EXERCISE 20.2 PAGE NO: 20.22

1. Find the area, in square metres, of the trapezium whose bases and altitudes are as under:
(i) bases = 12 dm and 20 dm, altitude = 10 dm
(ii) bases = 28 cm and 3 dm, altitude = 25 cm
(iii) bases = 8 m and 60 dm, altitude = 40 dm
(iv) bases = 150 cm and 30 dm, altitude = 9 dm
Solution:
(i) Given that,
Length of bases of trapezium = 12 dm and 20 dm
Length of altitude = 10 dm
We know that, 10 dm = 1 m
∴ Length of bases in m = 1.2 m and 2 m
Similarly, length of altitude in m = 1 m
Area of trapezium = 1/2 (Sum of lengths of parallel sides) × altitude
Area of trapezium = 1/2 (1.2 + 2.0) × 1
Area of trapezium = 1/2 × 3.2 = 1.6
So, Area of trapezium = $1.6m^2$

(ii) Given that,
Length of bases of trapezium = 28 cm and 3 dm
Length of altitude = 25 cm
We know that, 10 dm = 1 m
∴ Length of bases in m = 0.28 m and 0.3 m
Similarly, length of altitude in m = 0.25 m
Area of trapezium = 1/2 (Sum of lengths of parallel sides) × altitude
Area of trapezium = 1/2 (0.28 + 0.3) × 0.25
Area of trapezium = 1/2 × 0.58× 0.25 = 0.0725
So, Area of trapezium = $0.0725m^2$

(iii) Given that,
Length of bases of trapezium = 8 m and 60 dm
Length of altitude = 40 dm
We know that, 10 dm = 1 m
∴ Length of bases in m = 8 m and 6 m
Similarly, length of altitude in m = 4 m
Area of trapezium = 1/2 (Sum of lengths of parallel sides) × altitude
Area of trapezium = 1/2 (8 + 6) × 4

Area of trapezium = 1/2 × 56 = 28
So, Area of trapezium = $28m^2$

(iv) Given that,
Length of bases of trapezium = 150 cm and 30 dm
Length of altitude = 9 dm
We know that, 10 dm = 1 m
∴ Length of bases in m = 1.5 m and 3 m
Similarly, length of altitude in m = 0.9 m
Area of trapezium = 1/2 (Sum of lengths of parallel sides) × altitude
Area of trapezium = 1/2 (1.5 + 3) × 0.9
Area of trapezium = 1/2 × 4.5 × 0.9 = 2.025
So, Area of trapezium = $2.025m^2$

2. Find the area of trapezium with base 15 cm and height 8 cm, if the side parallel to the given base is 9 cm long.
Solution:
Given that,
Length of bases of trapezium = 15 cm and 9 cm
Length of altitude = 8 cm
We know that,
Area of trapezium = 1/2 (Sum of lengths of parallel sides) × altitude
Area of trapezium = 1/2 (15 + 9) × 8
Area of trapezium = 1/2 × 192 = 96
So, Area of trapezium = $96m^2$

3. Find the area of a trapezium whose parallel sides are of length 16 dm and 22 dm and whose height is 12 dm.
Solution:
Given that,
Length of bases of trapezium = 16 dm and 22 dm
Length of altitude = 12 dm
We know that, 10 dm = 1 m
∴ Length of bases in m = 1.6 m and 2.2 m
Similarly, length of altitude in m = 1.2 m
Area of trapezium = 1/2 (Sum of lengths of parallel sides) × altitude
Area of trapezium = 1/2 (1.6 + 2.2) × 1.2
Area of trapezium = 1/2 × 3.8 × 1.2 = 2.28
So, Area of trapezium = $2.28m^2$

4. Find the height of a trapezium, the sum of the lengths of whose bases (parallel sides) is 60 cm and whose area is 600 cm^2.

