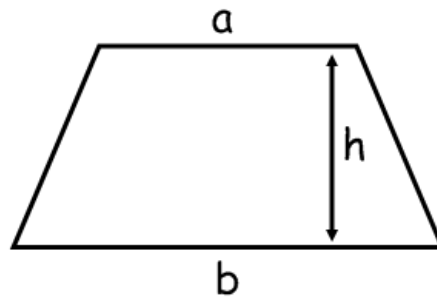


Area of Trapezium and Polygon

Ex 18A



$$\text{Area of Trapezium} = \frac{1}{2}h(a+b)$$

∴ Area of the trapezium = Area of the rectangle + Area of the triangle

$$= bh + \frac{1}{2}(a-b)h$$

$$= h \left[b + \frac{1}{2}(a-b) \right]$$

$$= h \left[\frac{2b}{2} + \frac{a-b}{2} \right]$$

$$= h \left[\frac{2b+a-b}{2} \right]$$

$$= h \left(\frac{a+b}{2} \right)$$

$$= \left(\begin{array}{l} \text{Half the sum of} \\ \text{parallel sides} \end{array} \right) \times \left(\begin{array}{l} \text{Perpendicular distance} \\ \text{between the parallel sides} \end{array} \right)$$

Q1.

Answer :

Area of a trapezium = $\frac{1}{2} \times (\text{Sum of parallel sides}) \times (\text{Distance between them})$

$$= \left\{ \frac{1}{2} \times (24 + 20) \times 15 \right\} \text{ cm}^2$$

$$= \left(\frac{1}{2} \times 44 \times 15 \right) \text{ cm}^2$$

$$= (22 \times 15) \text{ cm}^2$$

$$= 330 \text{ cm}^2$$

Hence, the area of the trapezium is 330 cm^2 .

Q2.

Answer :

Area of a trapezium = $\frac{1}{2} \times (\text{Sum of parallel sides}) \times (\text{Distance between them})$

$$= \left\{ \frac{1}{2} \times (38.7 + 22.3) \times 16 \right\} \text{ cm}^2$$

$$= \left(\frac{1}{2} \times 61 \times 16 \right) \text{ cm}^2$$

$$= (61 \times 8) \text{ cm}^2$$

$$= 488 \text{ cm}^2$$

Hence, the area of the trapezium is 488 cm^2 .

Q3.

Answer :

Area of a trapezium = $\frac{1}{2} \times (\text{Sum of parallel sides}) \times (\text{Distance between them})$

$$= \left\{ \frac{1}{2} \times (1 + 1.4) \times 0.9 \right\} \text{ m}^2$$

$$= \left(\frac{1}{2} \times 2.4 \times 0.9 \right) \text{ m}^2$$

$$= (1.2 \times 0.9) \text{ m}^2$$

$$= 1.08 \text{ m}^2$$

Hence, the area of the top surface of the table is 1.08 m^2 .

Q4.

Answer :

Let the distance between the parallel sides be x .

Now,

$$\begin{aligned}\text{Area of trapezium} &= \left\{ \frac{1}{2} \times (55 + 35) \times x \right\} \text{ cm}^2 \\ &= \left(\frac{1}{2} \times 90 \times x \right) \text{ cm}^2 \\ &= 45x \text{ cm}^2\end{aligned}$$

Area of the trapezium = 1080 cm² (Given)

$$\therefore 45x = 1080$$

$$\Rightarrow x = \frac{1080}{45}$$

$$\Rightarrow x = 24 \text{ cm}$$

Hence, the distance between the parallel sides is 24 cm.

Q5.

Answer :

Let the length of the required side be x cm.

Now,

$$\begin{aligned}\text{Area of trapezium} &= \left\{ \frac{1}{2} \times (84 + x) \times 26 \right\} \text{ m}^2 \\ &= (1092 + 13x) \text{ m}^2\end{aligned}$$

Area of trapezium = 1586 m² (Given)

$$\therefore 1092 + 13x = 1586$$

$$\Rightarrow 13x = (1586 - 1092)$$

$$\Rightarrow 13x = 494$$

$$\Rightarrow x = \frac{494}{13}$$

$$\Rightarrow x = 38 \text{ m}$$

Hence, the length of the other side is 38 m.

Q6.

Answer :

Let the lengths of the parallel sides of the trapezium be $4x$ cm and $5x$ cm, respectively.

