

EXERCISE 20.2

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 = $\frac{1}{2}$ (Sum of lengths of parallel sides) \times altitude

Area of trapezium = $\frac{1}{2}$ (1.2 + 2.0) \times 1

Area of trapezium = $\frac{1}{2} \times 3.2 = 1.6$

So, Area of trapezium = 1.6m²

(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 = $\frac{1}{2}$ (Sum of lengths of parallel sides) \times altitude

Area of trapezium = $\frac{1}{2}$ (0.28 + 0.3) \times 0.25

Area of trapezium = $\frac{1}{2} \times 0.58 \times 0.25 = 0.0725$

So, Area of trapezium = 0.0725m²

(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 = $\frac{1}{2}$ (Sum of lengths of parallel sides) \times altitude

Area of trapezium = $\frac{1}{2}$ (8 + 6) \times 4

Area of trapezium = $\frac{1}{2} \times 56 = 28$
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

\therefore Length of bases in m = 1.5 m and 3 m

Similarly, length of altitude in m = 0.9 m

Area of trapezium = $\frac{1}{2}$ (Sum of lengths of parallel sides) \times altitude

Area of trapezium = $\frac{1}{2} (1.5 + 3) \times 0.9$

Area of trapezium = $\frac{1}{2} \times 4.5 \times 0.9 = 2.025$

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 = $\frac{1}{2}$ (Sum of lengths of parallel sides) \times altitude

Area of trapezium = $\frac{1}{2} (15 + 9) \times 8$

Area of trapezium = $\frac{1}{2} \times 192 = 96$

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

\therefore Length of bases in m = 1.6 m and 2.2 m

Similarly, length of altitude in m = 1.2 m

Area of trapezium = $\frac{1}{2}$ (Sum of lengths of parallel sides) \times altitude

Area of trapezium = $\frac{1}{2} (1.6 + 2.2) \times 1.2$

Area of trapezium = $\frac{1}{2} \times 3.8 \times 1.2 = 2.28$

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 cm².

Solution:

Given that,

Length of bases of trapezium = 60 cm

Area = 600 cm²

We know that,

Area of trapezium = $\frac{1}{2}$ (Sum of lengths of parallel sides) \times altitude

$600 = \frac{1}{2} (60) \times \text{altitude}$

$600 = 30 \times \text{altitude}$

Which implies, altitude = $600/30 = 20$

\therefore Length of altitude is 20 cm

5. Find the altitude of a trapezium whose area is 65 cm² and whose base are 13 cm and 26 cm.

Solution:

Given that,

Length of bases of trapezium = 13 cm and 26 cm

Area = 65 cm²

We know that,

Area of trapezium = $\frac{1}{2}$ (Sum of lengths of parallel sides) \times altitude

$65 = \frac{1}{2} (13 + 26) \times \text{altitude}$

$65 = \frac{39}{2} \times \text{altitude}$

Which implies, altitude = $(65 \times 2) / 39 = 130/39 = 10/3$

\therefore Length of altitude = $10/3$ cm

6. Find the sum of the lengths of the bases of a trapezium whose area is 4.2 m² and whose height is 280 cm.

Solution:

Given that,

Height of trapezium = 280 cm = 2.8m

Area = 4.2 m²

We know that,

Area of trapezium = $\frac{1}{2}$ (Sum of lengths of parallel sides) \times altitude

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

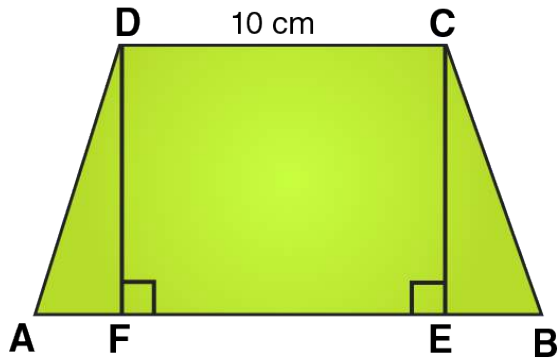
Sum of lengths of parallel sides = $(2 \times \text{Area}) / \text{altitude}$

