

## 18. Area of a Trapezium and a Polygon

### Exercise 18A

#### 1. Question

Find the area of a trapezium whose parallel sides are 24 cm and 20 cm and the distance between them is 15 cm.

#### Answer

Given:

Length of parallel sides is 24cm and 20 cm

Height (h) = 15 cm

We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

Therefore, Area of trapezium =  $\frac{1}{2} \times (24 + 20) \times 15 = 330 \text{ cm}^2$ .

#### 2. Question

Find the area of a trapezium whose parallel sides are 38.7 cm and 22.3 cm, and the distance between them is 16 cm.

#### Answer

Given

Length of parallel sides is 38.7cm and 22.3 cm

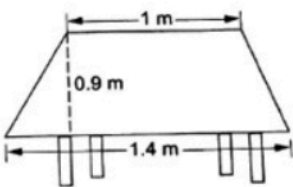
Height (h) = 16 cm

We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

Therefore Area of trapezium =  $\frac{1}{2} \times (38.7 + 22.3) \times 16 = 488 \text{ cm}^2$ .

#### 3. Question

The shape of the top surface of a table is trapezium. Its parallel sides are 1 m and 1.4 m and the perpendicular distance between them is 0.9 cm. Find its area.



#### Answer

Given

Length of parallel sides is 1m and 1.4m

Height (h) = 0.9m

We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

Therefore Area of trapezium =  $\frac{1}{2} \times (1 + 1.4) \times 0.9$

= 1.08 m<sup>2</sup>.

#### 4. Question

The area of a trapezium is 1080 cm<sup>2</sup>. If the lengths of its parallel sides be 55 cm and 35 cm, find the distance

between them.

### Answer

Given

Length of parallel sides is 55cm and 35 cm

Area of trapezium =  $1080 \text{ cm}^2$

Let Height (h) =  $y \text{ cm}$

We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

Therefore Area of trapezium is  $\frac{1}{2} \times (55 + 35) \times y = 1080 \text{ cm}^2$ .

$$\therefore \frac{1}{2} \times (90) \times y = 1080$$

$$\Rightarrow 45 \times y = 1080$$

$$\Rightarrow y = \frac{1080}{45} = 24$$

$\therefore$  Distance between the parallel lines is 24 cm.

### 5. Question

A field is in the form of a trapezium. Its area is  $1586 \text{ m}^2$  and the distance between its parallel sides is 26 m. If one of the parallel sides is 84 m, find the other.

### Answer

Given

Let length of parallel sides be 84cm and  $y \text{ cm}$

Area of trapezium =  $1586 \text{ cm}^2$

Let Height (h) = 26 cm

We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

Therefore Area of trapezium is  $\frac{1}{2} \times (84 + y) \times 26 = 1586 \text{ cm}^2$ .

$$\therefore \frac{1}{2} \times (84 + y) \times 26 = 1586$$

$$\Rightarrow (84 + y) \times 13 = 1586$$

$$\Rightarrow 84 + y = \frac{1586}{13}$$

$$\Rightarrow y = 122 - 84 = 38$$

$\therefore$  Length of the other parallel side is 38 cm.

### 6. Question

The area of a trapezium is  $405 \text{ cm}^2$ . Its parallel sides are in the ratio 4:5 and the distance between them is 18 cm. Find the length of each of the parallel sides.

### Answer

Given

Lengths of the parallel sides are in the ratio 4:5

Therefore let one of the side length be  $4X$  and other side length be  $5X$

Area of trapezium =  $405 \text{ cm}^2$

Let Height (h) = 18 cm

We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

Therefore Area of trapezium is  $\frac{1}{2} \times (4X + 5X) \times 18 = 405 \text{ cm}^2$ .

$$\therefore \frac{1}{2} \times (4X + 5X) \times 18 = 405$$

$$\Rightarrow (9X) \times 9 = 405$$

$$\Rightarrow 81X = 405$$

$$\Rightarrow X = \frac{405}{81} = 5$$

$\therefore$  Length of the parallel sides is  $4X = 4 \times 5 = 20 \text{ cm}$  and  $5X = 5 \times 5 = 25 \text{ cm}$ .

Therefore lengths of the parallel sides are 20 cm, 25 cm.

### 7. Question

The area of a trapezium is  $180 \text{ cm}^2$  and its height is 9 cm. If one of the parallel sides is longer than the other by 6 cm, find the two parallel sides.

### Answer

Given

Let length of first parallel side X

Length of other parallel side is X + 6

Area of trapezium =  $180 \text{ cm}^2$

Let Height (h) = 9 cm

We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

Therefore Area of trapezium is  $\frac{1}{2} \times (X + 6 + X) \times 9 = 180 \text{ cm}^2$ .

$$\therefore \frac{1}{2} \times (X + 6 + X) \times 9 = 180$$

$$\Rightarrow \frac{1}{2} \times (2X + 6) \times 9 = 180$$

$$\Rightarrow 2X + 6 = \frac{180}{9} \times 2$$

$$\Rightarrow 2X + 6 = 40$$

$$\Rightarrow 2X = 40 - 6 = 34$$

$$\Rightarrow X = 17$$

$\therefore$  Length of the parallel sides is  $X = 17 \text{ cm}$  and  $X + 6 = 17 + 6 = 23 \text{ cm}$ .

Therefore lengths of the parallel sides are 17 cm, 23 cm.

### 8. Question

In a trapezium-shaped field, one of the parallel sides is twice the other. If the area of the field is  $9450 \text{ m}^2$  and the perpendicular distance between the two parallel sides is 84 m, find the length of the longer of the parallel sides.

### Answer

Given

Let length of first parallel side X

Length of other parallel side is 2X

Area of trapezium = 9450 m<sup>2</sup>

Let Height (h) = 84 m

We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

Therefore Area of trapezium is  $\frac{1}{2} \times (X + 2X) \times 84 = 9450 \text{ cm}^2$ .

$$\therefore \frac{1}{2} \times (X + 2X) \times 84 = 9450$$

$$\Rightarrow (3X) \times 42 = 9450$$

$$\Rightarrow 126X = 9450$$

$$\Rightarrow 2X + 6 = \frac{9450}{126} = 75$$

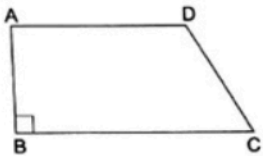
$$\Rightarrow X = 17$$

$\therefore$  Length of the parallel sides is X = 75 m and 2X = 150 m.