Solution:

Given that,

Length of bases of trapezium = 60 cm

Area = 600 cm^2

We know that,

Area of trapezium = 1/2 (Sum of lengths of parallel sides) × altitude

600 = 1/2 (60) × altitude

600 = 30 × altitude

Which implies, altitude = 600/30 = 20

∴ Length of altitude is 20 cm

5. Find the altitude of a trapezium whose area is 65 cm^2 and whose base are 13 cm and 26 cm.

Solution:

Given that,

Length of bases of trapezium = 13 cm and 26 cm

Area = 65 cm^2

We know that,

Area of trapezium = 1/2 (Sum of lengths of parallel sides) × altitude

65 = 1/2 (13 + 26) × altitude

65 = 39/2 × altitude

Which implies, altitude = (65×2) /39 = 130/39 = 10/3

∴ Length of altitude = 10/3 cm

6. Find the sum of the lengths of the bases of a trapezium whose area is 4.2 m^2 and whose height is 280 cm.

Solution:

Given that,

Height of trapezium = 280 cm = 2.8m

Area = 4.2 m^2

We know that,

Area of trapezium = 1/2 (Sum of lengths of parallel sides) × altitude

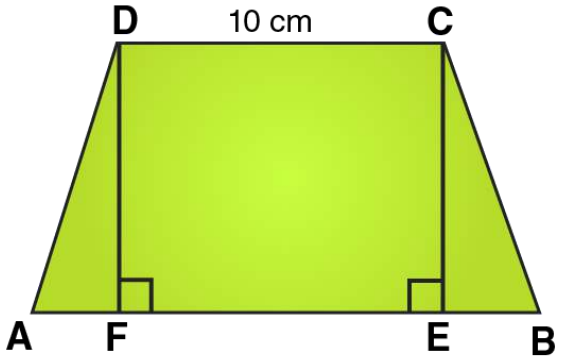
To calculate the length of parallel sides we can rewrite the above equation as,

Sum of lengths of parallel sides = (2 × Area) / altitude

Sum of lengths of parallel sides = (2 × 4.2) / 2.8 = 8.4/2.8 = 3

∴ Sum of lengths of parallel sides = 3 m

7. Find the area of a trapezium whose parallel sides of lengths 10 cm and 15 cm are at a distance of 6 cm from each other. Calculate this area as,
(i) the sum of the areas of two triangles and one rectangle.
(ii) the difference of the area of a rectangle and the sum of the areas of two triangles.
Solution:



We know that, Area of a trapezium ABCD
= area (ΔDFA) + area (rectangle DFEC) + area (ΔCEB)
= (1/2 × AF × DF) + (FE × DF) + (1/2 × EB × CE)
= (1/2 × AF × h) + (FE × h) + (1/2 × EB × h)
= 1/2 × h × (AF + 2FE + EB)
= 1/2 × h × (AF + FE + EB + FE)
= 1/2 × h × (AB + FE)
= 1/2 × h × (AB + CD) [Opposite sides of rectangle are equal]
= 1/2 × 6 × (15 + 10)
= 1/2 × 6 × 25 = 75
∴ Area of trapezium = 75 cm^2

8. The area of a trapezium is 960 cm^2. If the parallel sides are 34 cm and 46 cm, find the distance between them.
Solution:
We know that,
Area of trapezium = 1/2 (Sum of lengths of parallel sides) × distance between parallel sides
i.e., Area of trapezium = 1/2 (Sum of sides) × distance between parallel sides
To calculate the distance between parallel sides we can rewrite the above equation as,
Distance between parallel sides = (2 × Area) / Sum of sides
= (2 × 960) / (34 + 46)
= (2 × 960) / 80 = 1920/80 = 24
∴ Distance between parallel sides = 24 cm