Sum of lengths of parallel sides = $(2 \times 4.2) / 2.8 = 8.4/2.8 = 3$

\therefore 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 ($\triangle DFA$) + area (rectangle DFEC) + area ($\triangle CEB$)
= $(\frac{1}{2} \times AF \times DF) + (FE \times DF) + (\frac{1}{2} \times EB \times CE)$
= $(\frac{1}{2} \times AF \times h) + (FE \times h) + (\frac{1}{2} \times EB \times h)$
= $\frac{1}{2} \times h \times (AF + 2FE + EB)$
= $\frac{1}{2} \times h \times (AF + FE + EB + FE)$
= $\frac{1}{2} \times h \times (AB + FE)$
= $\frac{1}{2} \times h \times (AB + CD)$ [Opposite sides of rectangle are equal]
= $\frac{1}{2} \times 6 \times (15 + 10)$
= $\frac{1}{2} \times 6 \times 25 = 75$
 \therefore 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 = $\frac{1}{2}$ (Sum of lengths of parallel sides) \times distance between parallel sides

i.e., Area of trapezium = $\frac{1}{2}$ (Sum of sides) \times distance between parallel sides

To calculate the distance between parallel sides we can rewrite the above equation as,

Distance between parallel sides = $(2 \times \text{Area}) / \text{Sum of sides}$

$$= (2 \times 960) / (34 + 46)$$

$$= (2 \times 960) / 80 = 1920/80 = 24$$

\therefore 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.

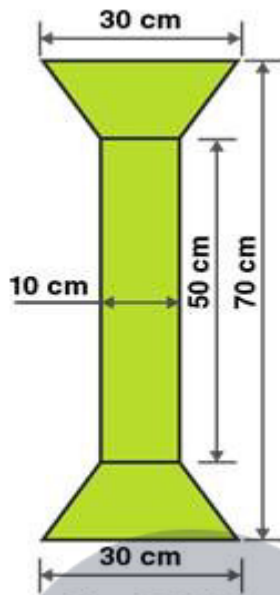


Fig. 20.35

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 = $2 \times \frac{1}{2} (\text{Sum of lengths of parallel sides}) \times \text{altitude} + \text{Length} \times \text{Breadth}$

Area of figure = $2 \times \frac{1}{2} (30+10) \times 10 + 50 \times 10$

Area of figure = $40 \times 10 + 50 \times 10$

Area of figure = $400 + 500 = 900$

\therefore 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.

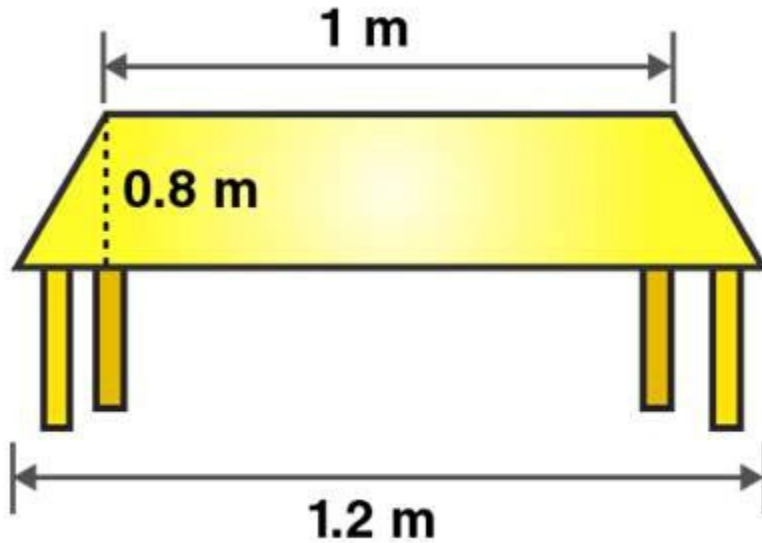


Fig. 20.36

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 = $\frac{1}{2}$ (Sum of lengths of parallel sides) \times distance between parallel sides

i.e., Area of trapezium = $\frac{1}{2}$ (Sum of sides) \times distance between parallel sides

Area of trapezium = $\frac{1}{2}$ (1.2 + 1) \times 0.8

Area of trapezium = $\frac{1}{2} \times 2.2 \times 0.8 = 0.88$

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 = $\frac{1}{2}$ (Sum of lengths of parallel sides) \times distance between parallel sides

i.e., Area of trapezium = $\frac{1}{2}$ (Sum of sides) \times distance between parallel sides

$$72 = \frac{1}{2} (10 + 6) \times x$$

$$72 = 8 \times x$$

$$x = 72/8 = 9$$

\therefore 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 = $\frac{1}{2}$ (Sum of lengths of parallel sides) \times altitude