Therefore length of the longest is 150 m.

### 9. Question

The length of the fence of a trapezium-shaped field ABCD is 130 m and side AB is perpendicular to each of the parallel sides AD and BC. If BC = 54 m, CD = 19 m and AD = 42 m, find the area of the field.



### Answer

Given

Length of parallel sides

$$AD = 42 \text{ m}$$

$$BC = 54 \text{ m}$$

Given that total length of fence is 130 m

$$\text{That is } AB + BC + CD + DA = 130$$

$$AB + 54 + 19 + 42 = 130$$

$$\text{Therefore } AB = 15$$

$$\text{Height (AB) = 15 m}$$

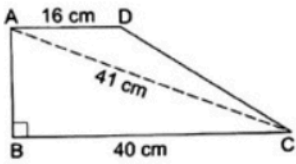
We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

$$\text{Therefore Area of trapezium} = \frac{1}{2} \times (42 + 54) \times 15 = 720 \text{ m}^2$$

### 10. Question

In the given figure, ABCD is a trapezium in which  $AD \parallel BC$ ,  $\angle ABC = 90^\circ$ ,  $AD = 16 \text{ cm}$ ,

$AC = 41 \text{ cm}$  and  $BC = 40 \text{ cm}$ . find the area of the trapezium.



### Answer

Given

$$AD = 16 \text{ cm}$$

$$BC = 40 \text{ cm}$$

$$AC = 41 \text{ cm}$$

$$\angle ABC = 90$$

Height = AB = ?

Here in  $\triangle ABC$  using Pythagoras theorem

$$AC^2 = AB^2 + BC^2$$

$$41^2 = AB^2 + 40^2$$

$$AB^2 = 41^2 - 40^2$$

$$AB^2 = 1681 - 1600 = 81$$

$$\therefore AB = 9$$

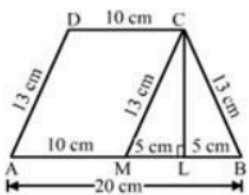
We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

$$\text{Therefore Area of trapezium} = \frac{1}{2} \times (16 + 40) \times 9 = 252 \text{ cm}^2.$$

### 11. Question

The parallel sides of a trapezium are 20 cm and 10 cm. Its nonparallel sides are both equal, each being 13 cm. Find the area of the trapezium.

### 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,

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

$$MB = (AB - AM)$$

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

Also,

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

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

And L is midpoint of B.

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

From right  $\triangle CLM$ , we have:

$$CL^2 = (CM^2 - ML^2)$$

$$CL^2 = (13^2 - 5^2)$$

$$CL^2 = (169 - 25)$$

$$CL^2 = 144$$

$$CL = 12$$

Therefore length of CL is 12 cm that is height of trapezium is 12 cm

There fore

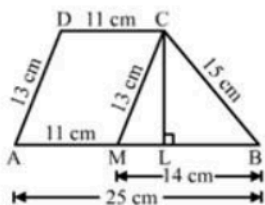
We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

$$\text{Therefore Area of trapezium} = \frac{1}{2} \times (20 + 10) \times 12 = 180\text{ cm}^2.$$

## 12. Question

The parallel sides of a trapezium are 25 cm and 11 cm, while its nonparallel sides are 15 cm and 13 cm. find the area of the trapezium.

**Answer**



Let ABCD be the given trapezium in which  $AB \parallel DC$ ,

$$AB = 25\text{ cm}, DC = 11\text{ cm and } AD = 13\text{ cm}, BC = 15\text{ cm}$$

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

Clearly, AMCD is a parallelogram.

Now,

$$MC = AD = 13\text{ cm}$$

$$AM = DC = 11\text{ cm}$$

$$MB = (AB - AM)$$

$$= (25 - 11) = 14\text{ cm}$$

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

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

$$MB = 14\text{ cm}$$

$$BC = 15\text{ cm}$$

Here let  $ML = X$ , hence  $LB = 14 - X$  and let  $CL = Y\text{ cm}$

Now in  $\triangle CML$ , using Pythagoras theorem

$$CL^2 = (CM^2 - ML^2)$$

$$Y^2 = (132 - X^2) \text{ eq - 1}$$

Again in  $\triangle CLB$ , using Pythagoras theorem

$$CL^2 = (CB^2 - LB^2)$$

$$Y^2 = (152 - (14 - X)^2) \text{ eq - 2}$$

Sub eq 1 in 2, we get

$$(132 - X^2) = (152 - (14 - X)^2)$$

$$169 - X^2 = 225 - (196 + X^2 - 28X)$$

$$169 - X^2 = 225 - 196 - X^2 + 28X$$

$$28X = 169 + 196 - 225 + X^2 - X^2$$

$$28X = 140$$

$$X = 5 \text{ cm}$$

Now substitute X value in eq -1

$$\text{That is } Y^2 = (132 - X^2)$$

$$Y^2 = (132 - 5^2)$$

$$Y^2 = (169 - 25)$$

$$Y^2 = 144$$

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

Therefore  $CL = 12 \text{ cm}$  that is height of the trapezium = 12 cm

Therefore

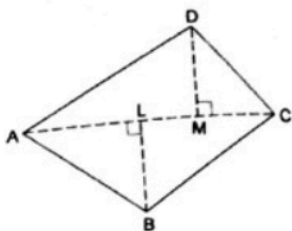
We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

$$\text{Therefore Area of trapezium} = \frac{1}{2} \times (25 + 11) \times 12 = 216 \text{ cm}^2.$$

## Exercise 18B

### 1. Question

In the given figure, ABCD is a quadrilateral in which  $AC = 24 \text{ cm}$ ,  $BL \perp AC$  and  $DM \perp AC$  such that  $BL = 8 \text{ cm}$  and  $DM = 7 \text{ cm}$ . find the area of quad. ABCD.