9. Find the area of Fig. 20.35 as the sum of the areas of two trapezium and a rectangle.

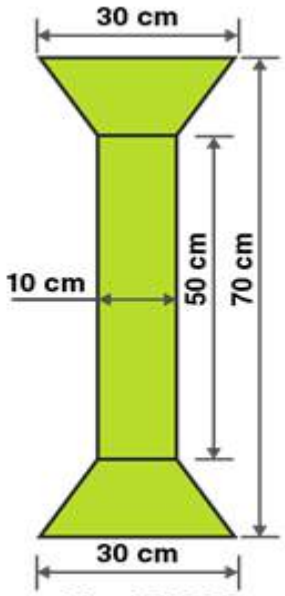


Fig. 20.35

Solution:

From the figure we can write,

Area of figure = Area of two trapeziums + Area of rectangle

Given that,

Length of rectangle = 50 cm

Breadth of rectangle = 10 cm

Length of parallel sides of trapezium = 30 cm and 10 cm

Distance between parallel sides of trapezium = (70–50)/2 = 20/2 = 10

So, Distance between parallel sides of trapezium = 10 cm

Area of figure = 2 × 1/2 (Sum of lengths of parallel sides) × altitude + Length × Breadth

Area of figure = 2 × 1/2 (30+10) × 10 + 50 × 10

Area of figure = 40 × 10 + 50 × 10

Area of figure = 400 + 500 = 900

∴ Area of figure = 900 cm^2

10. Top surface of a table is trapezium in shape. Find its area if its parallel sides are 1 m and 1.2 m and perpendicular distance between them is 0.8 m.

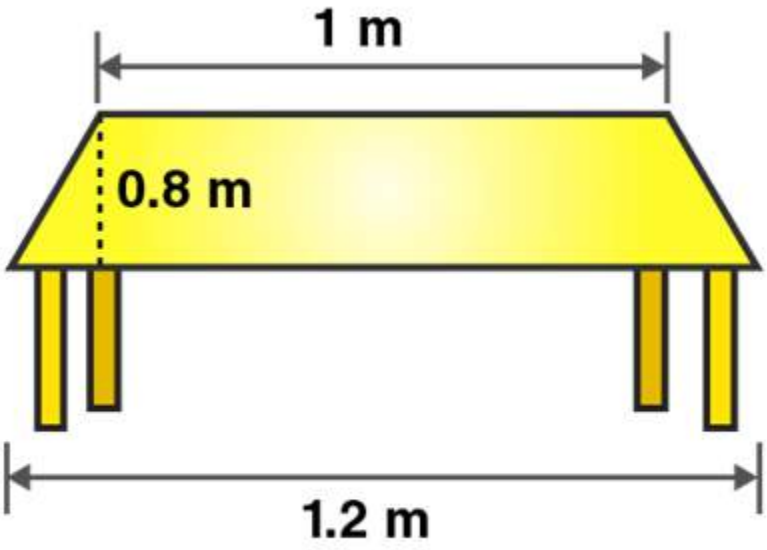


Fig. 20.36

Solution:
Given that,
Length of parallel sides of trapezium = 1.2m and 1m
Distance between parallel sides of trapezium = 0.8m
We know that,
Area of trapezium = 1/2 (Sum of lengths of parallel sides) × distance between parallel sides
i.e., Area of trapezium = 1/2 (Sum of sides) × distance between parallel sides
Area of trapezium = 1/2 (1.2 + 1) × 0.8
Area of trapezium = 1/2 × 2.2 × 0.8 = 0.88
So, Area of trapezium = $0.88m^2$

11. The cross-section of a canal is a trapezium in shape. If the canal is 10 m wide at the top 6 m wide at the bottom and the area of cross-section is 72 m^2 determine its depth.
Solution:
Given that,
Length of parallel sides of trapezium = 10m and 6m
Area = 72 m^2
Let the distance between parallel sides of trapezium = x meter
We know that,
Area of trapezium = 1/2 (Sum of lengths of parallel sides) × distance between parallel sides

i.e., Area of trapezium = 1/2 (Sum of sides) × distance between parallel sides
72 = 1/2 (10 + 6) × x
72 = 8 × x
x = 72/8 = 9
∴ The depth is 9m.

