

FluidMaths

GCSE Mathematics (Grade 9-1)

Problem Solving

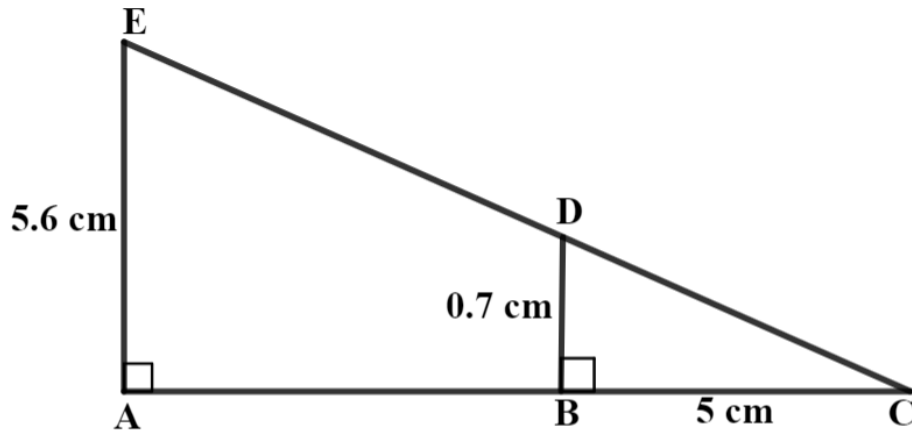
Similar Shapes Set 1 (Length)

Solutions

The marks shown are for guidance purposes only

The questions are repeated here for your convenience

1 ACE and BCD are mathematically similar.



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

$$AE = 5.6 \text{ cm}$$

$$BD = 0.7 \text{ cm}$$

Calculate the area of the trapezium ABDE?

Solution

Use proportional equations

$$\frac{5.6}{0.7} = \frac{AC}{5}$$

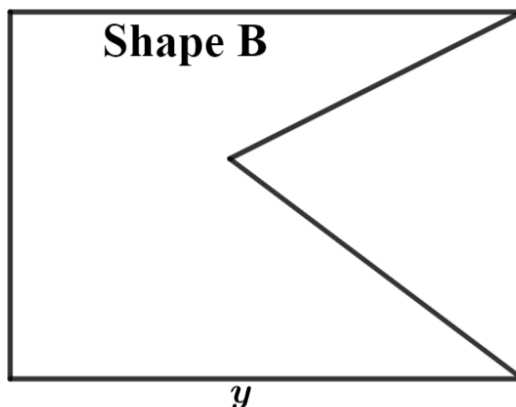
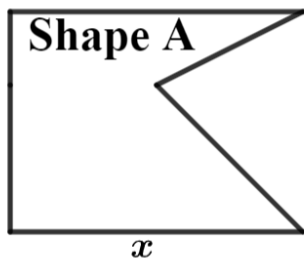
$$AC = \frac{5.6 \times 5}{0.7} = 40 \quad \text{[1mark]}$$

$$\text{Therefore, } AB = 40 - 5 = 35 \quad \text{[1mark]}$$

$$\text{The area of the trapezium is } \left(\frac{5.6 + 0.7}{2} \right) \times 35 = 110.25 \text{ cm}^2$$

[1mark]

2 Shape A and Shape B are mathematically similar



The perimeter of shape A is 294 cm

Given that $x : y = 3 : 5$,

what is the perimeter of shape B?