### Answer

Given: A quadrilateral ABCD

$BL \perp AC$  and  $DM \perp AC$

$AC = 24 \text{ cm}$

$$BL = 8 \text{ cm}$$

$$DM = 7 \text{ cm}$$

Here,

$$\text{Area (quad. ABCD)} = \text{area } (\triangle ABC) + \text{area } (\triangle ADC)$$

$$\text{Area of triangle} = \frac{1}{2} \times (\text{base}) \times (\text{height}).$$

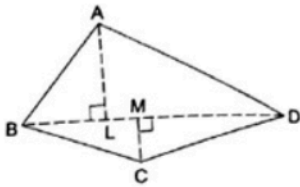
Therefore

$$\begin{aligned} \text{Area of quad ABCD} &= \frac{1}{2} \times (AC) \times (BL) + \frac{1}{2} \times (AC) \times (DM) \\ &= \frac{1}{2} \times (24) \times (8) + \frac{1}{2} \times (24) \times (7) = 96 + 84 = 180 \text{ cm}^2 \end{aligned}$$

Therefore area of the quadrilateral ABCD is  $180 \text{ cm}^2$

## 2. Question

In the given figure, ABCD is a quadrilateral-shaped field in which diagonal BD is 36 m,  $AL \perp BD$  and  $CM \perp BD$  such that  $AL = 19 \text{ m}$  and  $CM = 11 \text{ m}$ . Find the area of the field.



## Answer

Given: A quadrilateral ABCD

$$AL \perp BD \text{ and } CM \perp BD$$

$$AL = 19 \text{ cm}$$

$$BD = 36 \text{ cm}$$

$$CM = 11 \text{ cm}$$

Here,

$$\text{Area (quad. ABCD)} = \text{area } (\triangle ABD) + \text{area } (\triangle CBD)$$

$$\text{Area of triangle} = \frac{1}{2} \times (\text{base}) \times (\text{height}).$$

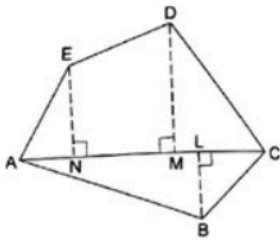
Therefore

$$\begin{aligned} \text{Area of quad ABCD} &= \frac{1}{2} \times (BD) \times (AL) + \frac{1}{2} \times (BD) \times (CM) \\ &= \frac{1}{2} \times (36) \times (19) + \frac{1}{2} \times (36) \times (11) = 342 + 198 = 540 \text{ cm}^2 \end{aligned}$$

Therefore area of the quadrilateral ABCD is  $540 \text{ cm}^2$ .

## 3. Question

Find the area of pentagon ABCDE in which  $BL \perp AC$ ,  $DM \perp AC$  and  $EN \perp AC$  such that  $AC = 18 \text{ cm}$ ,  $AM = 14 \text{ cm}$ ,  $AN = 6 \text{ cm}$ ,  $BL = 4 \text{ cm}$ ,  $DM = 12 \text{ cm}$  and  $EN = 9 \text{ cm}$ .



### Answer

Given: A pentagon ABCDE

$BL \perp AC$ ,  $DM \perp AC$  and  $EN \perp AC$

$AC = 18 \text{ cm}$

$AM = 14 \text{ cm}$

$AN = 6 \text{ cm}$

$BL = 4 \text{ cm}$

$DM = 12 \text{ cm}$

$EN = 9 \text{ cm}$

$MC = AC - AM = 18 - 14 = 4 \text{ cm}$

$MN = AM - AN = 14 - 6 = 8 \text{ cm}$

Here,

Area (Pent. ABCDE) = area ( $\triangle AEN$ ) + area ( $\triangle DMC$ ) + area ( $\triangle ABC$ ) + area (Trap. DMNE)

Area of triangle =  $\frac{1}{2} \times (\text{base}) \times (\text{height})$ .

Area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

Here,

$$\text{Area } (\triangle AEN) = \frac{1}{2} \times (AN) \times (EN) = \frac{1}{2} \times (6) \times (9) = 27 \text{ cm}^2.$$

$$\text{Area } (\triangle DMC) = \frac{1}{2} \times (MC) \times (DM) = \frac{1}{2} \times (4) \times (12) = 24 \text{ cm}^2.$$

$$\text{Area } (\triangle ABC) = \frac{1}{2} \times (AC) \times (BL) = \frac{1}{2} \times (18) \times (4) = 36 \text{ cm}^2.$$

$$\text{Area (Trap. DMNE)} = \frac{1}{2} \times (DM + EN) \times MN = \frac{1}{2} \times (12 + 9) \times 8 = 84 \text{ cm}^2.$$

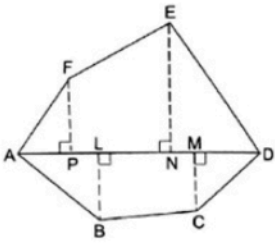
$$\therefore \text{Area (Pent. ABCDE)} = \text{area } (\triangle AEN) + \text{area } (\triangle DMC) + \text{area } (\triangle ABC) + \text{area (Trap. DMNE)}$$

$$= 27 + 24 + 36 + 84 = 171 \text{ cm}^2.$$

$$\therefore \text{Area (Pent. ABCDE)} = 171 \text{ cm}^2.$$

### 4. Question

Find the area of hexagon ABCDEF in which  $BL \perp AD$ ,  $CM \perp AD$ ,  $EN \perp AD$  and  $FP \perp AD$  such that  $AP = 6 \text{ cm}$ ,  $PL = 2 \text{ cm}$ ,  $LN = 8 \text{ cm}$ ,  $NM = 2 \text{ cm}$ ,  $MD = 3 \text{ cm}$ ,  $FP = 8 \text{ cm}$ ,  $EN = 12 \text{ cm}$ ,  $BL = 8 \text{ cm}$  and  $CM = 6 \text{ cm}$ .



### Answer

Given: A Hexagon ABCDE

$BL \perp AD$ ,  $CM \perp AD$ ,  $EN \perp AD$  and  $FP \perp AD$

$AP = 6$  cm

$PL = 2$  cm

$LN = 8$  cm

$NM = 2$  cm

$MD = 3$  cm

$FP = 8$  cm

$EN = 12$  cm

$BL = 8$  cm

$CM = 6$  cm

$AL = AP + PL = 6 + 2 = 8$  cm

$PN = PL + LN = 2 + 8 = 10$  cm

$LM = LN + NM = 8 + 2 = 10$  cm

$ND = NM + MD = 2 + 3 = 5$  cm

Here,

Area (Hex. ABCDEF) = area ( $\triangle APF$ ) + area ( $\triangle DEN$ ) + area ( $\triangle ABL$ ) + area ( $\triangle CMD$ )

+ area (Trap. PNEF) + area (Trap. LMCB)

Area of triangle =  $\frac{1}{2} \times (\text{base}) \times (\text{height})$ .