12. The area of a trapezium is 91 cm^2 and its height is 7 cm. If one of the parallel sides is longer than the other by 8 cm, find the two parallel sides.
Solution:
Given that,
Let the length of one parallel side of trapezium = x meter
Length of other parallel side of trapezium = (x+8) meter
Area of trapezium = 91 cm^2
Height = 7 cm
We know that,
Area of trapezium = 1/2 (Sum of lengths of parallel sides) × altitude
91 = 1/2 (x+x+8) × 7
91 = 1/2(2x+8) × 7
91 = (x+4) × 7
(x+4) = 91/7
x+4 = 13
x = 13 – 4
x = 9
∴ Length of one parallel side of trapezium = 9 cm
And, Length of other parallel side of trapezium = x+8 = 9+8 = 17 cm

13. The area of a trapezium is 384 cm^2. Its parallel sides are in the ratio 3:5 and the perpendicular distance between them is 12 cm. Find the length of each one of the parallel sides.
Solution:
Given that,
Let the length of one parallel side of trapezium = 3x meter
Length of other parallel side of trapezium = 5x meter
Area of trapezium = 384 cm^2
Distance between parallel sides = 12 cm
We know that,
Area of trapezium = 1/2 (Sum of lengths of parallel sides) × distance between parallel sides
i.e., Area of trapezium = 1/2 (Sum of sides) × distance between parallel sides

384 = 1/2 (3x + 5x) × 12
384 = 1/2 (8x) × 12
4x = 384/12
4x = 32
x = 8
∴ Length of one parallel side of trapezium = 3x = 3× 8 = 24 cm
And, Length of other parallel side of trapezium = 5x = 5× 8 = 40 cm

14. Mohan wants to buy a trapezium shaped field. Its side along the river is parallel and twice the side along the road. If the area of this field is 10500 m^2 and the perpendicular distance between the two parallel sides is 100 m, find the length of the side along the river.