Now,

$$\begin{aligned}\text{Area of trapezium} &= \left\{ \frac{1}{2} \times (4x + 5x) \times 18 \right\} \text{ cm}^2 \\ &= \left(\frac{1}{2} \times 9x \times 18 \right) \text{ cm}^2 \\ &= 81x \text{ cm}^2\end{aligned}$$

Area of trapezium = 405 cm² (Given)

$$\therefore 81x = 405$$

$$\Rightarrow x = \frac{405}{81}$$

$$\Rightarrow x = 5 \text{ cm}$$

$$\text{Length of one side} = (4 \times 5) \text{ cm} = 20 \text{ cm}$$

$$\text{Length of the other side} = (5 \times 5) \text{ cm} = 25 \text{ cm}$$

Q7.

Answer :

Let the lengths of the parallel sides be x cm and $(x + 6)$ cm.

Now,

$$\begin{aligned}\text{Area of trapezium} &= \left\{ \frac{1}{2} \times (x + x + 6) \times 9 \right\} \text{ cm}^2 \\ &= \left(\frac{1}{2} \times (2x + 6) \times 9 \right) \text{ cm}^2 \\ &= 4.5(2x + 6) \text{ cm}^2 \\ &= (9x + 27) \text{ cm}^2\end{aligned}$$

Area of trapezium = 180 cm^2 (Given)

$$\therefore 9x + 27 = 180$$

$$\Rightarrow 9x = (180 - 27)$$

$$\Rightarrow 9x = 153$$

$$\Rightarrow x = \frac{153}{9}$$

$$\Rightarrow x = 17$$

Hence, the lengths of the parallel sides are 17 cm and 23 cm, that is, $(17 + 6)$ cm.

Q8.

Answer :

Let the lengths of the parallel sides be x cm and $2x$ cm.

$$\begin{aligned}\text{Area of trapezium} &= \left\{ \frac{1}{2} \times (x + 2x) \times 84 \right\} \text{ m}^2 \\ &= \left(\frac{1}{2} \times 3x \times 84 \right) \text{ m}^2 \\ &= (42 \times 3x) \text{ m}^2 \\ &= 126x \text{ m}^2\end{aligned}$$

Area of the trapezium = 9450 m^2 (Given)

$$\therefore 126x = 9450$$

$$\Rightarrow x = \frac{9450}{126}$$

$$\Rightarrow x = 75$$

Thus, the length of the parallel sides are 75 m and 150 m, that is, (2×75) m, and the length of the longer side is 150 m.

Q9.

Answer :

$$\begin{aligned}\text{Length of the side AB} &= (130 - (54 + 19 + 42)) \text{ m} \\ &= 15 \text{ m}\end{aligned}$$

$$\begin{aligned}\text{Area of the trapezium - shaped field} &= \left\{ \frac{1}{2} \times (AD + BC) \times AB \right\} \\ &= \left\{ \frac{1}{2} \times (42 + 54) \times 15 \right\} \text{ m}^2 \\ &= \left(\frac{1}{2} \times 96 \times 15 \right) \text{ m}^2 \\ &= (48 \times 15) \text{ m}^2 \\ &= 720 \text{ m}^2\end{aligned}$$

Hence, the area of the field is 720 m^2 .

Q10.

Answer :

$$\angle ABC = 90^\circ$$

From the right $\triangle ABC$, we have :

$$AB^2 = (AC^2 - BC^2)$$

$$\Rightarrow AB^2 = \{(41^2) - (40^2)\}$$

$$\Rightarrow AB^2 = (1681 - 1600)$$

$$\Rightarrow AB^2 = 81$$

$$\Rightarrow AB = \sqrt{81}$$

$$\Rightarrow AB = 9 \text{ cm}$$

$$\therefore \text{Length } AB = 9 \text{ cm}$$

Now,

$$\text{Area of the trapezium} = \left\{ \frac{1}{2} \times (AD + BC) \times AB \right\}$$

$$= \left(\frac{1}{2} \times (16 + 40) \times 9 \right) \text{ cm}^2$$

$$= \left(\frac{1}{2} \times 56 \times 9 \right) \text{ cm}^2$$

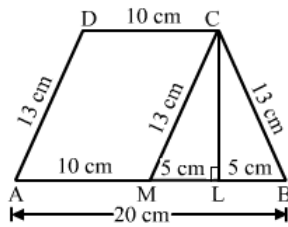
$$= (28 \times 9) \text{ cm}^2$$

$$= 252 \text{ cm}^2$$

Hence, the area of the trapezium is 252 cm^2 .

Q11.

Answer :



Let ABCD be the given trapezium in which $AB \parallel DC$, $AB = 20 \text{ cm}$, $DC = 10 \text{ cm}$ and $AD = BC = 13 \text{ cm}$.

Draw $CL \perp AB$ and $CM \parallel DA$ meeting AB at L and M , respectively.

