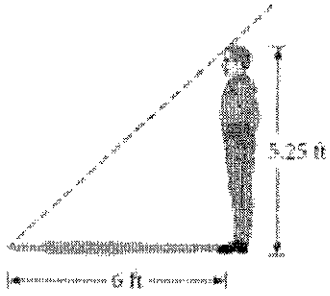
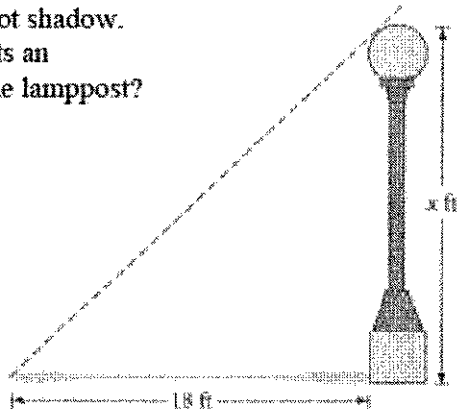
Geometry Name KEY

Simply Similar

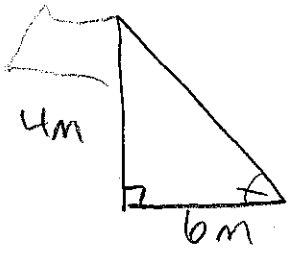
EXAMPLE A person 5 feet 3 inches tall casts a 6-foot shadow. At the same time of day, a lamppost casts an 18-foot shadow. What is the height of the lamppost?

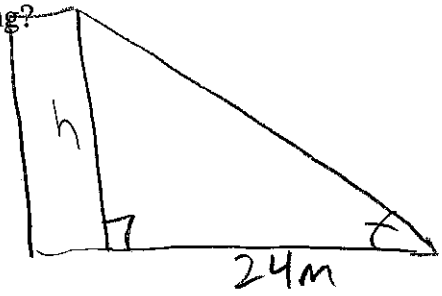




Exercises.

1) A flagpole 4 meters tall casts a 6-meter shadow. At the same time of day, a nearby building casts a 24-meter shadow. How tall is the building?

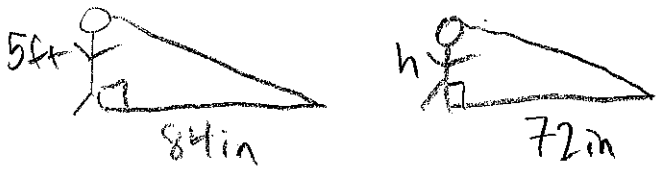




$\frac{24}{6} = \frac{h}{4}$

$h = 16\text{ m}$

2) Five-foot-tall Melody casts an 84-inch shadow. How tall is her friend if, at the same time of day, his shadow is 1 foot shorter than hers?

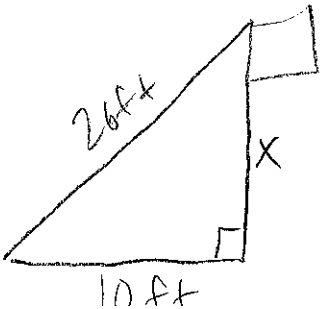


$1\text{ft} = 12\text{in}$

$\frac{84}{72} = \frac{5}{h}$

$h = 4.29\text{ ft}$

3) A 26-ft rope from the top of a flagpole reaches to the end of the flagpole's 10-ft shadow. How tall is the nearby football goalpost if, at the same moment, it has a shadow of 12.5 ft?