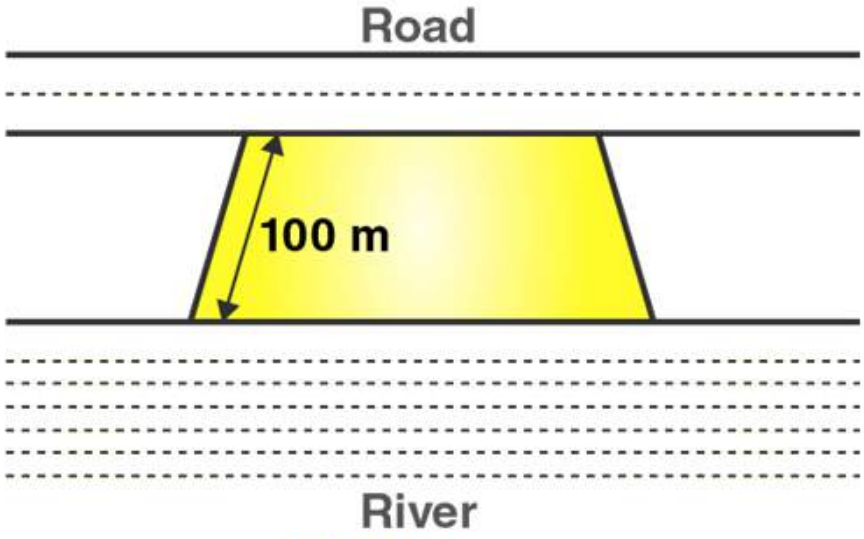


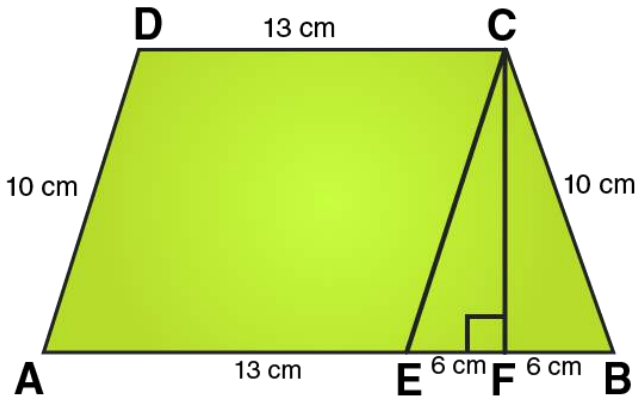
Fig. 20.37

Solution:
Given that,
Let the length of side of trapezium shaped field along road = x meter
Length of other side of trapezium shaped field along road = 2x meter
Area of trapezium = 10500 cm^2
Distance between parallel sides = 100 m
We know that,
Area of trapezium = 1/2 (Sum of lengths of parallel sides) × distance between parallel sides
i.e., Area of trapezium = 1/2 (Sum of sides) × distance between parallel sides
10500 = 1/2 (x + 2x) × 100
10500 = 1/2 (3x) × 100

3x = 10500/50
3x = 210
x = 210/3 = 70
x = 70
∴ Length of side of trapezium shaped field along road = 70 m
And, Length of other side of trapezium shaped field along road = 2x = 70× 2 = 140 m

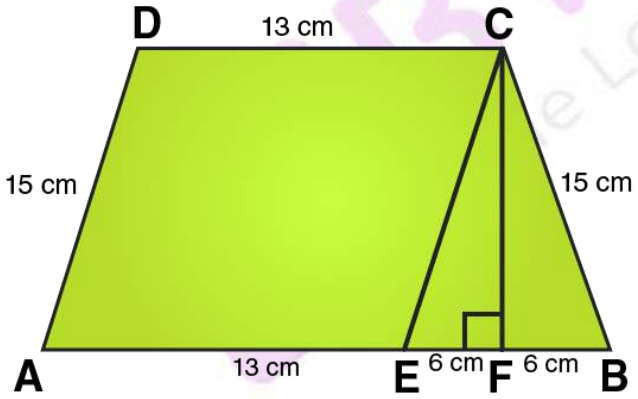
15. The area of a trapezium is 1586 cm^2 and the distance between the parallel sides is 26 cm. If one of the parallel sides is 38 cm, find the other.
Solution:
Given that,
Let the length of other parallel side of trapezium = x cm
Length of one parallel side of trapezium = 38 cm
Area of trapezium = 1586 cm^2
Distance between parallel sides = 26 cm
We know that,
Area of trapezium = 1/2 (Sum of lengths of parallel sides) × distance between parallel sides
i.e., Area of trapezium = 1/2 (Sum of sides) × distance between parallel sides
1586 = 1/2 (x + 38) × 26
1586 = (x + 38) × 13
(x + 38) = 1586/13
x = 122 – 38
x =84
∴ Length of the other parallel side of trapezium = 84 cm

16. The parallel sides of a trapezium are 25 cm and 13 cm; its nonparallel sides are equal, each being 10 cm, find the area of the trapezium.
Solution:



In ΔCEF,
CE = 10 cm and EF = 6cm
Using Pythagoras theorem:
$CE^2 = CF^2 + EF^2$
$CF^2 = CE^2 - EF^2$
$CF^2 = 10^2 - 6^2$
$CF^2 = 100-36$
$CF^2 = 64$
CF = 8 cm
From the figure we can write,
Area of trapezium = Area of parallelogram AECD + Area of area of triangle CEF
Area of trapezium = base × height + 1/2 (base × height)
Area of trapezium = 13 × 8 + 1/2 (12 × 8)
Area of trapezium = 104 + 48 = 152
∴ Area of trapezium = 152 cm^2

17. Find the area of a trapezium whose parallel sides are 25 cm, 13 cm and the other sides are 15 cm each.
Solution:



In ΔCEF,
CE = 10 cm and EF = 6cm
Using Pythagoras theorem:
$CE^2 = CF^2 + EF^2$
$CF^2 = CE^2 - EF^2$
$CF^2 = 15^2 - 6^2$
$CF^2 = 225-36$
$CF^2 = 189$
$CF = \sqrt{189}$