$$91 = \frac{1}{2} (x+x+8) \times 7$$

$$91 = \frac{1}{2}(2x+8) \times 7$$

$$91 = (x+4) \times 7$$

$$(x+4) = 91/7$$

$$x+4 = 13$$

$$x = 13 - 4$$

$$x = 9$$

\therefore Length of one parallel side of trapezium = 9 cm

And, Length of other parallel side of trapezium = $x+8 = 9+8 = 17 \text{ cm}$

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 = $\frac{1}{2}$ (Sum of lengths of parallel sides) \times distance between parallel sides

i.e., Area of trapezium = $\frac{1}{2}$ (Sum of sides) \times distance between parallel sides

$$384 = \frac{1}{2} (3x + 5x) \times 12$$

$$384 = \frac{1}{2} (8x) \times 12$$

$$4x = 384/12$$

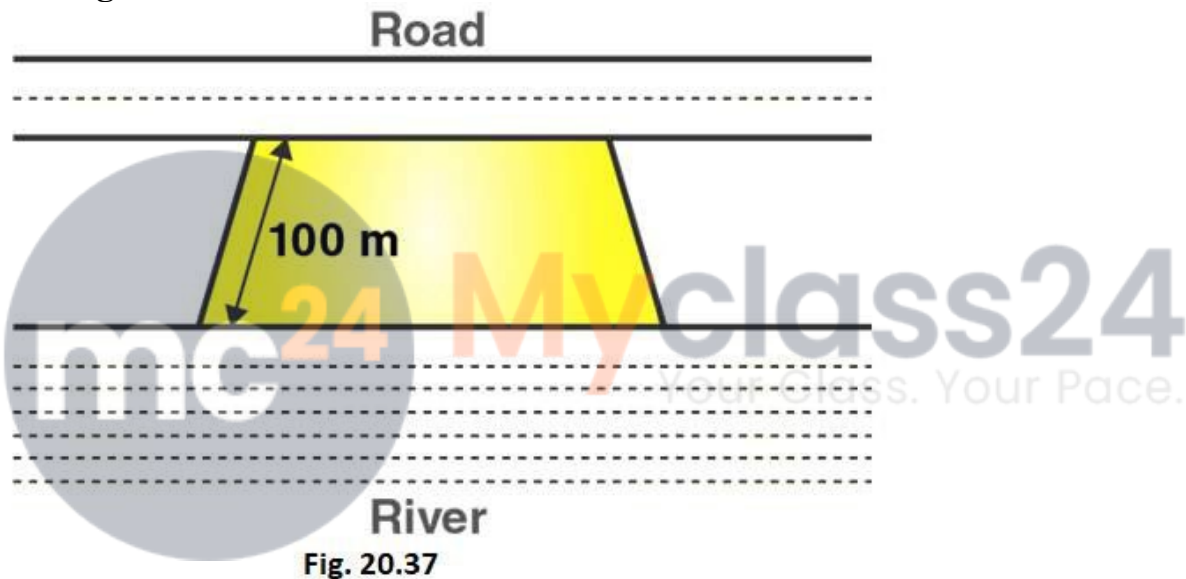
$$4x = 32$$

$$x = 8$$

∴ Length of one parallel side of trapezium = $3x = 3 \times 8 = 24$ cm

And, Length of other parallel side of trapezium = $5x = 5 \times 8 = 40$ 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.



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 = $\frac{1}{2}$ (Sum of lengths of parallel sides) \times distance between parallel sides

i.e., Area of trapezium = $\frac{1}{2}$ (Sum of sides) \times distance between parallel sides

$$10500 = \frac{1}{2} (x + 2x) \times 100$$

$$10500 = \frac{1}{2} (3x) \times 100$$

$$3x = 10500/50$$

$$3x = 210$$

$$x = 210/3 = 70$$

$$x = 70$$

∴ Length of side of trapezium shaped field along road = 70 m

And, Length of other side of trapezium shaped field along road = $2x = 70 \times 2 = 140$ 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) \times distance between parallel sides

i.e., Area of trapezium = $1/2$ (Sum of sides) \times distance between parallel sides