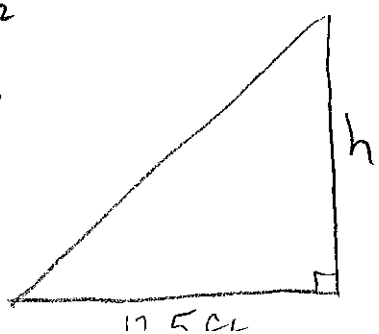


$10^2 + x^2 = 26^2$

$100 + x^2 = 676$

$\sqrt{x^2} = \sqrt{576}$

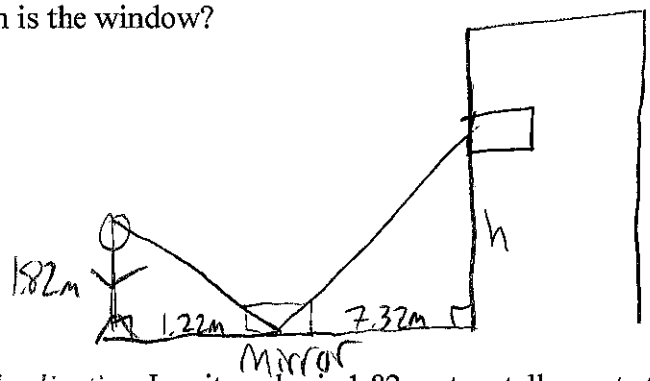
$x \approx 24\text{ ft}$



$\frac{12.5}{10} = \frac{h}{24}$

$h = 30\text{ ft}$

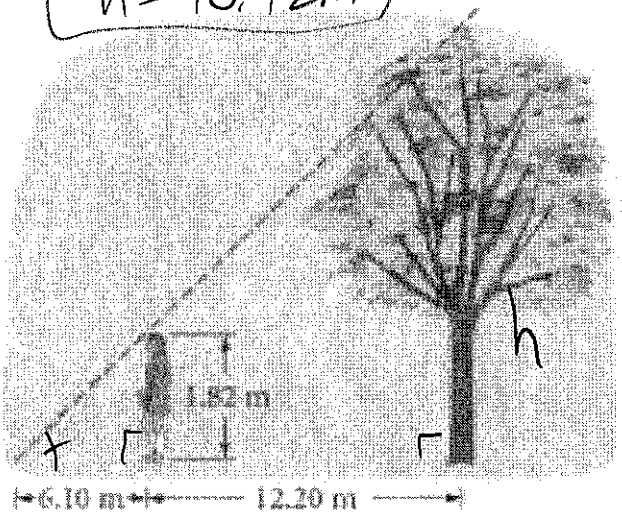
4) Private eye Samantha Diamond places a mirror on the ground between herself and an apartment building and stands so that when she looks into the mirror, she sees into a window. The mirror's crosshairs are 1.22 meters from her feet and 7.32 meters from the base of the building. Sam's eye is 1.82 meters above the ground. How high is the window?



$\frac{7.32}{1.22} = \frac{h}{1.82}$

$h = 10.92\text{m}$

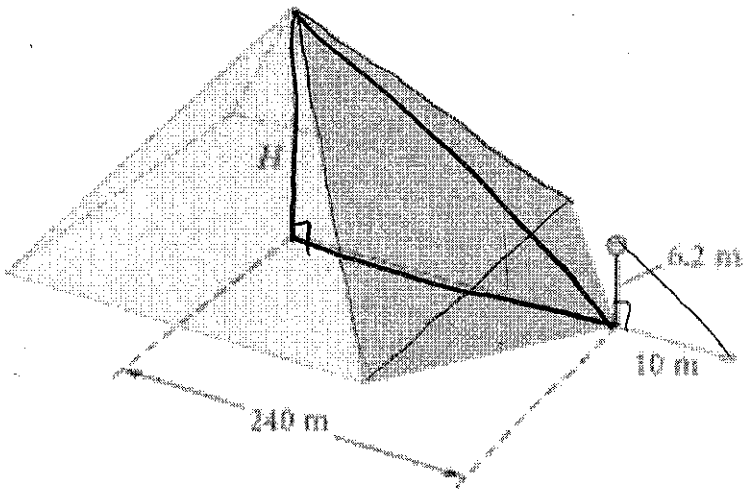
5) *Application* Juanita, who is 1.82 meters tall, wants to find the height of a tree in her backyard. From the tree's base, she walks 12.20 meters along the tree's shadow to a position where the end of her shadow exactly overlaps the end of the tree's shadow. She is now 6.10 meters from the end of the shadows. How tall is the tree?