Area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

Here,

$$\text{Area } (\triangle APF) = \frac{1}{2} \times (AP) \times (FP) = \frac{1}{2} \times (6) \times (8) = 24 \text{ cm}^2.$$

$$\text{Area } (\triangle DEN) = \frac{1}{2} \times (ND) \times (EN) = \frac{1}{2} \times (5) \times (12) = 30 \text{ cm}^2.$$

$$\text{Area } (\triangle ABL) = \frac{1}{2} \times (AL) \times (BL) = \frac{1}{2} \times (8) \times (8) = 32 \text{ cm}^2.$$

$$\text{Area } (\triangle CMD) = \frac{1}{2} \times (MD) \times (CM) = \frac{1}{2} \times (3) \times (6) = 9 \text{ cm}^2.$$

$$\text{Area (Trap. PNEF)} = \frac{1}{2} \times (FP + EN) \times PN = \frac{1}{2} \times (8 + 12) \times 10 = 100 \text{ cm}^2.$$

$$\text{Area (Trap. LMCB)} = \frac{1}{2} \times (BL + CM) \times LM = \frac{1}{2} \times (8 + 6) \times 10 = 70 \text{ cm}^2.$$

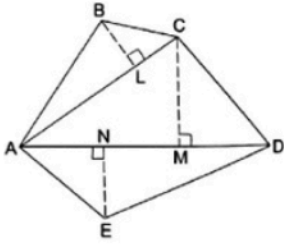
$\therefore$  Area (Hex. ABCDEF) = area ( $\triangle APF$ ) + area ( $\triangle DEN$ ) + area ( $\triangle ABL$ ) + area ( $\triangle CMD$ )

$$+ \text{area (Trap. PNEF)} + \text{area (Trap. LMCB)} = 24 + 30 + 32 + 9 + 100 + 70 = 265 \text{ cm}^2.$$

$$\therefore \text{Area (Hex. ABCDEF)} = 265 \text{ cm}^2$$

### 5. Question

Find the area of pentagon ABCDE in which  $BL \perp AC$ ,  $CM \perp AD$  and  $EN \perp AD$  such that  $AC = 10 \text{ cm}$ ,  $AD = 12 \text{ cm}$ ,  $BL = 3 \text{ cm}$ ,  $CM = 7 \text{ cm}$  and  $EN = 5 \text{ cm}$ .



### Answer

Given: A pentagon ABCDE

$BL \perp AC$ ,  $CM \perp AD$  and  $EN \perp AD$

$AC = 10 \text{ cm}$

$AD = 12 \text{ cm}$

$BL = 3 \text{ cm}$

$CM = 7 \text{ cm}$

$EN = 5 \text{ cm}$

Here,

Area (Pent. ABCDE) = area ( $\triangle ABC$ ) + area ( $\triangle ACD$ ) + area ( $\triangle ADE$ )

Area of triangle =  $\frac{1}{2} \times (\text{base}) \times (\text{height})$ .

Here,

$$\text{Area } (\triangle ABC) = \frac{1}{2} \times (AC) \times (BL) = \frac{1}{2} \times (10) \times (3) = 15 \text{ cm}^2.$$

$$\text{Area } (\triangle ACD) = \frac{1}{2} \times (AD) \times (CM) = \frac{1}{2} \times (12) \times (7) = 42 \text{ cm}^2.$$

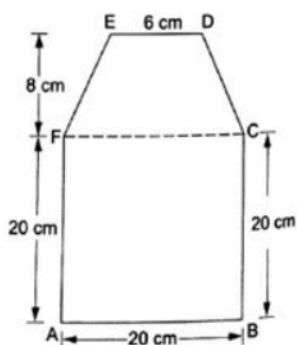
$$\text{Area } (\triangle ADE) = \frac{1}{2} \times (AD) \times (EN) = \frac{1}{2} \times (12) \times (5) = 30 \text{ cm}^2.$$

$$\therefore \text{Area (Pent. ABCDE)} = \text{area } (\triangle ABC) + \text{area } (\triangle ACD) + \text{area } (\triangle ADE) = 15 + 42 + 30 = 87 \text{ cm}^2.$$

$$\therefore \text{Area (Pent. ABCDE)} = 87 \text{ cm}^2.$$

### 6. Question

Find the area enclosed by the given figure ABCDEF as per dimensions given herewith.



## Answer

Given: A figure ABCDEF

$$AB = 20 \text{ cm}$$

$$BC = 20 \text{ cm}$$

$$ED = 6 \text{ cm}$$

$$AF = 20 \text{ cm}$$

$$AB \parallel FC$$

$$FC = 20 \text{ cm}$$

Let distance between FC and ED be  $h = 8 \text{ cm}$

$$FC \parallel ED$$

Here,

From the figure we can see that ABCF forms a square and EFCD forms a trapezium.

$$\text{Area of square} = (\text{side length})^2$$

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

Therefore,

$$\text{Area of the figure ABCDEF} = \text{Area of square (ABCF)} + \text{Area of trapezium (EFCD)}$$

Here,

$$\text{Area of square (ABCF)} = (AB)^2 = (20)^2 = 400 \text{ cm}^2$$

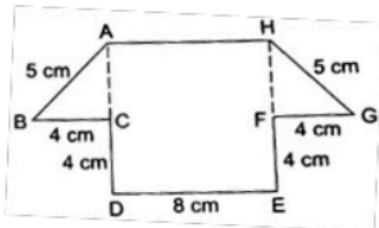
$$\text{Area of trapezium (EFCD)} = \frac{1}{2} \times (FC + ED) \times h = \frac{1}{2} \times (6 + 20) \times 8 = 104 \text{ cm}^2$$

$$\therefore \text{Area (ABCDEF)} = \text{Area of square (ABCF)} + \text{Area of trapezium (EFCD)} = 400 + 104 = 504 \text{ cm}^2.$$

$$\therefore \text{Area (Fig. ABCDEF)} = 504 \text{ cm}^2.$$

## 7. Question

Find the area of given figure ABCDEFGH as per dimensions given in it.