$$1586 = 1/2 (x + 38) \times 26$$

$$1586 = (x + 38) \times 13$$

$$(x + 38) = 1586/13$$

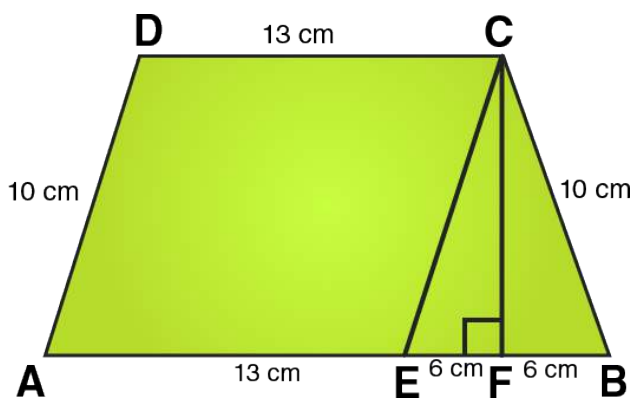
$$x = 122 - 38$$

$$x = 84$$

∴ 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 $\triangle CEF$,

$CE = 10$ cm and $EF = 6$ cm

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 \times height + $1/2$ (base \times height)

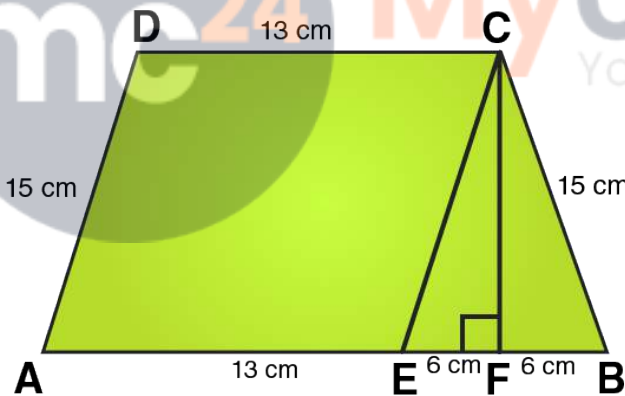
$$\text{Area of trapezium} = 13 \times 8 + 1/2 (12 \times 8)$$

$$\text{Area of trapezium} = 104 + 48 = 152$$

$$\therefore \text{Area of trapezium} = 152 \text{ cm}^2$$

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 $\triangle CEF$,

$CE = 10$ cm and $EF = 6$ cm

Using Pythagoras theorem:

$$CE^2 = CF^2 + EF^2$$

$$CF^2 = CE^2 - EF^2$$

$$CF^2 = 15^2 - 6^2$$

$$CF^2 = 225 - 36$$

$$CF^2 = 189$$

$$CF = \sqrt{189}$$

$$= \sqrt{9 \times 21}$$
$$= 3\sqrt{21} \text{ cm}$$

From the figure we can write,

Area of trapezium = Area of parallelogram AECD + Area of area of triangle CEF

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

Area of trapezium = $3\sqrt{21} \times \frac{1}{2} (25 + 13)$

Area of trapezium = $3\sqrt{21} \times 19 = 57\sqrt{21}$

\therefore Area of trapezium = $57\sqrt{21} \text{ cm}^2$

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 = $x \text{ cm}$

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 = $\frac{1}{2}$ (Sum of lengths of parallel sides) \times distance between parallel sides

i.e., Area of trapezium = $\frac{1}{2}$ (Sum of sides) \times distance between parallel sides

$$28 = \frac{1}{2} (6 + x) \times 4$$

$$28 = (6 + x) \times 2$$

$$(6 + x) = \frac{28}{2}$$

$$(6 + x) = 14$$

$$x = 14 - 6$$

$$x = 8$$

\therefore 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.

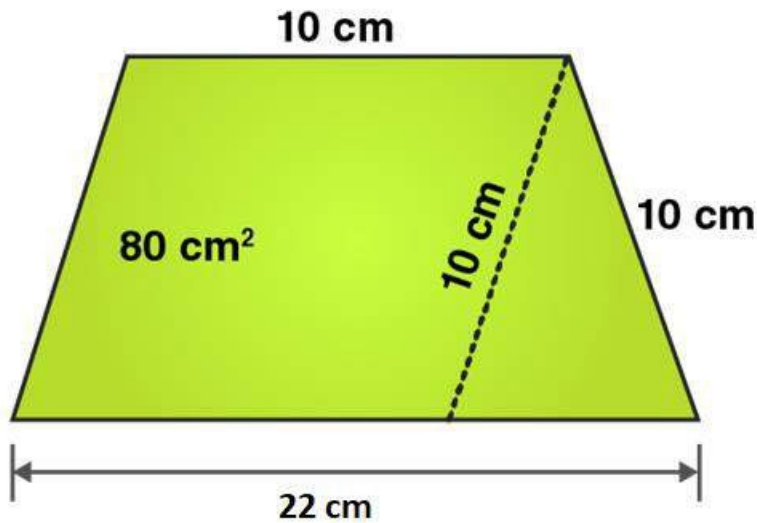
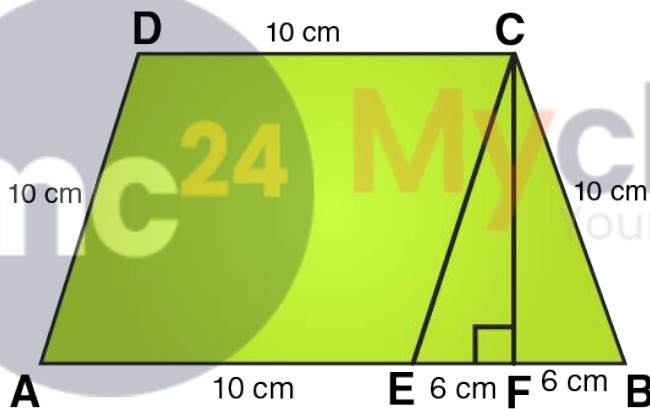