$\frac{h}{1.82} = \frac{18.3}{6.1}$

$h = 5.46\text{m}$

6) While vacationing in Egypt, the Greek mathematician Thales calculated the height of the Great Pyramid. According to legend, Thales placed a pole at the tip of the pyramid's shadow and used similar triangles to calculate its height. This involved some estimating because he was unable to measure the distance from directly beneath the height of the pyramid to the tip of the shadow. From the diagram, explain his method. Calculate the height of the pyramid from the information given in the diagram.



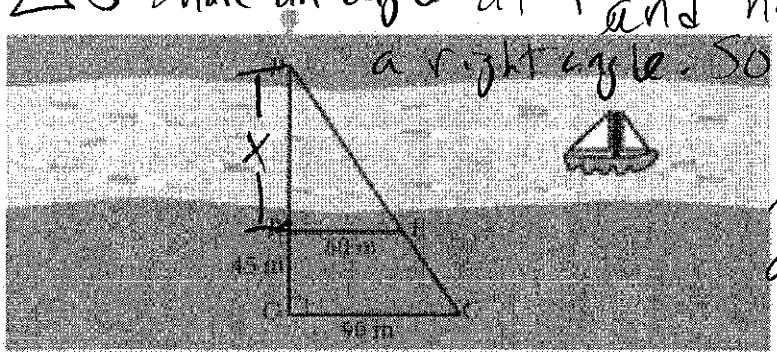
$\frac{H}{6.2} = \frac{240}{10}$

$H = 148.8\text{m}$

Present height is 146.5 m. So pretty good approx.

7) Calculate the distance across this river, PR, by sighting a pole, at point P, on the opposite bank. Points R and O are collinear with point P. Point C is chosen so that $\overline{OC} \perp \overline{PO}$. Lastly, point E is chosen so that P, E, and C are collinear and $\overline{RE} \perp \overline{PO}$. Also explain why $\Delta PRE \sim \Delta POC$.

△'s share an angle at P and have a right angle. So by AA~, the △'s are similar.



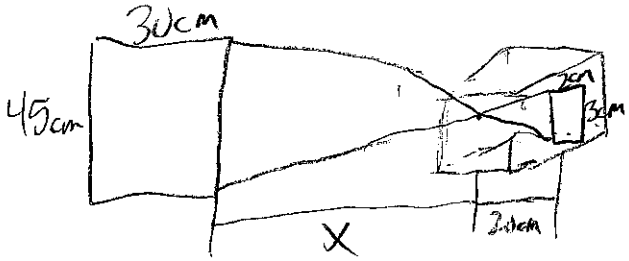
$$\frac{90}{60} = \frac{x+45}{x}$$

$$90x = 60x + 2700$$
$$-60x \quad -60x$$

$$\frac{30x}{30} = \frac{2700}{30}$$

$$x = 90\text{m}$$

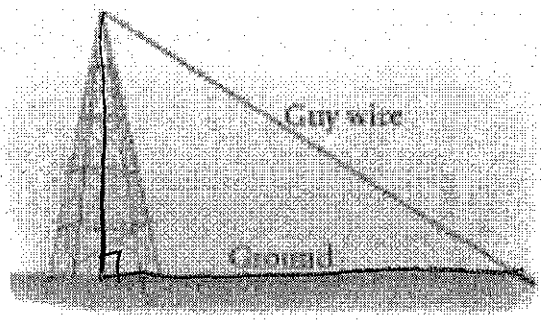
8) A pinhole camera is a simple device. Place unexposed film at one end of a shoe box, and make a pinhole at the opposite end. When light comes through the pinhole, an inverted image is produced on the film. Suppose you take a picture of a painting that is 30 cm wide by 45 cm high with a pinhole box camera that is 20 cm deep. How far from the painting should the pinhole be to make an image that is 2 cm wide by 3 cm high? Sketch a diagram of this situation.



