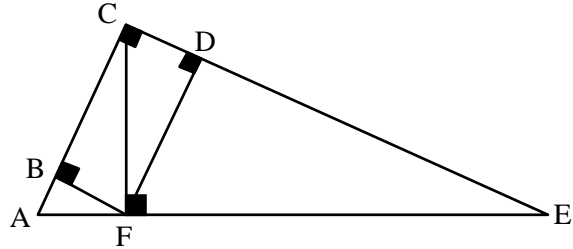


- 1 To construct the roof of a house, an architect must determine the measures of the support beams of the roof.

$$m \overline{AC} = 6 \text{ m}$$

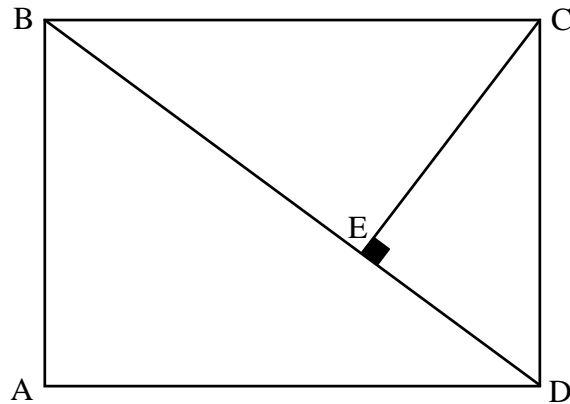
$$m \overline{CE} = 8 \text{ m}$$

$$m \overline{AE} = 10 \text{ m}$$



What is the length of segment AF?

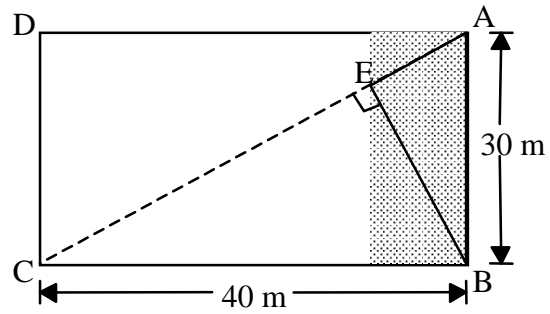
- 2 In rectangle ABCD shown below, line segment CE is perpendicular to diagonal BD. In addition, $m \overline{ED} = 9 \text{ cm}$ and $m \overline{CD} = 15 \text{ cm}$.



What is the length of diagonal BD?

The length of diagonal BD is _____ cm.

- 3 Louise wants to buy the piece of land corresponding to triangle BAE shown in the rectangle below.



What is the area of this piece of land?

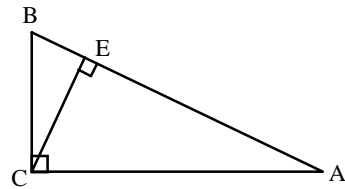
Show your work.

- 4 In the figure to the right, triangle ABC is right-angled at C and \overline{CE} is an altitude.

$$m \overline{AB} = 15 \text{ cm and } m \overline{AC} = 12 \text{ cm.}$$

What is the perimeter of triangle ACE?

Show your work.

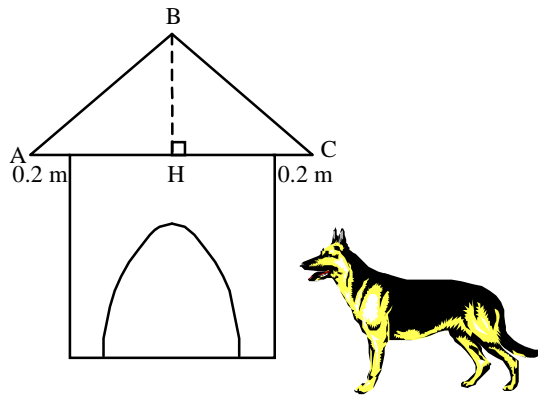


- 5 A kennel is the shape of a **square** topped by an **isosceles right triangle**, as shown in the adjacent sketch.

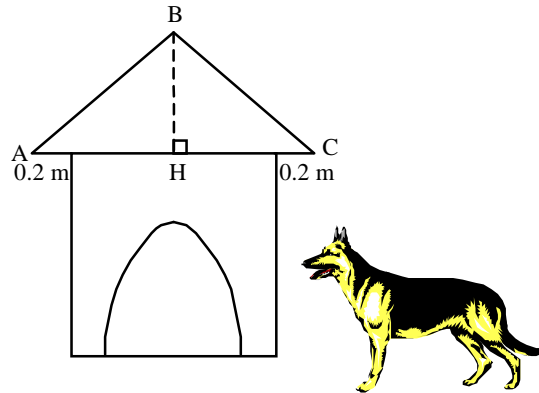
Each congruent side of the triangular roof measures 1 metre. The roof extends 0.2 metres over each side of the kennel.