## Answer

Given: A figure ABCDEFGH

$$BC = FG = 4 \text{ cm}$$

$$AB = HG = 5 \text{ cm}$$

$$CD = EF = 4 \text{ cm}$$

$$ED = 8 \text{ cm}$$

$$ED \parallel AH$$

$$AH = 8 \text{ cm}$$

Here

$\triangle ABC$  and  $\triangle GHF$  are equal and right angled

$$AC = AH = ?$$

In  $\triangle ABC$  using Pythagoras theorem

$$AB^2 = BC^2 + AC^2$$

$$5^2 = 4^2 + AC^2$$

$$25 = 16 + AC^2$$

$$AC^2 = 25 - 16 = 9$$

$$AC = 3$$

$$AH = 3$$

$$\text{Area}(\text{ABCDEF}) = \text{area}(\text{Rect. ADEH}) + 2 \times \text{area}(\triangle ABC)$$

Area of rectangle = (length  $\times$  breadth)

Area of triangle =  $\frac{1}{2} \times (\text{base}) \times (\text{height})$ .

$$\text{Area}(\text{Rect. ADEH}) = (DE \times AD) = (DE \times (AC + AD)) = (8 \times (3 + 4)) = 56 \text{ cm}^2$$

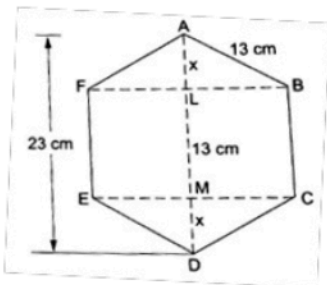
$$\text{Area}(\triangle ABC) = \frac{1}{2} \times (BC) \times (AC) = \frac{1}{2} \times (4) \times (3) = 6 \text{ cm}^2$$

$$\therefore \text{Area}(\text{ABCDEF}) = \text{area}(\text{Rect. ADEH}) + 2 \times \text{area}(\triangle ABC) = 56 + (2 \times 6) = 68 \text{ cm}^2$$

$$\therefore \text{Area}(\text{ABCDEF}) = 68 \text{ cm}^2.$$

### 8. Question

Find the area of a regular hexagon ABCDEF in which each side measures 13 cm and whose height is 23 cm, as shown in the given figure.



### Answer

Given: a regular hexagon ABCDEF

$$AB = BC = CD = DE = EF = FA = 13 \text{ cm}$$

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

Here  $AL = MD$

Therefore Let  $AL = MD = x$

Here  $AD = AL + LM + MD$

$$23 = 13 + 2x$$

$$2x = 23 - 13 = 10$$

$$x = 5$$

Now,

In  $\triangle ABL$  using Pythagoras theorem

$$AB^2 = AL^2 + LB^2$$

$$13^2 = x^2 + LB^2$$

$$13^2 = 5^2 + LB^2$$

$$169 = 25 + LB^2$$

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

$$LB = 12$$

Here area (Trap. ABCD) = area (Trap. AFED)

Therefore,

Area (Hex. ABCDEF) = 2  $\times$  area (Trap. ABCD)

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

$$\text{Area (Trap. ABCD)} = \frac{1}{2} \times (BC + AD) \times LB = \frac{1}{2} \times (13 + 23) \times 12 = 216 \text{ cm}^2.$$

$$\therefore \text{Area(ABCDEF)} = 2 \times \text{area (Trap. ABCD)} = 2 \times 216 = 432 \text{ cm}^2$$

$$\therefore \text{Area(ABCDEF)} = 432 \text{ cm}^2.$$

### Exercise 18C

#### 1. Question

The parallel sides of a trapezium measure 14 cm and 18 cm and the distance between them is 9 cm. The area of the trapezium is

- A. 96 cm<sup>2</sup>
- B. 144 cm<sup>2</sup>
- C. 189 cm<sup>2</sup>
- D. 207 cm<sup>2</sup>

#### Answer

Given

Length of parallel sides is 14cm and 18 cm

Height (h) = 9 cm

We know that area of trapezium is  $\frac{1}{2} \times$  (sum of parallel sides)  $\times$  height

$$\text{Therefore Area of trapezium} = \frac{1}{2} \times (14 + 18) \times 9 = 144 \text{ cm}^2.$$

#### 2. Question

The length of the parallel sides of a trapezium are 19 cm and 13 cm and its area is 128 cm<sup>2</sup>. The distance between the parallel sides is

- A. 9 cm
- B. 7 cm
- C. 8 cm

D. 12.5 cm

**Answer**

Given

Length of parallel sides is 19 cm and 13 cm

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

Let Height (h) =  $y \text{ cm}$

We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

Therefore Area of trapezium is  $\frac{1}{2} \times (19 + 13) \times y = 128 \text{ cm}^2$ .

$$\therefore \frac{1}{2} \times (19 + 13) \times y = 128$$

$$\Rightarrow \frac{1}{2} \times (32) \times y = 128$$

$$\Rightarrow 16 \times y = 128$$

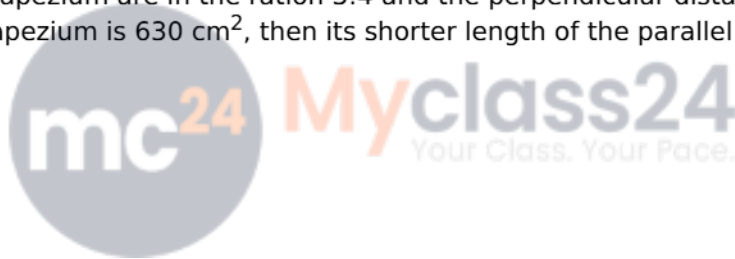
$$\Rightarrow y = \frac{128}{16} = 8 \text{ cm}$$

$\therefore$  Distance between the parallel lines is 8 cm.

