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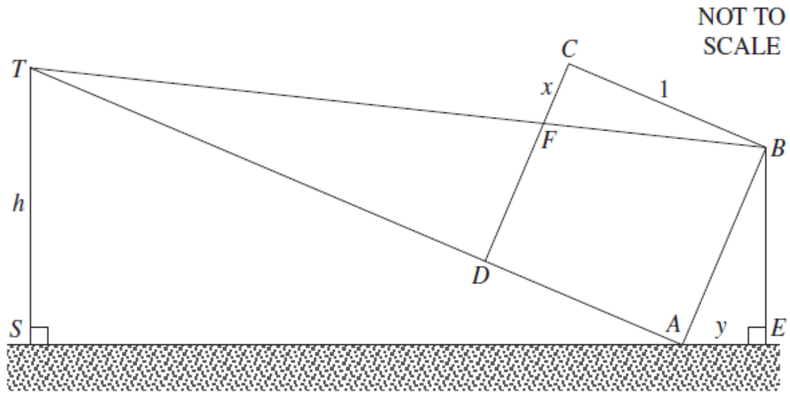
2016 15 c Maryam wishes to estimate the height, h metres, of a tower, ST, using a square, $ABCD$, with side length 1 metre. She places the point A on the horizontal ground and ensures that the point D lies on the line joining A to the top of the tower T. The point F is the intersection of the line joining B and T and the side BC. The point E is the foot of the perpendicular from B to the ground. Let CF have length x metres and AE have length y metres.

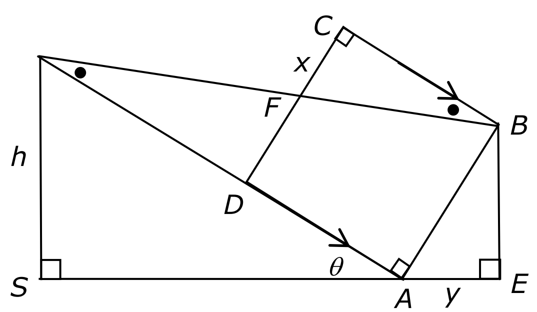


Copy and trace the diagram into your writing booklet.

(i) Show that ΔFCB and ΔBAT are similar. **2**

(ii) Show that ΔTSA and ΔAEB are similar. **2**

(iii) Find h in terms of x and y. **2**



(i) $\angle FCB = \angle BAT$ ($\angle$s in square)

Now, $BC \parallel AT$ (opp sides of square),

$\therefore \angle CBF = \angle ATB$ (alt $\angle$s, $BC \parallel AT$)

$\therefore \Delta FCB \equiv \Delta BAT$ (equiangular)

State Mean: **1.19**

(ii) $\angle TSA = \angle AEB$ (given)

Let $\angle SAT = \theta$

As $\angle BAD = 90^\circ$ ($\angle$s in square)

$\therefore \angle BAE = (90 - \theta)^\circ$ (straight $\angle$)

$\therefore \angle EBA = \theta$ ($\angle$ sum of Δ)

$\therefore \angle SAT = \angle EBA$

$\therefore \Delta TSA \equiv \Delta AEB$ (equiangular)

State Mean: **0.51**

(iii) Using $\Delta FCB \;|||\; \Delta BAT$:

$$\frac{1}{x} = \frac{AT}{1} \quad \text{(matching sides of sim } \Delta\text{s in proportion)}$$

$$AT = \frac{1}{x}$$

Using $\Delta TSA \;|||\; \Delta AEB$:

$$\frac{h}{y} = \frac{AT}{1} \quad \text{(matching sides of sim } \Delta\text{s in proportion)}$$

$$h = y \times AT$$

$$= y \times \frac{1}{x}$$

$$\therefore h = \frac{y}{x}$$

State Mean: **0.51**

* These solutions have been provided by *projectmaths* and are not supplied or endorsed by BOSTES.

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BOSTES: Notes from the Marking Centre

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