$$\frac{45}{3} = \frac{x}{20}$$

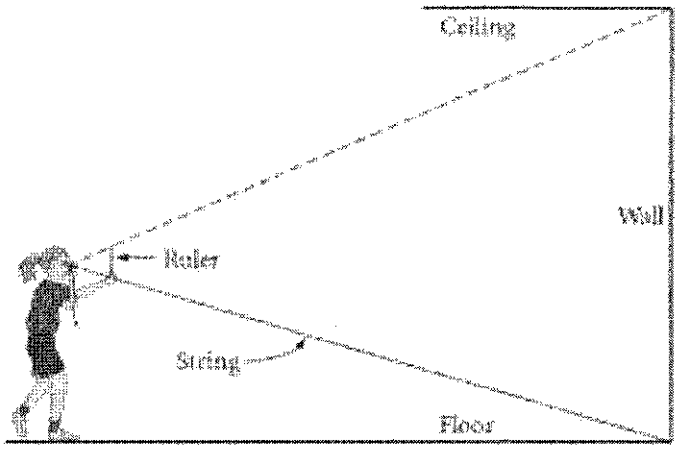
$$x = 300\text{cm}$$

9) *Application* A guy wire attached to a high tower needs to be replaced. The contractor does not know the height of the tower or the length of the wire. Find a method to measure the length of the wire indirectly.

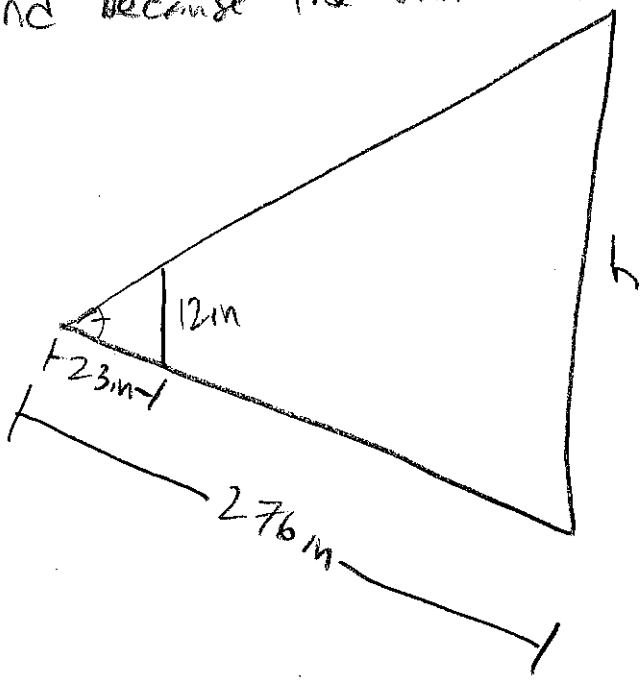


During the same time of day, measure the length of the tower's shadow and the length of your shadow. Measure your height and set-up a proportion to find the height of the tower. Use the tower height and shadow length w/ Pythag. Thm to find the guide wire length

10) Kristin has developed a new method for indirectly measuring the height of her classroom. Her method uses string and a ruler. She tacks a piece of string to the base of the wall and walks back from the wall holding the other end of the string to her eye with her right hand. She holds a 12-inch ruler parallel to the wall in her left hand and adjusts her distance to the wall until the bottom of the ruler is in line with the bottom edge of the wall and the top of the ruler is in line with the top edge of the wall. Now with two measurements, she is able to calculate the height of the room. Explain her method. If the distance from her eye to the bottom of the ruler is 23 inches and the distance from her eye to the bottom of the wall is 276 inches, calculate the height of the room.



She creates two similar $\triangle$s that share an angle at her eye and because the wall & the ruler are parallel, other angles are equal.



$$\frac{h}{12} = \frac{276}{23}$$

$$h = 144 \text{ in}$$

$$= 12 \text{ ft}$$