**3. Question**

The parallel sides of a trapezium are in the ratio 3:4 and the perpendicular distance between them is 12 cm. If the area of the trapezium is  $630 \text{ cm}^2$ , then its shorter length of the parallel sides is

- A. 45 cm
- B. 42 cm
- C. 60 cm
- D. 36 cm



**Answer**

Given

Lengths of the parallel sides are in the ratio 3:4

Therefore let one of the side length be  $3X$  and other side length be  $4X$

Area of trapezium =  $630 \text{ cm}^2$

Let Height (h) =  $12 \text{ cm}$

We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

Therefore Area of trapezium is  $\frac{1}{2} \times (3X + 4X) \times 12 = 630 \text{ cm}^2$ .

$$\therefore \frac{1}{2} \times (3X + 4X) \times 12 = 630$$

$$\Rightarrow (7X) \times 6 = 630$$

$$\Rightarrow 42X = 630$$

$$\Rightarrow X = \frac{630}{42} = 15$$

$\therefore$  length of the parallel sides is  $3X = 3 \times 15 = 45 \text{ cm}$  and  $4X = 4 \times 15 = 60 \text{ cm}$ .

Therefore shortest length of the parallel sides is 45 cm.

#### 4. Question

The area of a trapezium is  $180 \text{ cm}^2$  and its height is  $9 \text{ cm}$ . If one of the parallel sides is longer than the other by  $6 \text{ cm}$ , the length of the longer parallel sides is

- A.  $17 \text{ cm}$
- B.  $23 \text{ cm}$
- C.  $18 \text{ cm}$
- D.  $24 \text{ cm}$

#### Answer

Given

Let length of first parallel side  $X$

Length of other parallel side is  $X + 6$

Area of trapezium =  $180 \text{ cm}^2$

Let Height ( $h$ ) =  $9 \text{ cm}$

We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

Therefore Area of trapezium is  $\frac{1}{2} \times (X + 6 + X) \times 9 = 180 \text{ cm}^2$ .

$$\therefore \frac{1}{2} \times (X + 6 + X) \times 9 = 180$$

$$\Rightarrow \frac{1}{2} \times (2X + 6) \times 9 = 180$$

$$\Rightarrow 2X + 6 = \frac{180}{9} \times 2$$

$$\Rightarrow 2X + 6 = 40$$

$$\Rightarrow 2X = 40 - 6 = 34$$

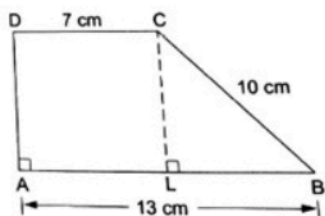
$$\Rightarrow X = 17$$

$\therefore$  length of the parallel sides is  $X = 17 \text{ cm}$  and  $X + 6 = 17 + 6 = 23 \text{ cm}$ .

Therefore length of the longer parallel side is  $23 \text{ cm}$ .

#### 5. Question

In the given figure,  $AB \parallel DC$  and  $DA \perp AB$ . If  $DC = 7 \text{ cm}$ ,  $BC = 10 \text{ cm}$ ,  $AB = 13 \text{ cm}$  and  $CL \perp AB$  the area of trap. ABCD is



- A.  $84 \text{ cm}^2$
- B.  $72 \text{ cm}^2$
- C.  $80 \text{ cm}^2$
- D.  $91 \text{ cm}^2$

#### Answer



Given:

$AB \parallel DC$ ,  $DA \perp AB$  and  $CL \perp AB$

$DC = 7 \text{ cm}$

$BC = 10 \text{ cm}$

$AB = 13 \text{ cm}$

Therefore here  $AL = DC$

That is  $AL = 7 \text{ cm}$

Hence  $LB = AB - AL = 13 - 7 = 6 \text{ cm}$

In  $\Delta LCB$  using Pythagoras theorem

$$BC^2 = BL^2 + CL^2$$

$$10^2 = 6^2 + CL^2$$

$$100 = 36 + CL^2$$

$$CL^2 = 100 - 36$$

$$CL^2 = 64$$

$$CL = 8$$

Here  $CL = AD =$  height of the trapezium

Therefore height = 8 cm

Now,

We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

Therefore Area of trapezium =  $\frac{1}{2} \times (7 + 13) \times 8 = 80 \text{ cm}^2$ .

## CCE Test Paper-18

### 1. Question

The base of a triangular field is three times its height and its area is  $1350 \text{ m}^2$ . Find the base and height of the field.

### Answer

Given

Area of triangle =  $1350 \text{ m}^2$

Let the length of the height of triangle be  $Y \text{ cm}$

Therefore its base is  $3Y \text{ cm}$

Area of the triangle =  $\frac{1}{2} \times \text{base} \times \text{height} = 1350$

$$\frac{1}{2} \times (3Y) \times (Y) = 1350$$

$$3Y^2 = 1350 \times 2 = 2700$$

$$Y^2 = \frac{2700}{3} = 900$$

$$Y = 30 \text{ cm}$$

Therefore height of triangle is 30 cm and base is  $3 \times 30 = 90 \text{ cm}$

That is

Base = 90 m, Height = 30 m .

## 2. Question

Find the area of an equilateral triangle of side 6 cm.

### Answer

Given

Side length of equilateral triangle is 6 cm

We know that area of the equilateral triangle is given by  $\frac{\sqrt{3}}{4}a^2$ , where a is side length

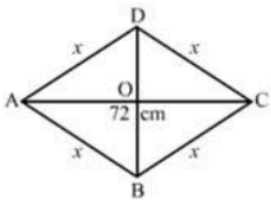
Therefore area of the triangle is

$$\Rightarrow \frac{\sqrt{3}}{4} \times 6^2 = \frac{\sqrt{3}}{4} \times 36 = \sqrt{3} \times 9 = 9\sqrt{3} \text{ cm}^2 .$$

## 3. Question

The perimeter of a rhombus is 180 cm and one of its diagonals is 72 cm. Find the length of the other diagonal and the area of the rhombus.

