)

= 375 m^2

Hence, Area of the quadrilateral ABCD = (750 + 375) m^2 = 1125 m^2

15. Calculate the area of the pentagon ABCDE, where AB = AE and with dimensions as shown in Fig. 36.

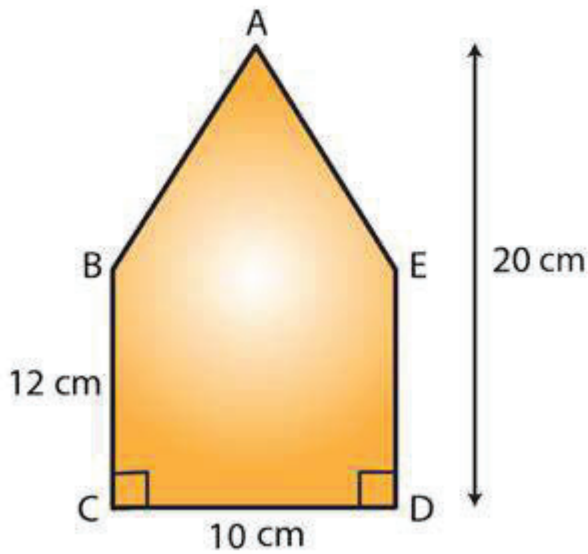
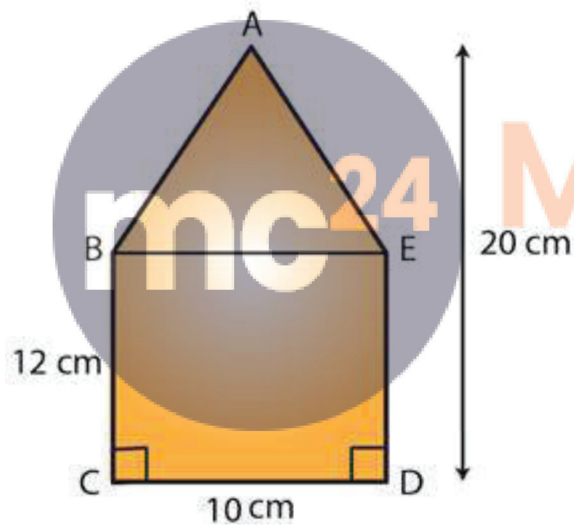


Fig. 36

Solution:



Join BE so that we can get rectangle and triangle.

We know that area of rectangle = length x breadth

Area of the rectangle BCDE = CD x DE

= 10 cm x 12 cm

= 120 c m^2

Area of triangle = ½ x base x height

Area of Triangle ABE = 1/2 (BE x height of the triangle)

= ½ (10 cm x (20 – 12) cm)

= ½ (10 cm x 8 cm)

= 40 cm^2

Hence, Area of the pentagon ABCDE = area of rectangle + area of triangle

= (120 + 40) cm^2
= 160 cm^2

16. The base of a triangular field is three times its altitude. If the cost of cultivating the field at Rs 24.60 per hectare is Rs 332.10, find its base and height.

Solution:
Let altitude of the triangular field be h m
Then base of the triangular field is 3h m.
We know that area of triangle = ½ x b x h
Area of the triangular field = ½ (h x 3h) = $3h^2/2$ m^2 ……. (i)
The rate of cultivating the field is Rs 24.60 per hectare.
Therefore,
Area of the triangular field = 332.10 /24.60
= 13.5 hectare
= 135000 m^2 [Since 1 hectare = 10000 m^2] …… (ii)
From equation (i) and (ii) we have,
$3h^2/2$ = 135000 m^2
$3h^2$ = 135000 x 2 = 270000 m^2
h^2 = 270000/3
= 90000 m^2
= $(300)^2$
h = 300 m
Hence, Height of the triangular field = 300 m and
Base of the triangular field = 3 x 300 m = 900 m

17. A wall is 4.5 m long and 3 m high. It has two equal windows, each having form and dimensions as shown in Fig. 37. Find the cost of painting the wall (leaving windows) at the rate of Rs 15 per m^2.

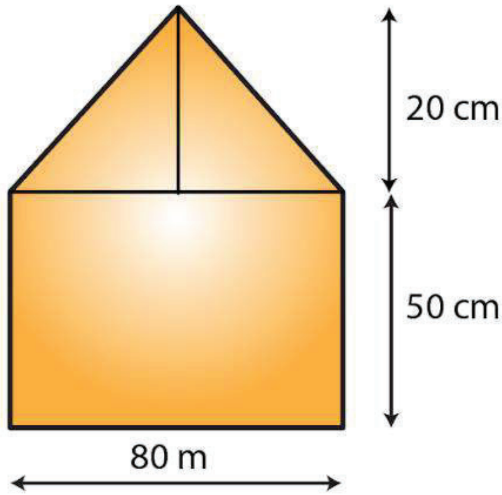


Fig. 37

Solution:

Given length of a wall = 4.5 m

Breadth of the wall = 3 m

We know that the area of triangle = length x Breadth

Area of the wall = Length x Breadth

= 4.5 m x 3 m = 13.5 m^2

From the figure we observed that,

Area of the window = Area of the rectangle + Area of the triangle

= (0.8 m x 0.5 m) + (1/2 x 0.8 m x 0.2 m) [Since 1 m = 100 cm]

= 0.4 m^2 + 0.08 m^2

= 0.48 m^2

Area of two windows = 2 x 0.48 = 0.96 m^2

Area of the remaining wall (leaving windows) = (13.5 – 0.96) m^2

= 12.54 m^2

Cost of painting the wall per m^2 = Rs. 15

Hence, the cost of painting the wall = Rs. (15 x 12.54)

= Rs. 188.1