What is the full height of the kennel?

Show your work.

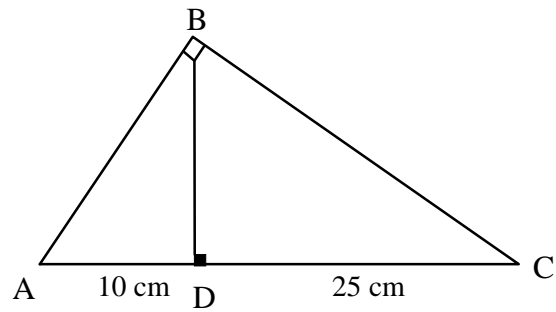


Work



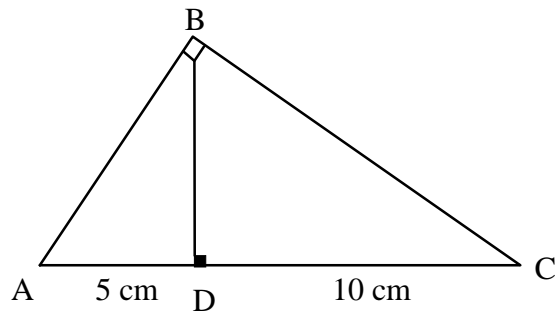
Answer : The full height of the kennel is _____ m.

- 6 ABC is a right triangle in which segment AD measures 10 cm and segment DC, 25 cm.



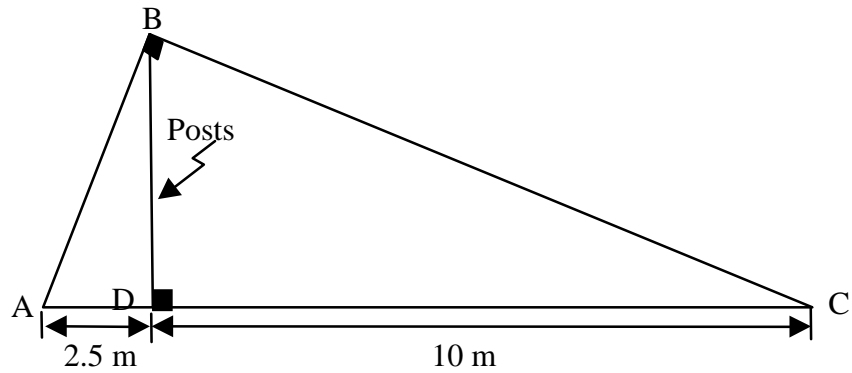
What is the measure of segment AB, to the nearest tenth?

- 7 ABC is a right triangle in which segment AD measures 5 cm and segment DC, 10 cm.



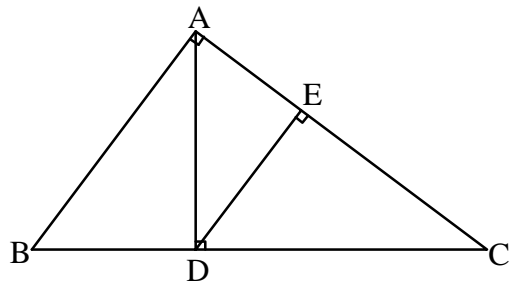
What is the measure of segment BD, to the nearest tenth?

- 8 A two-sided shelter is supported by vertical posts. The diagram below represents one end of this shelter.



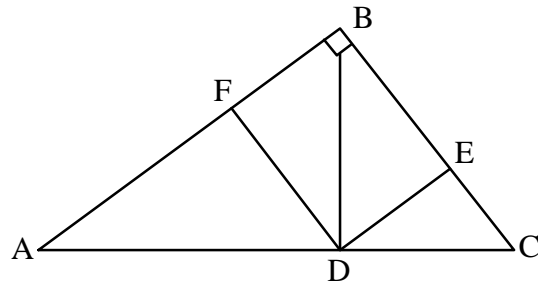
Using the information given in the diagram, calculate the length of side BC.

- 9 Given triangle ABC with a right angle at A. AD is drawn perpendicular to BC at D and DE is drawn perpendicular to AC at E. The height AD measures 12 cm, hypotenuse BC measures 25 cm and side AC measures 20 cm.



