

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

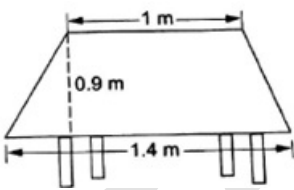
Height (h) = 16 cm

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 m².

4. Question

The area of a trapezium is 1080 cm². 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 cm²

Let Height (h) = y 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 m² 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 cm

Area of trapezium = 1586 cm²

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 cm². 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 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 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 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 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 m²

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 $\frac{1}{2} \times (X + 2X) \times 84 = 9450 \text{ cm}^2$.

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

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

$$\Rightarrow 126X = 9450$$

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

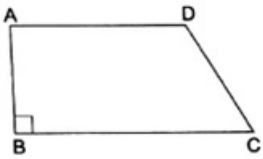
$$\Rightarrow X = 17$$

\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

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

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

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

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

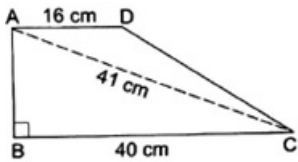
We know that area of trapezium is $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

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

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

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

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

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

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

Height = AB = ?

Here in $\triangle ABC$ using Pythagoras theorem

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

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

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

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

$$\therefore AB = 9$$

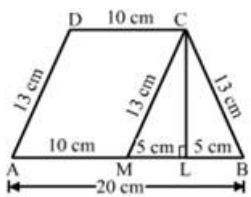
We know that area of trapezium is $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

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

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

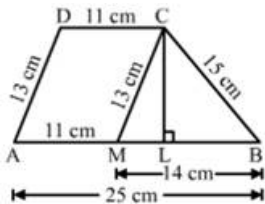
We know that area of trapezium is $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

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

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 $AB \parallel DC$,

$AB = 25\text{ cm}$, $CD = 11\text{ cm}$ 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

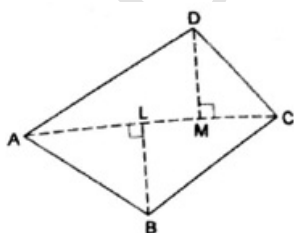
We know that area of trapezium is $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$

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

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,

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

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

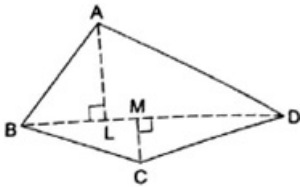
Therefore

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

Therefore area of the quadrilateral ABCD is 180 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,

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

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

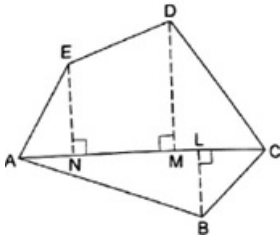
Therefore

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

Therefore area of the quadrilateral ABCD is 540 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,

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

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

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

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

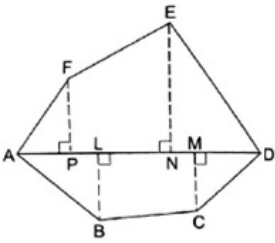
\therefore Area (Pent. ABCDE) = area ($\triangle AEN$) + area ($\triangle DMC$) + area ($\triangle ABC$) + area (Trap. DMNE)

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

\therefore Area (Pent. ABCDE) = 171 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,

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

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

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

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

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

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

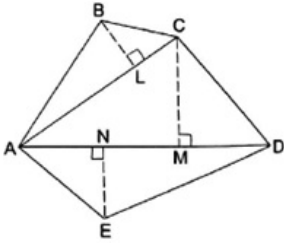
$$\therefore \text{Area (Hex. ABCDEF)} = \text{area } (\triangle APF) + \text{area } (\triangle DEN) + \text{area } (\triangle ABL) + \text{area } (\triangle CMD)$$

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

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

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,

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

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

Here,

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

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

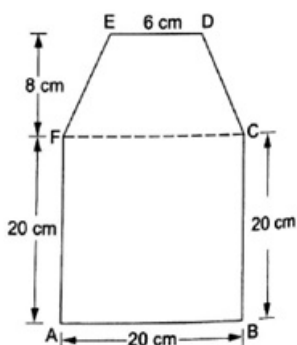
$$\text{Area } (\triangle ADE) = \frac{1}{2} \times (AD) \times (EN) = \frac{1}{2} \times (12) \times (5) = 30 \text{ cm}^2.$$

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

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

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,

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

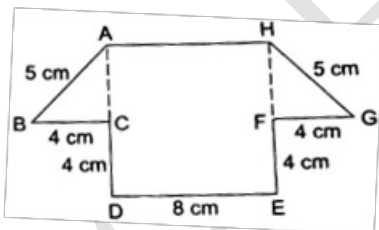
$$\text{Area of trapezium (EFCD)} = \frac{1}{2} \times (FC + ED) \times h = \frac{1}{2} \times (6 + 20) \times 8 = 104 \text{ cm}^2$$