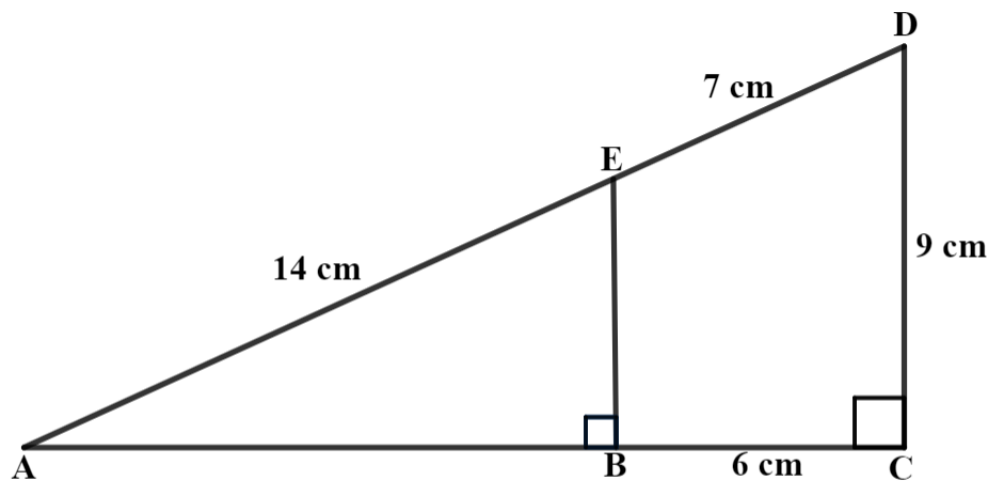
Give your answer in meters

Solution

$$\frac{5}{3} \times 294 = 490 \text{ cm} \quad [2\text{marks}]$$

Therefore, the perimeter is 4.9 m [1mark]

3 ABE and ACD are similar triangles



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

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

$$CD = 9 \text{ cm}$$

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

Calculate the area of triangle ABE.

Give your answer to 3 significant figures

Solution

$$\text{scale factor} = 21 \div 14 = 1.5$$

$$BE = 9 \div 1.5 = 6 \quad \text{[1mark]}$$

Find AB using Pythagoras theorem

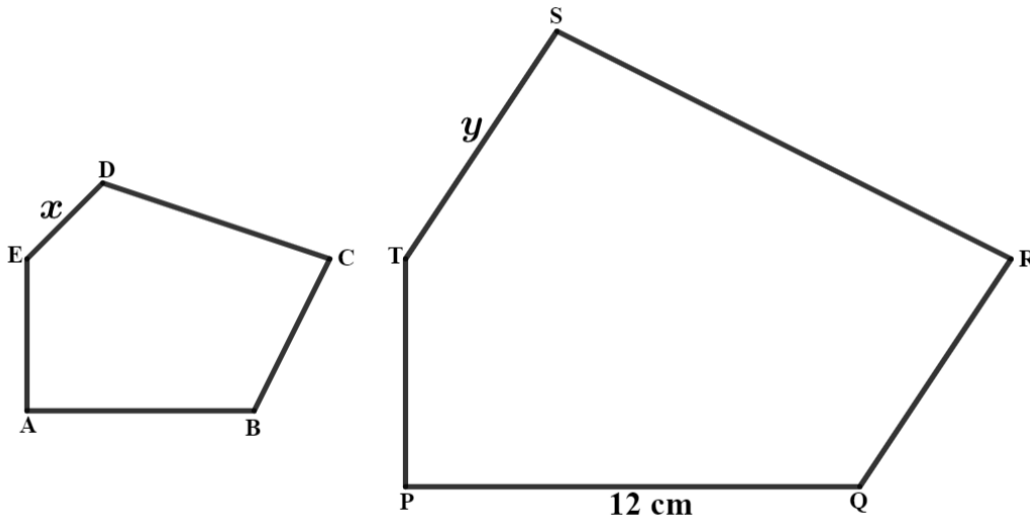
$$(AB)^2 = 14^2 - 6^2 \quad \text{[1mark]}$$

$$AB = \sqrt{14^2 - 6^2} = 12.6(3\text{sf}) \quad \text{[1mark]}$$

Area of triangle ABE is

$$\frac{1}{2} \times 12.6 \times 6 = 37.8 \text{ cm}^2 (3\text{sf}) \quad \text{[1mark]}$$

