

EXERCISE 20.3

Find the area of the pentagon shown in fig. 20.48, if $AD = 10$ cm, $AG = 8$ cm, $AH = 6$ cm, $AF = 5$ cm, $BF = 5$ cm, $CG = 7$ cm and $EH = 3$ cm.

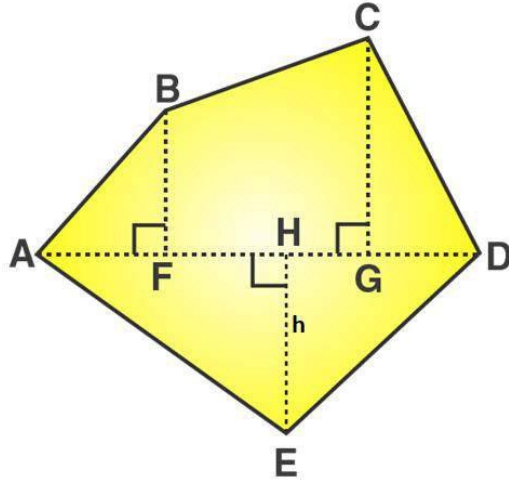


Fig. 20.48

Solution:

$$GH = AG - AH = 8 - 6 = 2 \text{ cm}$$

$$HF = AH - AF = 6 - 5 = 1 \text{ cm}$$

$$GD = AD - AG = 10 - 8 = 2 \text{ cm}$$

From the figure we can write,

Area of given figure = Area of triangle AFB + Area of trapezium BCGF + Area of triangle CGD + Area of triangle AHE + Area of triangle EGD

We know that,

$$\text{Area of right angled triangle} = \frac{1}{2} \times \text{base} \times \text{altitude}$$

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

$$\text{Area of given pentagon} = \frac{1}{2} \times AF \times BF + \frac{1}{2} (CG + BF) \times FG + \frac{1}{2} \times GD \times CG + \frac{1}{2} \times AH \times EH + \frac{1}{2} \times HD \times EH$$

$$\text{Area of given pentagon} = \frac{1}{2} \times 5 \times 5 + \frac{1}{2} (7 + 5) \times 3 + \frac{1}{2} \times 2 \times 7 + \frac{1}{2} \times 6 \times 3 + \frac{1}{2} \times 4 \times 3$$

$$\text{Area of given pentagon} = 12.5 + 18 + 7 + 9 + 6 = 52.5$$

$$\therefore \text{Area of given pentagon} = 52.5 \text{ cm}^2$$

1. Find the area enclosed by each of the following figures [fig. 20.49 (i)-(ii)] as the sum of the areas of a rectangle and a trapezium.

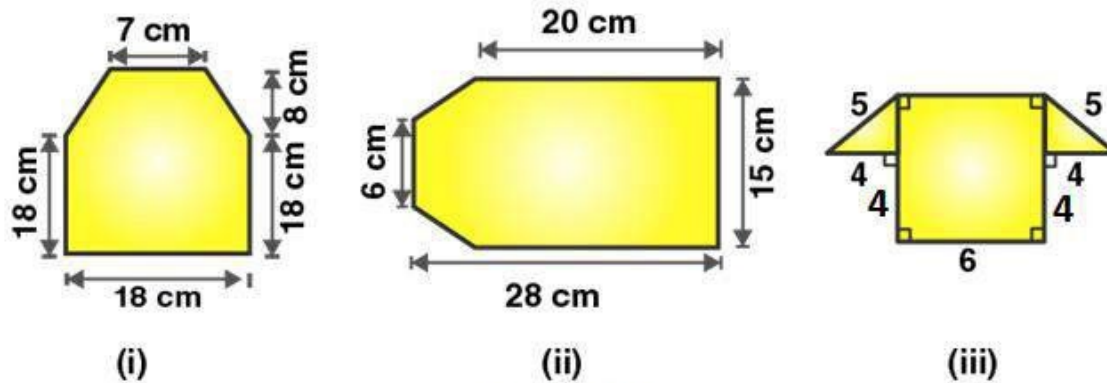


Fig. 20.49

Solution:

Figure (i)

From the figure we can write,

Area of figure = Area of trapezium + Area of rectangle

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

Area of figure = $\frac{1}{2}$ (18 + 7) \times 8 + 18 \times 18

Area of figure = $\frac{1}{2}$ (25) \times 8 + 18 \times 18

Area of figure = 100 + 324 = 424

\therefore Area of figure is 424 cm²

Figure (ii)