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

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

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

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

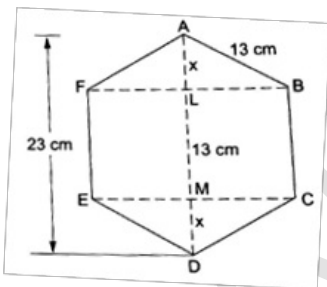
$$\text{Area}(\triangle ABC) = \frac{1}{2} \times (BC) \times (AC) = \frac{1}{2} \times (4) \times (3) = 6 \text{ cm}^2$$

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

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

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

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

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

$$\text{Here } AL = MD$$

$$\text{Therefore Let } AL = MD = x$$

$$\text{Here } AD = AL + LM + MD$$

$$23 = 13 + 2x$$

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

$$x = 5$$

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 cm²
- B. 144 cm²
- C. 189 cm²
- D. 207 cm²

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 cm². 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 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 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 cm^2

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

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

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

$$\Rightarrow 42X = 630$$

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

\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 cm^2 and its height is 9 cm . If one of the parallel sides is longer than the other by 6 cm , the length of the longer parallel sides is

- A. 17 cm
- B. 23 cm
- C. 18 cm
- D. 24 cm

Answer

Given

Let length of first parallel side X

Length of other parallel side is $X + 6$

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

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

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

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

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

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

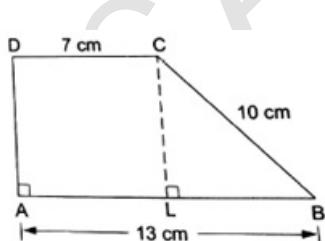
$$\Rightarrow X = 17$$

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

Therefore length of the longer parallel side is 23 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 cm^2
- B. 72 cm^2
- C. 80 cm^2
- D. 91 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 $\triangle LCB$ 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 $\frac{1}{2} \times$ (sum of parallel sides) \times 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 m^2 . Find the base and height of the field.

Answer

Given

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

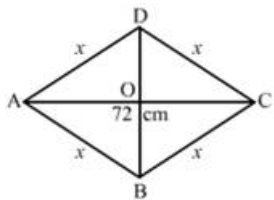
Therefore area of the triangle is

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

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 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 $X - 14$

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

Let Height (h) = 12 m

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

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

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

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

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

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

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

$$\Rightarrow X = 25$$

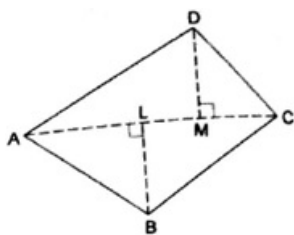
\therefore length of the parallel sides is $X = 25 \text{ cm}$ and $X - 14 = 25 - 14 = 11 \text{ m}$.

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

Diagonal AC = 40 cm

Perpendiculars to diagonal AC are: BL = 16 cm and DM = 12 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 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 cm^2

B. 56 cm^2

C. 122 cm^2

D. 66 cm^2

Answer

Given

Length of the base of the triangle = 14 cm

Length of the height of the triangle = 8 cm

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

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 m^2 . The length of its base is

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

Answer

Given

Area of triangle = 50 m^2

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

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

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

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

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

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

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

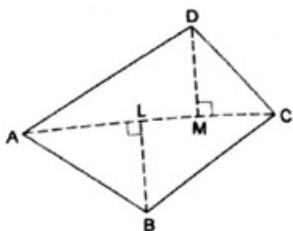
Therefore length of base is $4 \times 5 = 20 \text{ cm}$

9. Question

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

- A. 400 cm^2
- B. 200 cm^2
- C. 300 cm^2
- D. 240 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 ($\triangle ABC$) + area ($\triangle ADC$)

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

Therefore

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

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

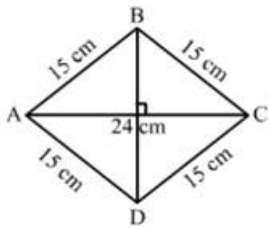
Therefore area of the quadrilateral ABCD is 200 cm^2 .

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 cm^2
- B. 216 cm^2
- C. 180 cm^2
- D. 144 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 $\triangle AOB$, 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.

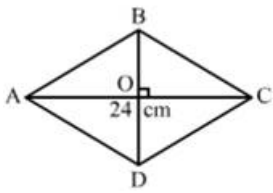
$$\text{Area of the rhombus} = \frac{1}{2} \times 24 \times 18 = 216 \text{ cm}^2$$

11. Question

The area of a rhombus is 120 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 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 cm²
- B. 810 cm²
- C. 405 cm²
- D. 600 cm²

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 cm². 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 cm²

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 cm².

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 = $\frac{1}{2} \times (14 + 18) \times 8 = 128$ cm².