$= \sqrt{}(9\times21)$
$= 3\sqrt{}21$ cm
From the figure we can write,
Area of trapezium = Area of parallelogram AECD + Area of area of triangle CEF
Area of trapezium = height + 1/2 (sum of parallel sides)
Area of trapezium = $3\sqrt{}21 \times 1/2\ (25 + 13)$
Area of trapezium = $3\sqrt{}21 \times 19 = 57\sqrt{}21$
∴ Area of trapezium = $57\sqrt{}21$ cm^2

18. If the area of a trapezium is 28 cm^2 and one of its parallel sides is 6 cm, find the other parallel side if its altitude is 4 cm.
Solution:
Given that,
Let the length of other parallel side of trapezium = x cm
Length of one parallel side of trapezium = 6 cm
Area of trapezium = 28 cm^2
Length of altitude of trapezium = 4 cm
We know that,
Area of trapezium = 1/2 (Sum of lengths of parallel sides) × distance between parallel sides
i.e., Area of trapezium = 1/2 (Sum of sides) × distance between parallel sides
$28 = 1/2\ (6 + x) \times 4$
$28 = (6 + x) \times 2$
$(6 + x) = 28/2$
$(6 + x) = 14$
$x = 14 – 6$
$x = 8$
∴ Length of the other parallel side of trapezium = 8 cm

19. In Fig. 20.38, a parallelogram is drawn in a trapezium, the area of the parallelogram is 80 cm^2, find the area of the trapezium.

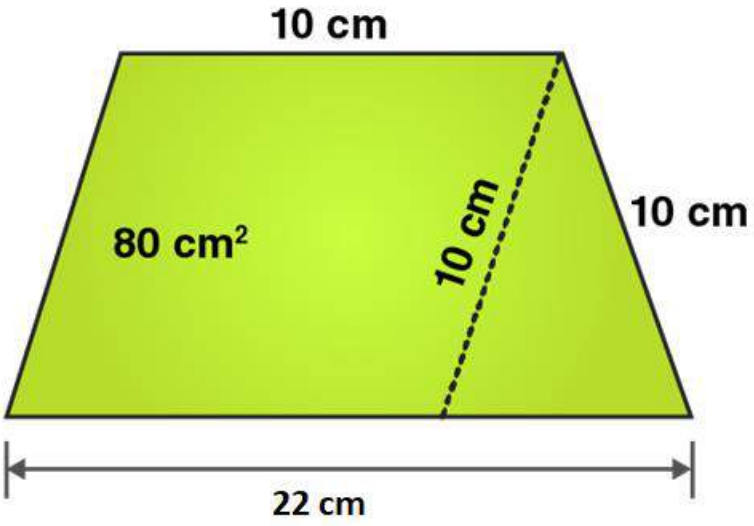
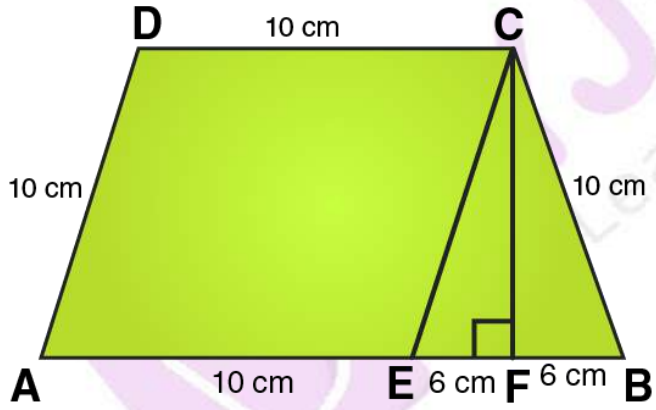


Fig. 20.38

Solution:



In ΔCEF,
CE = 10 cm and EF = 6cm
Using Pythagoras theorem:
$CE^2 = CF^2 + EF^2$
$CF^2 = CE^2 - EF^2$
$CF^2 = 10^2 - 6^2$
$CF^2 = 100-36$
$CF^2 = 64$
CF = 8 cm
Area of parallelogram = 80 cm^2
From the figure we can write,
Area of trapezium = Area of parallelogram AECD + Area of area of triangle CEF
Area of trapezium = base × height + 1/2 (base × height)

Area of trapezium = 10 × 8 + 1/2 (12 × 8)
Area of trapezium = 80 + 48 = 128
∴ Area of trapezium = 128 cm^2

20. Find the area of the field shown in Fig. 20.39 by dividing it into a square, a rectangle and a trapezium.

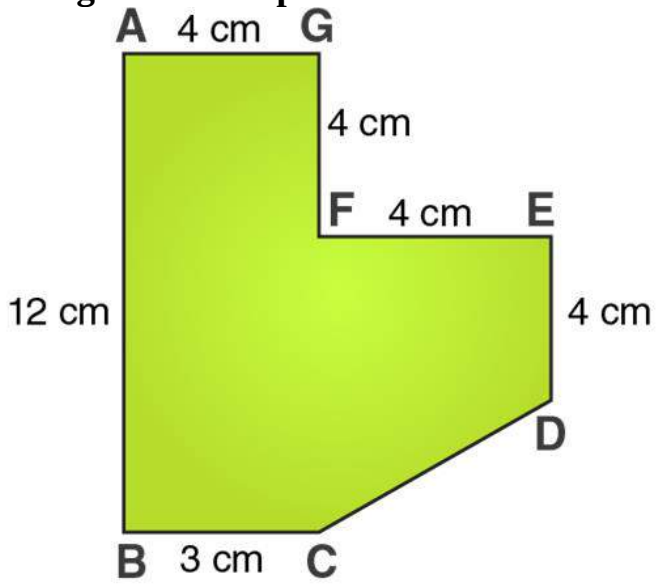
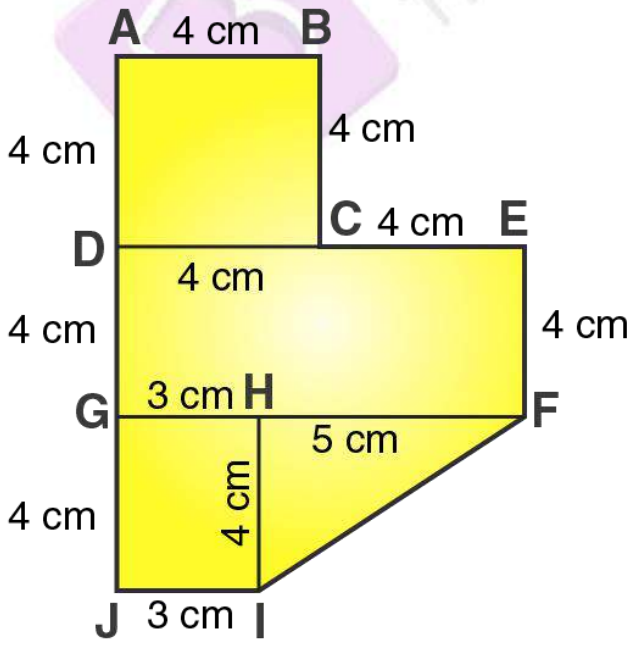


Fig. 20.39

Solution:



From the figure we can write,
Area of given figure = Area of square ABCD + Area of rectangle DEFG + Area of rectangle GHIJ + Area of triangle FHI
i.e., Area of given figure = side × side + length × breadth + length × breadth + 1/2 × base × altitude
Area of given figure = 4×4 + 8×4 + 3×4 + 1/2×5×5
Area of given figure = 16 + 32 + 12 + 10 = 70
∴ Area of given figure = 70 cm^2