Fig. 20.38

Solution:



In $\triangle CEF$,

$CE = 10$ cm and $EF = 6$ cm

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 cm²

From the figure we can write,

Area of trapezium = Area of parallelogram AECD + Area of area of triangle CEF

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

$$\text{Area of trapezium} = 10 \times 8 + \frac{1}{2} (12 \times 8)$$

$$\text{Area of trapezium} = 80 + 48 = 128$$

$$\therefore \text{Area of trapezium} = 128 \text{ cm}^2$$

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

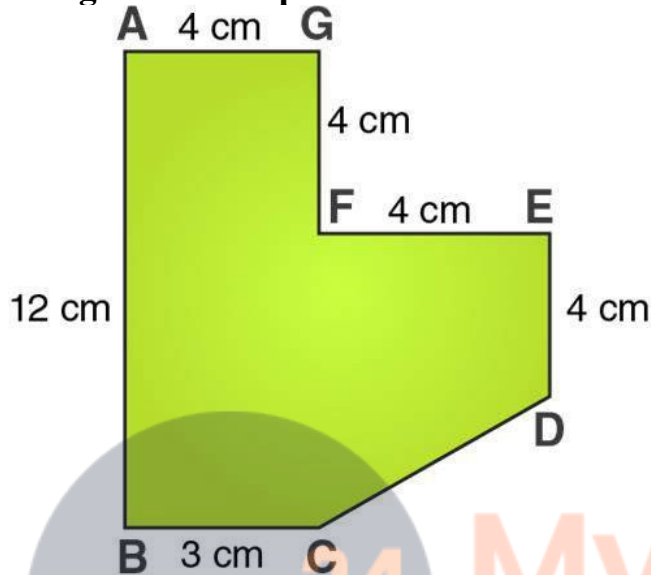
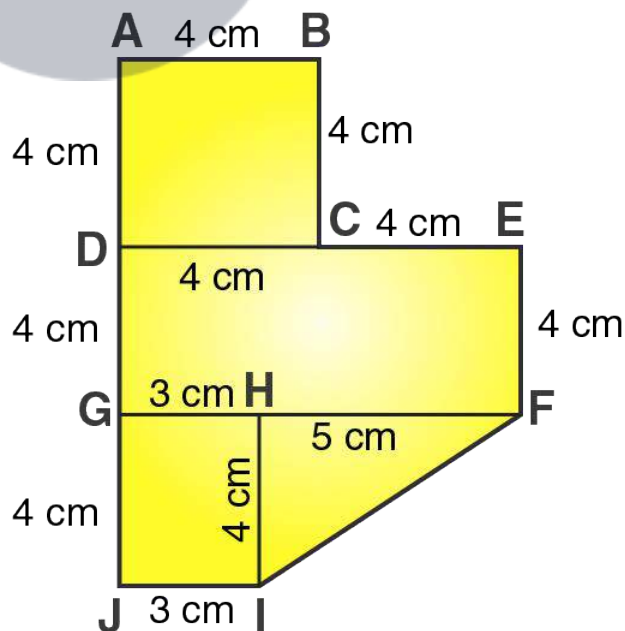


Fig. 20.39

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 \times side + length \times breadth + length \times breadth + $1/2 \times$ base \times altitude

Area of given figure = $4 \times 4 + 8 \times 4 + 3 \times 4 + 1/2 \times 5 \times 5$

Area of given figure = $16 + 32 + 12 + 10 = 70$

\therefore Area of given figure = 70 cm^2



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