Find the measure of DE.

- 10 In right-angled triangle ABC below, altitude BD coincides with a diagonal of rectangle FBED.



Line segments AD and DC measure 16 m and 9 m respectively.

Rounded to the nearest tenth, what is the perimeter of rectangle FBED?

Show your work.

- 11 In the following figure, ABC is a right triangle.

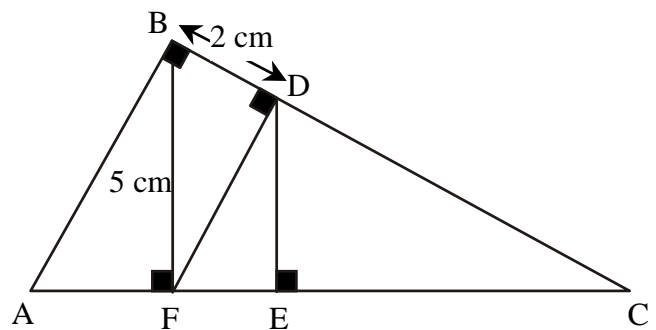
$$m \overline{BF} = 5 \text{ cm}$$

$$m \overline{BD} = 2 \text{ cm}$$

$$\overline{BF} \perp \overline{AC}$$

$$\overline{DE} \perp \overline{AC}$$

$$\overline{FD} \perp \overline{BC}$$



What is the area of triangle FDC?

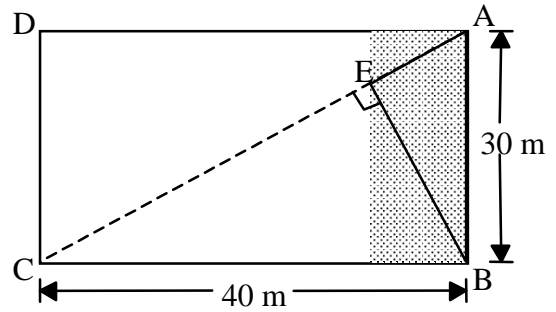
Show all your work.

Answers

1 3.60 m

2 The length of diagonal BD is **25** cm.

3



Measure of segment AC

$$m \overline{AC} = \sqrt{(m \overline{BC})^2 + (m \overline{AB})^2}$$

$$m \overline{AC} = \sqrt{40^2 + 30^2}$$

$$m \overline{AC} = 50 \text{ m}$$

Pythagorean theorem

Measure of segment BE

$$m \overline{AB} \times m \overline{BC} = m \overline{AC} \times m \overline{BE}$$

$$30 \times 40 = 50 \times m \overline{BE}$$

$$m \overline{BE} = 24 \text{ m}$$

In a right triangle, the product of the measures of the legs is equal to the product of the measures of the hypotenuse and the altitude drawn to the hypotenuse.

Measure of segment AE

$$m \overline{AE} = \sqrt{(m \overline{AB})^2 - (m \overline{BE})^2}$$

$$m \overline{AE} = \sqrt{30^2 - 24^2}$$

$$m \overline{AE} = 18 \text{ m}$$

Pythagorean theorem

Area of triangle ABE

$$\text{Area} = \frac{m \overline{AE} \times m \overline{BE}}{2}$$

$$\text{Area} = \frac{18 \times 24}{2}$$

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

Result : The area of the piece of land is 216 m^2 .

4 Measure of \overline{BC}

$$m \overline{BC} = \sqrt{15^2 - 12^2} = 9$$

Measure of \overline{CE}

$$m \overline{CE} \times m \overline{AB} = m \overline{AC} \times m \overline{BC}$$

$$m \overline{CE} \times 15 = 12 \times 9$$

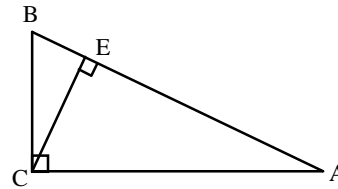
$$m \overline{CE} = \frac{12 \times 9}{15} = 7.2$$

Measure of \overline{AE}

$$m \overline{AE} = \sqrt{12^2 - (7.2)^2} = 9.6$$

Perimeter of triangle ACE : $12 + 7.2 + 9.6 = 28.8$

Result : The perimeter of triangle ACE is 28.8 cm.