Clearly, $AMCD$ is a parallelogram.

Now,

$$AM = DC = 10 \text{ cm}$$

$$MB = (AB - AM)$$

$$= (20 - 10) \text{ cm}$$

$$= 10 \text{ cm}$$

Also,

$$CM = DA = 13 \text{ cm}$$

Therefore, $\triangle CMB$ is an isosceles triangle and $CL \perp MB$.

L is the midpoint of B .

$$\begin{aligned}\Rightarrow ML &= LB = \left(\frac{1}{2} \times MB\right) \\ &= \left(\frac{1}{2} \times 10\right) \text{ cm} \\ &= 5 \text{ cm}\end{aligned}$$

From right $\triangle CLM$, we have :

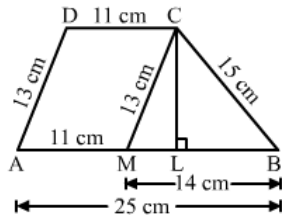
$$\begin{aligned}CL^2 &= (CM^2 - ML^2) \text{ cm}^2 \\ \Rightarrow CL^2 &= \{(13)^2 - (5)^2\} \text{ cm}^2 \\ \Rightarrow CL^2 &= (109 - 25) \text{ cm}^2 \\ \Rightarrow CL^2 &= 144 \text{ cm}^2 \\ \Rightarrow CL &= \sqrt{144} \text{ cm} \\ \Rightarrow CL &= 12 \text{ cm} \\ \therefore \text{Length of CL} &= 12 \text{ cm}\end{aligned}$$

$$\begin{aligned}\text{Area of the trapezium} &= \left\{\frac{1}{2} \times (AB + DC) \times CL\right\} \\ &= \left\{\frac{1}{2} \times (20 + 10) \times 12\right\} \text{ cm}^2 \\ &= \left(\frac{1}{2} \times 30 \times 12\right) \text{ cm}^2 \\ &= (15 \times 12) \text{ cm}^2 \\ &= 180 \text{ cm}^2\end{aligned}$$

Hence, the area of the trapezium is 180 cm^2 .

Q12

Answer :



Let ABCD be the trapezium in which $AB \parallel DC$, $AB = 25 \text{ cm}$, $CD = 11 \text{ cm}$, $AD = 13 \text{ cm}$ and $BC = 15 \text{ cm}$.

Draw $CL \perp AB$ and $CM \parallel DA$ meeting AB at L and M , respectively.

Clearly, $AMCD$ is a parallelogram.

Now,

$$\begin{aligned}MC &= AD = 13 \text{ cm} \\ AM &= DC = 11 \text{ cm} \\ \Rightarrow MB &= (AB - AM) \\ &= (25 - 11) \text{ cm} \\ &= 14 \text{ cm}\end{aligned}$$

Thus, in $\triangle CMB$, we have :

$$\begin{aligned}CM &= 13 \text{ cm} \\ MB &= 14 \text{ cm} \\ BC &= 15 \text{ cm} \\ \therefore s &= \frac{1}{2} (13 + 14 + 15) \text{ cm} \\ &= \frac{1}{2} 42 \text{ cm} \\ &= 21 \text{ cm} \\ (s - a) &= (21 - 13) \text{ cm} \\ &= 8 \text{ cm} \\ (s - b) &= (21 - 14) \text{ cm} \\ &= 7 \text{ cm} \\ (s - c) &= (21 - 15) \text{ cm} \\ &= 6 \text{ cm}\end{aligned}$$

$$\begin{aligned}\therefore \text{Area of } \triangle CMB &= \sqrt{s(s-a)(s-b)(s-c)} \\ &= \sqrt{21 \times 8 \times 7 \times 6} \text{ cm}^2 \\ &= 84 \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\therefore \frac{1}{2} \times MB \times CL &= 84 \text{ cm}^2 \\ \Rightarrow \frac{1}{2} \times 14 \times CL &= 84 \text{ cm}^2 \\ \Rightarrow CL &= \frac{84}{7} \\ \Rightarrow CL &= 12 \text{ cm}\end{aligned}$$

$$\begin{aligned}\text{Area of the trapezium} &= \left\{ \frac{1}{2} \times (\text{AB} + \text{DC}) \times \text{CL} \right\} \\ &= \left\{ \frac{1}{2} \times (25 + 11) \times 12 \right\} \text{ cm}^2 \\ &= \left(\frac{1}{2} \times 36 \times 12 \right) \text{ cm}^2 \\ &= (18 \times 12) \text{ cm}^2 \\ &= 216 \text{ cm}^2\end{aligned}$$

Hence, the area of the trapezium is 216 cm^2 .