- 4
4 ABCDE and PQRST are mathematically similar



Find AB in terms of x and y

Solution

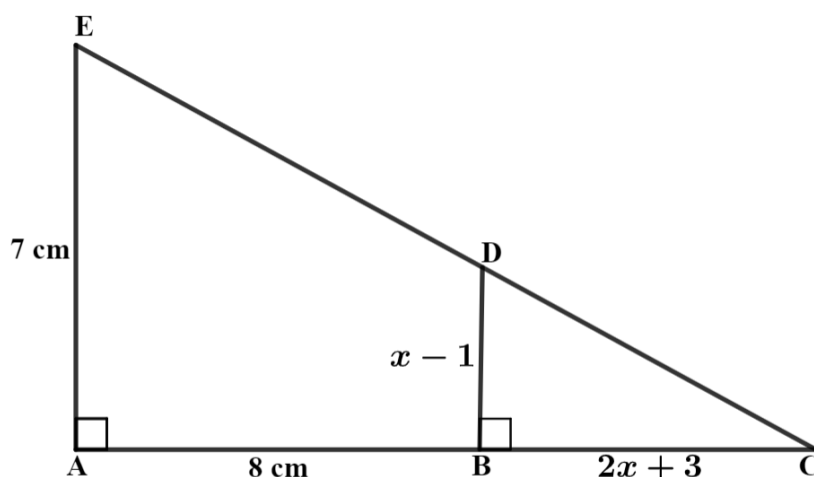
$$\text{Scale factor} = \frac{y}{x}$$

$$\text{Therefore, } AB = 12 \div \frac{y}{x}$$

$$AB = \frac{12x}{y}$$

[2marks]

5 ACE and BCD are mathematically similar triangles.



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

$$BC = 2x + 3$$

$$BD = x - 1$$

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

Calculate the true value of x to 2 decimal places.

Solution

$$AC = 8 + (2x + 3) = 2x + 11 \quad [1\text{mark}]$$

Apply proportional equations on corresponding sides.

$$\frac{7}{x-1} = \frac{2x+11}{2x+3} \quad \{\text{Cross multiply}\} \quad [1\text{mark}]$$

$$7(2x + 3) = (x - 1)(2x + 11)$$

$$14x + 21 = 2x^2 - 2x + 11x - 11$$

$$2x^2 - 2x + 11x - 14x - 11 - 21 = 0$$

$$2x^2 - 5x - 32 = 0 \quad [1\text{mark}]$$

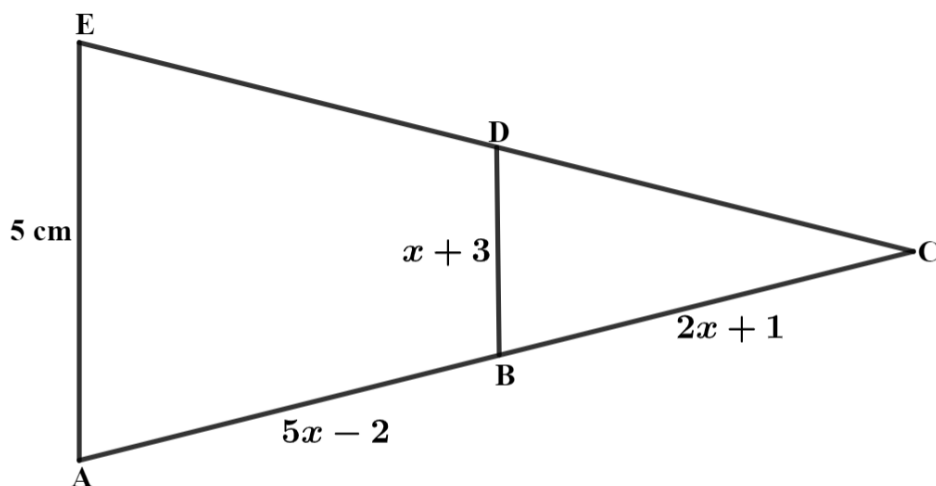
$$\left\{ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \right\} \quad a = 2; \quad b = -5; \quad c = -32$$

$$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4 \times 2 \times -32}}{2 \times 2}$$

$$x = 5.44 \text{ or } x = -2.94$$

Therefore, the true value of x is 5.44(2dp) [2mark]

6 ACE and BCD are mathematically similar triangles



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

$$AB = 5x - 2$$

$$BC = 2x + 1$$

$$BD = x + 3$$

Calculate the true value of x .

Solution

$$AC = 5x - 2 + 2x + 1 = 7x - 1 \quad [1\text{mark}]$$

$$\text{So, we have } \frac{5}{x+3} = \frac{7x-1}{2x+1} \quad \{\text{Cross multiply}\}$$

$$10x + 5 = 7x^2 + 21x - x - 3 \quad [1\text{mark}]$$

$$7x^2 + 10x - 8 = 0 \quad \{\text{Factorise}\}$$

$$(7x - 4)(x + 2) = 0 \quad [1\text{mark}]$$

$$\text{Therefore, } x = \frac{4}{7} \text{ or } x = -2$$

$$\text{Hence, the true value of } x = \frac{4}{7} \quad [1\text{mark}]$$