### Answer



Given: A rhombus

Diagonal AC = 72 cm

Perimeter = 180 cm

Perimeter of the rhombus = 4x

Therefore 4x = 180

x = 45

hence, the side length of the rhombus is 45 cm

We know that diagonals of the rhombus bisect each other right angles.

$$\therefore AO = \frac{1}{2} AC$$

$$\Rightarrow AO = \left(\frac{1}{2} \times 72\right) \text{ cm}$$

$$\Rightarrow AO = 36 \text{ cm}$$

From right  $\triangle AOB$ , we have :

$$BO^2 = AB^2 - AO^2$$

$$\Rightarrow BO^2 = AB^2 - AO^2$$

$$\Rightarrow BO^2 = 45^2 - 36^2$$

$$\Rightarrow BO^2 = 2025 - 1296$$

$$\Rightarrow BO^2 = 729$$



$$BO = 27 \text{ cm}$$

$$\therefore BD = 2 \times BO$$

$$BD = 2 \times 27 = 54 \text{ cm}$$

Hence, the length of the other diagonal is 54 cm.

$$\text{Area of the rhombus} = \frac{1}{2} \times 72 \times 54 = 1944 \text{ cm}^2$$

#### 4. Question

The area of a trapezium is  $216 \text{ m}^2$  and its height is 12 m. If one of the parallel sides is 14 m less than the other, find the length of each of the parallel sides.

#### Answer

Given

Let length of first parallel side X

Length of other parallel side is  $X - 14$

$$\text{Area of trapezium} = 216 \text{ m}^2$$

$$\text{Let Height (h)} = 12 \text{ m}$$

We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

$$\text{Therefore Area of trapezium is } \frac{1}{2} \times (X - 14 + X) \times 12 = 216 \text{ m}^2.$$

$$\therefore \frac{1}{2} \times (X - 14 + X) \times 12 = 216$$

$$\Rightarrow \frac{1}{2} \times (2X - 14) \times 12 = 216$$

$$\Rightarrow 2X - 14 = \frac{216}{12} \times 2$$

$$\Rightarrow 2X - 14 = 36$$

$$\Rightarrow 2X = 36 + 14 = 50$$

$$\Rightarrow X = 25$$

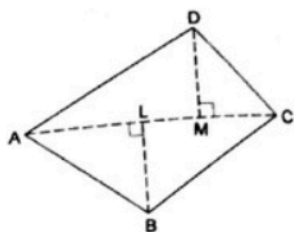
$\therefore$  length of the parallel sides is  $X = 25 \text{ cm}$  and  $X - 14 = 25 - 14 = 11 \text{ m}$ .

Therefore lengths of the parallel sides are 25 m, 11 m.

#### 5. Question

Find the area of a quadrilateral one of whose diagonals is 40 cm and the lengths of the perpendiculars drawn from the opposite vertices on the diagonal are 16 cm and 12 cm.

#### Answer



Given : A quadrilateral

$$\text{Diagonal AC} = 40 \text{ cm}$$

$$\text{Perpendiculars to diagonal AC are: BL} = 16 \text{ cm and DM} = 12 \text{ cm}$$

Now,

Area (quad. ABCD) = area ( $\triangle ABC$ ) + area ( $\triangle ADC$ )

Area of triangle =  $\frac{1}{2} \times (\text{base}) \times (\text{height})$ .

Therefore

Area of quad ABCD =  $\frac{1}{2} \times (AC) \times (BL) + \frac{1}{2} \times (AC) \times (DM)$

$$= \frac{1}{2} \times (40) \times (16) + \frac{1}{2} \times (40) \times (12) = 320 + 240 = 560 \text{ cm}^2$$

Therefore area of the quadrilateral ABCD is  $560 \text{ cm}^2$ .

### 6. Question

A field is in the form of a right triangle with hypotenuse 50 m and one side 30m. Find the area of the field.

### Answer

Given

A right angled triangle with hypotenuse = 50 cm and one of the side = 30 cm

Let base = 30 cm

Height = Y cm

Area = ?

By using hypotenuse theorem

$$\text{Hypotenuse}^2 = \text{base}^2 + \text{height}^2$$

$$50^2 = 30^2 + Y^2$$

$$Y^2 = 50^2 - 30^2 = 2500 - 900 = 1600$$

$$\text{Therefore } Y^2 = 1600$$

$$Y = 40 \text{ cm}$$

Area of the triangle =  $\frac{1}{2} \times \text{base} \times \text{height}$

$$\text{Area} = \frac{1}{2} \times 30 \times Y$$

$$= \frac{1}{2} \times 30 \times 40 = 600 \text{ m}^2.$$

### 7. Question

The base of a triangle is 14 cm and its height is 8 cm. The area of the triangle is

A.  $112 \text{ cm}^2$

B.  $56 \text{ cm}^2$

C.  $122 \text{ cm}^2$

D.  $66 \text{ cm}^2$

### Answer

Given

Length of the base of the triangle = 14 cm

Length of the height of the triangle = 8 cm

$$\text{Area of the triangle} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$\text{Therefore area} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$= \frac{1}{2} \times 14 \times 8 = 7 \times 8 = 56 \text{ cm}$$

### 8. Question

The base of a triangle is four times its height and its area is  $50 \text{ m}^2$ . The length of its base is

- A. 10 m
- B. 15 m
- C. 20 m
- D. 25 m

### Answer

Given

$$\text{Area of triangle} = 50 \text{ m}^2$$

Let the length of the height of triangle be  $Y \text{ cm}$

Therefore its base is  $4Y \text{ cm}$

$$\text{Area of the triangle} = \frac{1}{2} \times \text{base} \times \text{height} = 50$$

$$\frac{1}{2} \times (4Y) \times (Y) = 50$$

$$4Y^2 = 50 \times 2 = 100$$

$$Y^2 = \frac{100}{4} = 25$$

$$Y = 5 \text{ cm}$$

Therefore length of base is  $4 \times 5 = 20 \text{ cm}$

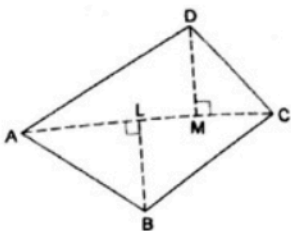


### 9. Question

The diagonal of a quadrilateral is  $20 \text{ cm}$  in length and the lengths of perpendiculars on it from the opposite vertices are  $8.5 \text{ cm}$  and  $11.5 \text{ cm}$ . The area of the quadrilateral is

- A.  $400 \text{ cm}^2$
- B.  $200 \text{ cm}^2$
- C.  $300 \text{ cm}^2$
- D.  $240 \text{ cm}^2$

### Answer



Given : A quadrilateral

Diagonal  $AC = 20 \text{ cm}$

Perpendiculars to diagonal AC are: BL = 11.5 cm and DM = 8.5 cm

Now,

Area (quad. ABCD) = area ( $\Delta ABC$ ) + area ( $\Delta ADC$ )

Area of triangle =  $\frac{1}{2} \times (\text{base}) \times (\text{height})$ .