From the figure we can write,

Area of figure = Area of trapezium + Area of rectangle

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

Area of given figure = $\frac{1}{2}$ (15 + 6) \times 8 + 15 \times 20

Area of given figure = 84 + 300 = 384

\therefore Area of figure is 384 cm²

Figure (iii)

Using Pythagoras theorem in the right angled triangle,

$$5^2 = 4^2 + x^2$$

$$x^2 = 25 - 16$$

$$x^2 = 9$$

$$x = 3 \text{ cm}$$

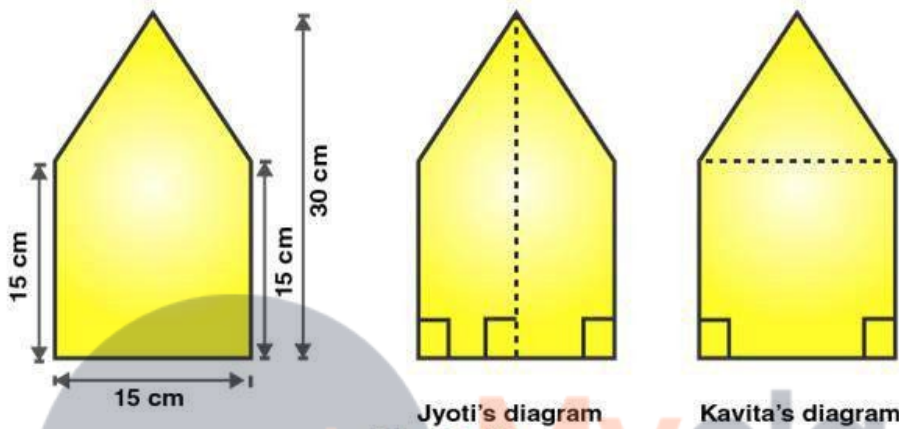
From the figure we can write,

Area of figure = Area of trapezium + Area of rectangle

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

Area of given figure = $\frac{1}{2} (14 + 6) \times 3 + 4 \times 6$
 Area of given figure = $30 + 24 = 54$
 \therefore Area of figure is 54 cm^2

2. There is a pentagonal shaped park as shown in Fig. 20.50. Jyoti and Kavita divided it in two different ways. Find the area of this park using both ways. Can you suggest some another way of finding its area?



Jyoti's diagram
 Fig. 20.50

Kavita's diagram

Solution:

From the figure we can write,

Area of figure = Area of trapezium + Area of rectangle

Area of Jyoti's diagram = $2 \times \frac{1}{2} (\text{Sum of lengths of parallel sides}) \times \text{altitude}$

Area of figure = $2 \times \frac{1}{2} \times (15 + 30) \times 7.5$

Area of figure = $45 \times 7.5 = 337.5$

Therefore, Area of figure = 337.5 cm^2

We also know that,

Area of Pentagon = Area of triangle + area of rectangle

Area of Pentagon = $\frac{1}{2} \times \text{Base} \times \text{Altitude} + \text{Length} \times \text{Breadth}$

Area of Pentagon = $\frac{1}{2} \times 15 \times 15 + 15 \times 15$

Area of Pentagon = $112.5 + 225 = 337.5$

\therefore Area of pentagon is 337.5 m^2

3. Find the area of the following polygon, if AL = 10 cm, AM = 20 cm, AN = 50 cm. AO = 60 cm and AD = 90 cm.

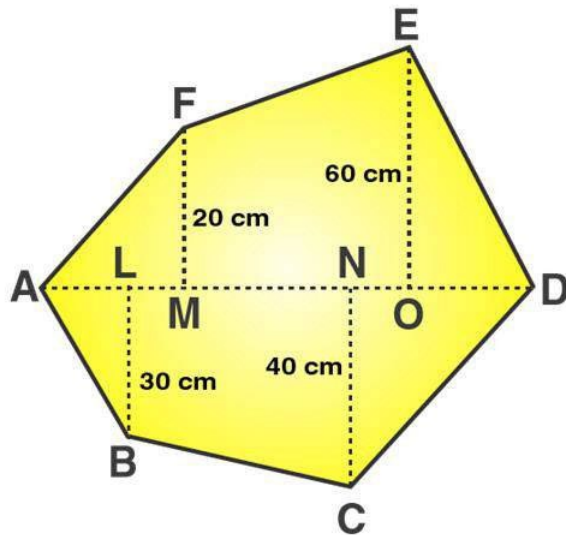


Fig. 20.51

Solution:

Given that,

$$AL = 10 \text{ cm}; AM = 20 \text{ cm}; AN = 50 \text{ cm}; AO = 60 \text{ cm}; AD = 90 \text{ cm}$$

$$LM = AM - AL = 20 - 10 = 10 \text{ cm}$$

$$MN = AN - AM = 50 - 20 = 30 \text{ cm}$$

$$OD = AD - AO = 90 - 60 = 30 \text{ cm}$$

$$ON = AO - AN = 60 - 50 = 10 \text{ cm}$$

$$DN = OD + ON = 30 + 10 = 40 \text{ cm}$$

$$OM = MN + ON = 30 + 10 = 40 \text{ cm}$$

$$LN = LM + MN = 10 + 30 = 40 \text{ cm}$$

From the figure we can write,

Area of figure = Area of triangle AMF + Area of trapezium FMNE + Area of triangle END + Area of triangle ALB + Area of trapezium LBCN + Area of triangle DNC

We know that,

$$\text{Area of right angled triangle} = \frac{1}{2} \times \text{base} \times \text{altitude}$$

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

$$\text{Area of given hexagon} = \frac{1}{2} \times AM \times FM + \frac{1}{2} (MF + OE) \times OM + \frac{1}{2} \times OD \times OE + \frac{1}{2} \times AL \times BL + \frac{1}{2} \times (BL + CN) \times LN + \frac{1}{2} \times DN \times CN$$

$$\text{Area of given hexagon} = \frac{1}{2} \times 20 \times 20 + \frac{1}{2} (20 + 60) \times 40 + \frac{1}{2} \times 30 \times 60 + \frac{1}{2} \times 10 \times 30 + \frac{1}{2} \times (30 + 40) \times 40 + \frac{1}{2} \times 40 \times 40$$

$$\text{Area of given hexagon} = 200 + 1600 + 900 + 150 + 1400 + 800 = 5050$$

$$\therefore \text{Area of given hexagon is } 5050 \text{ cm}^2$$

4. Find the area of the following regular hexagon.

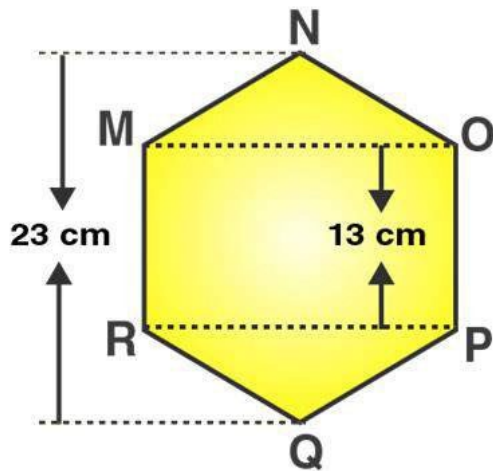


Fig. 20.52

Solution:

Given that,

$$NQ = 23 \text{ cm}$$

$$NA = BQ = 10/2 = 5 \text{ cm}$$

$$MR = OP = 13 \text{ cm}$$

In the right triangle BPQ

$$PQ^2 = BQ^2 + BP^2$$

Substituting the values

$$(13)^2 = (5)^2 + BP^2$$

$$169 = 25 + BP^2$$

So we get

$$BP^2 = 169 - 25 = 144$$

$$BP = 12 \text{ cm}$$

Here

$$PR = MO = 2 \times 12 = 24 \text{ cm}$$

$$\text{Area of rectangle RPOM} = RP \times PO = 24 \times 13 = 312 \text{ cm}^2$$

$$\text{Area of triangle PRQ} = 1/2 \times PR \times BQ$$

$$= 1/2 \times 24 \times 5$$

$$= 60 \text{ cm}^2$$

$$\text{Area of triangle MON} = 60 \text{ cm}^2$$

$$\text{Area of hexagon} = 312 + 60 + 60 = 432 \text{ cm}^2$$

Therefore, area of given hexagon is 432 cm^2