5

Measure the roof's base, AC

$$(m \overline{AC})^2 = 1^2 + 1^2$$

$$m \overline{AC} \approx 1.41$$

Measure of one side of square

$$1.41 - 2 \times 0.2 = 1.01$$

Height BH of roof

$$m \overline{AB} \times m \overline{BC} = m \overline{AC} \times m \overline{BH}$$

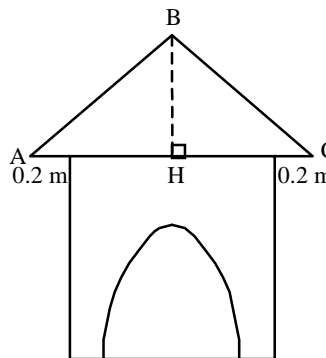
$$1 \times 1 \approx 1.41 \times m \overline{BH}$$

$$m \overline{BH} \approx 0.71$$

Full height of kennel

$$1.01 + 0.71 = 1.72$$

Answer : The full height of the kennel is 1.72 m.



7 7.1 cm

$$(m \overline{BC})^2 = m \overline{CD} \times m \overline{CA}$$

$$(m \overline{BC})^2 = 10 \times 12.5$$

$$(m \overline{BC})^2 = 125$$

$$m \overline{BC} = 5\sqrt{5} \text{ m} \approx 11.2 \text{ m}$$

Result : $m \overline{BC} = 5\sqrt{5} \text{ m}$ or $m \overline{BC} \approx 11.2 \text{ m}$.

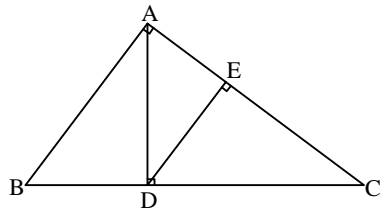
9

In right triangle ADC, we apply the Pythagorean relation.

$$(m \overline{AC})^2 = (m \overline{AD})^2 + (m \overline{DC})^2$$

$$20^2 = 12^2 + (m \overline{DC})^2$$

$$m \overline{DC} = 16$$



- a) $\angle ADC \cong \angle AED$ Right angles.
- b) $\angle DAC \cong \angle DAE$ Angles common to both triangles
- c) $\triangle ADE \sim \triangle ADC$ Two triangles are similar if they have two corresponding angles congruent.

In two similar triangles, the corresponding sides are proportional.

$$\frac{m \overline{DE}}{m \overline{DC}} = \frac{m \overline{AD}}{m \overline{AC}}$$

$$\frac{m \overline{DE}}{16} = \frac{12}{20}$$

$$m \overline{DE} = \frac{16 \times 12}{20} = 9.6$$

Result : 9.6 cm.

10

Measure of segment BD
 $(m \overline{BD})^2 = m \overline{AD} \times m \overline{DC}$
 $m \overline{BD} = 12$

In a right triangle, the altitude from the hypotenuse is the proportional mean between the two segments it determines on the hypotenuse.

$$m \overline{BC} = \sqrt{(m \overline{BD})^2 + (m \overline{DC})^2}$$

$$= \sqrt{12^2 + 9^2} = 15$$

Pythagorean theorem

$$m \overline{BD} \times m \overline{DC} = m \overline{BC} \times m \overline{DE}$$

$$16 \times 9 = 15 \times m \overline{DE}$$

$$m \overline{DE} = 144 \div 15 = 7.2$$

In a right-angled triangle, the product of the measures of the legs is equal to the product of the measures of the hypotenuse and the altitude drawn to the hypotenuse.

$$m \overline{BE} = \sqrt{(m \overline{BD})^2 - (m \overline{DE})^2}$$

$$= \sqrt{12^2 - 7.2^2} = 9.6$$

Pythagorean theorem

Perimeter of rectangle FBED

$$P = 2m \overline{BE} + 2m \overline{DE}$$

$$= 2 \times 9.6 + 2 \times 7.2 = 19.2 + 14.4 = 33.6$$

Result : Rounded to the nearest tenth, the perimeter of rectangle FBED is 33.6 m.

11

Calculate $m \overline{DF}$

$$\sqrt{(m \overline{BF})^2 - (m \overline{BD})^2} = m \overline{DF}$$

$$\sqrt{5^2 - 2^2} = m \overline{DF}$$

$$\sqrt{21} = m \overline{DF}$$

Calculate $m \overline{CD}$

$$M \overline{BD} \cdot m \overline{CD} = (m \overline{DF})^2$$

$$2 \cdot m \overline{CD} = 21$$

$$m \overline{CD} = \frac{21}{2} = 10.5$$

Area of triangle FDC

$$\frac{m \overline{CD} \times m \overline{DF}}{2} = \frac{10.5 \times \sqrt{21}}{2} \approx 24.06$$

Answer The area of triangle FDC is 24.06 cm^2 .