Therefore

Area of quad ABCD =  $\frac{1}{2} \times (AC) \times (BL) + \frac{1}{2} \times (AC) \times (DM)$

$$= \frac{1}{2} \times (20) \times (11.5) + \frac{1}{2} \times (20) \times (8.5) = 115 + 85 = 200 \text{ cm}^2$$

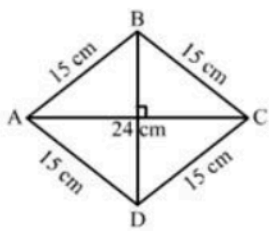
Therefore area of the quadrilateral ABCD is  $200 \text{ cm}^2$ .

### 10. Question

Each side of a rhombus is 15 cm and the length of one of its diagonals is 24 cm. The area of the rhombus is

- A.  $432 \text{ cm}^2$
- B.  $216 \text{ cm}^2$
- C.  $180 \text{ cm}^2$
- D.  $144 \text{ cm}^2$

### Answer



Given: A rhombus ABCD

Diagonal AC = 24 cm

Side length : AB = BC = CD = DA = 15 cm

We know that diagonals of the rhombus bisect each other right angles.

$$\therefore AO = \frac{1}{2} AC$$

$$\Rightarrow AO = \left(\frac{1}{2} \times 24\right) \text{ cm}$$

$$\Rightarrow AO = 12 \text{ cm}$$

From right  $\Delta AOB$ , we have :

$$BO^2 = AB^2 - AO^2$$

$$\Rightarrow BO^2 = AB^2 - AO^2$$

$$\Rightarrow BO^2 = 15^2 - 12^2$$

$$\Rightarrow BO^2 = 225 - 144$$

$$\Rightarrow BO^2 = 81$$

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

$$\therefore BD = 2 \times BO$$

$$BD = 2 \times 9 = 18 \text{ cm}$$

Hence, the length of the other diagonal is 18 cm.

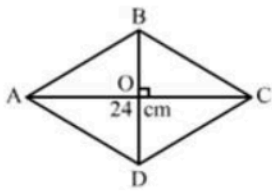
$$\text{Area of the rhombus} = \frac{1}{2} \times 24 \times 18 = 216 \text{ cm}^2$$

### 11. Question

The area of a rhombus is  $120 \text{ cm}^2$  and one of its diagonals is 24 cm. Each side of the rhombus is

- A. 10 cm
- B. 13 cm
- C. 12 cm
- D. 15 cm

### Answer



Given: A rhombus ABCD

Diagonal AC = 24 cm

Area =  $120 \text{ cm}^2$

$$\text{Area of the rhombus} = \frac{1}{2} \times AC \times BD$$

Therefore,

$$\frac{1}{2} \times AC \times BD = \frac{1}{2} \times 24 \times BD = 120$$

$$24 \times BD = 120 \times 2$$

$$BD = \frac{240}{24} = 10 \text{ cm}$$

$$OB = \frac{BD}{2} = \frac{10}{2} = 5 \text{ cm}$$

$$OA = \frac{AC}{2} = \frac{24}{2} = 12 \text{ cm}$$

Now,

In  $\triangle AOB$  using Pythagoras theorem

$$AB^2 = OA^2 + OB^2$$

$$AB^2 = 12^2 + 5^2$$

$$AB^2 = 144 + 25$$

$$AB^2 = 169$$

$$AB = 13$$

Therefore length of each side of the rhombus = 13 cm

### 12. Question

The parallel sides of a trapezium are 54 cm and 26 cm and the distance between them is 15 cm. The area of the trapezium is

- A. 702 cm<sup>2</sup>
- B. 810 cm<sup>2</sup>
- C. 405 cm<sup>2</sup>
- D. 600 cm<sup>2</sup>

**Answer**

Given

Length of parallel sides is 54cm and 26 cm

Height (h) = 15 cm

We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

Therefore Area of trapezium =  $\frac{1}{2} \times (54 + 26) \times 15 = 600 \text{ cm}^2$ .

**13. Question**

The area of a trapezium is 384 cm<sup>2</sup>. Its parallel sides are in the ratio 5:3 and the distance between them is 12 cm. the longer of the parallel sides is

- A. 24 cm
- B. 40 cm
- C. 32 cm
- D. 36 cm

**Answer**

Given

Lengths of the parallel sides are in the ratio 5:3

Therefore let one of the side length be 5X and other side length be 3X

Area of trapezium= 384 cm<sup>2</sup>

Let Height (h) =12 cm

We know that area of trapezium is  $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

Therefore Area of trapezium is  $\frac{1}{2} \times (5X + 3X) \times 12 = 384 \text{ cm}^2$ .

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

$$\Rightarrow (8X) \times 6 = 384$$

$$\Rightarrow 48X = 384$$

$$\Rightarrow X = \frac{384}{48} = 8$$

$\therefore$  length of the parallel sides is  $5X = 5 \times 8 = 40 \text{ cm}$  and  $3X = 3 \times 8 = 24 \text{ cm}$ .

Therefore length of the longest side is 40 cm.

**14. Question**

Fill in the blanks.

(i) Area of triangle =  $\frac{1}{2} \times (\dots) \times (\dots)$ .



(ii) Area of a ||gm = (.....) × (.....)

(iii) Area of a trapezium =  $\frac{1}{2} \times (\dots) \times (\dots)$ .

(iv) The parallel sides of a trapezium are 14 cm and 18 cm and the distance between them is 8 cm. The area of the trapezium is ..... cm<sup>2</sup>.

**Answer**

(i) Area of triangle =  $\frac{1}{2} \times$  (base) × (height).

(ii) Area of || gm = (base) × (height).

(iii) Area of trapezium is  $\frac{1}{2} \times$  (sum of parallel sides) × (height)

(iv) Given

Length of parallel sides is 14cm and 18 cm

Height (h) = 8 cm

We know that area of trapezium is  $\frac{1}{2} \times$  (sum of parallel sides) × height

Therefore Area of trapezium =  $\frac{1}{2} \times (14 + 18) \times 8 = 128 \text{ cm}^2$ .

