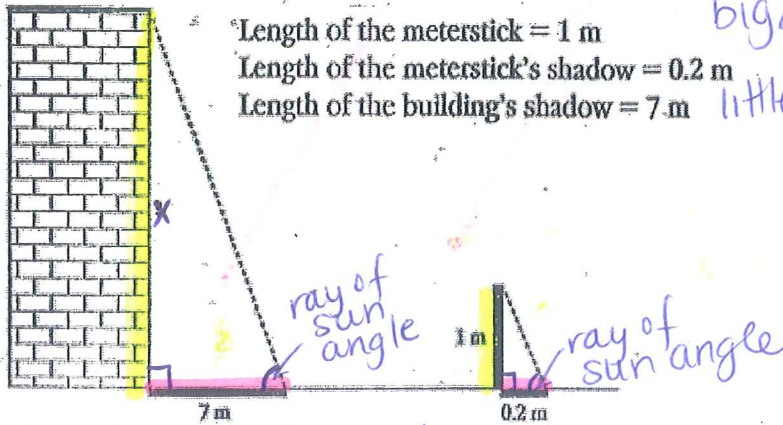


Indirect Measurement Notes (Day 6 & 7)

Using Similar Triangles

1. **The Shadow Method:** Mrs. Smith's class is using the shadow method to estimate the height of their school building. They have made the following measurements and sketch. Use what you know about similar triangles to find the building's height from the given measurements.



Length of the meterstick = 1 m
 Length of the meterstick's shadow = 0.2 m
 Length of the building's shadow = 7 m

big $\Delta \Rightarrow \frac{\text{height}}{\text{shadow}}$
 little $\Delta \Rightarrow \frac{\text{height}}{\text{shadow}}$

$$\frac{x}{1} = \frac{7}{0.2}$$

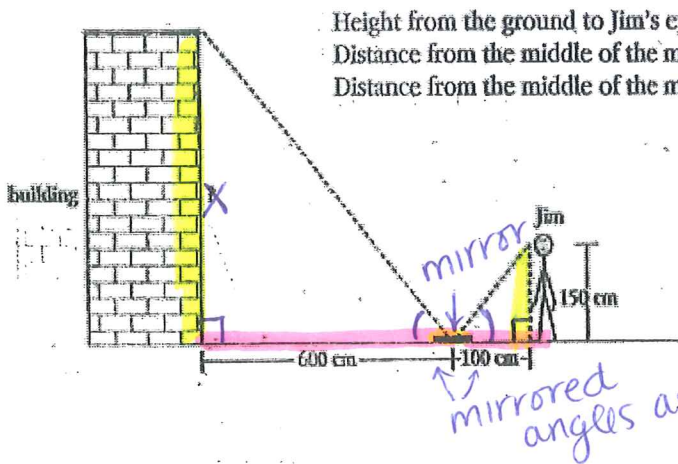
$$0.2x = 7$$

$$x = 35 \text{ m}$$

Δ s are similar by AA Similarity

* in a perfect world, buildings, trees, people, etc. are all \perp to the ground \Rightarrow right \angle s are \cong

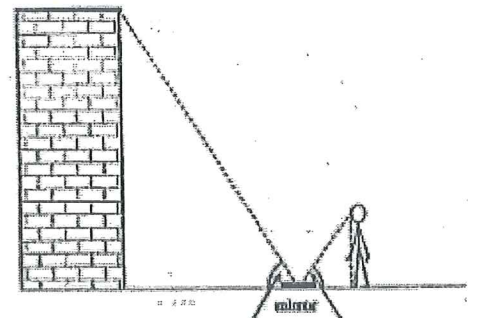
2. **The Mirror Method:** Jim and Sally, students in Mrs. Smith's class, are using the mirror method to estimate the height of their school building. They have made the following measurements and sketch:



Height from the ground to Jim's eyes = 150 cm
 Distance from the middle of the mirror to Jim = 100 cm
 Distance from the middle of the mirror to the building = 600 cm

Δ s are similar by AA Similarity

HINT:



These angles are equal because light reflects off of mirror at the same angle at which it hits the mirror

$$\frac{\text{height}}{\text{height}} = \frac{\text{dist. to mirror} \Rightarrow \text{big } \Delta}{\text{dist. to mirror} \Rightarrow \text{little } \Delta}$$

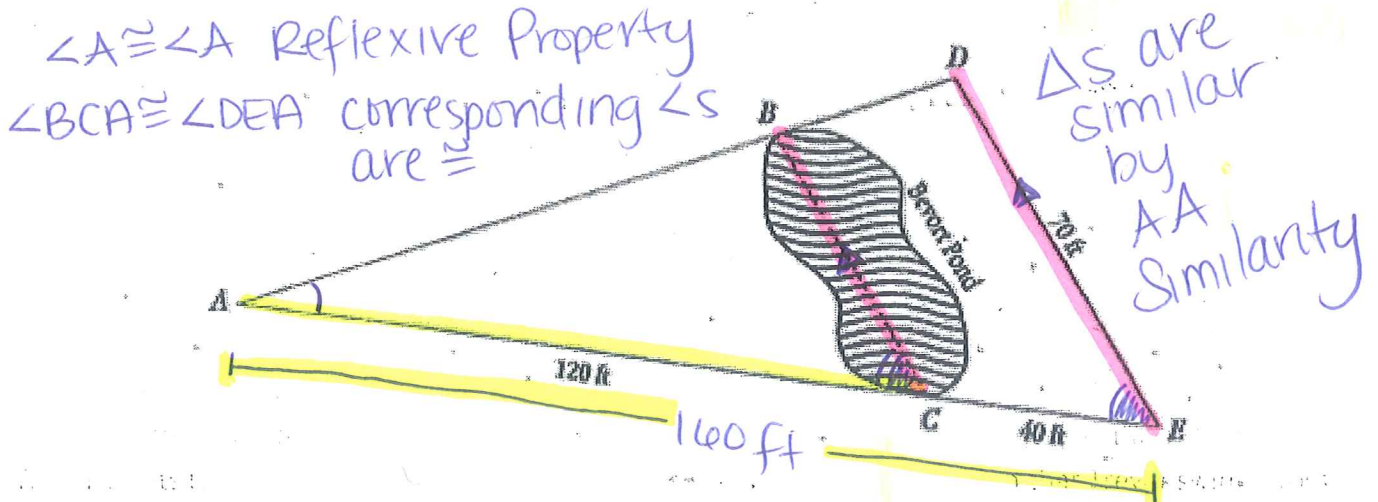
$$\frac{x}{150} = \frac{600}{100}$$

$$100x = 90,000$$

$$x = 900 \text{ cm}$$

3. **Triangle within a Triangle Method:** Mrs. Smith's class went to Beaver Pond for a picnic. Darnell, Angie, and Trevor wants to find the distance across the pond. Darnell and Angie suggested that Trevor swim across with a tape measure in his mouth. Trevor said "No! The water is way too cold!!" They decided to try to use what they had learned about similar triangles to find the distance across the pond. They drew a diagram and started to make the necessary measurements.

Here is the diagram Darnell, Angie, and Trevor made, including their measurements.



$$\frac{AC}{AE} = \frac{BC}{DE} \Rightarrow \text{small } \Delta$$

$$\frac{AC}{AE} = \frac{BC}{DE} \Rightarrow \text{large } \Delta$$

$$\frac{120}{160} = \frac{x}{70}$$

$$160x = 8400$$

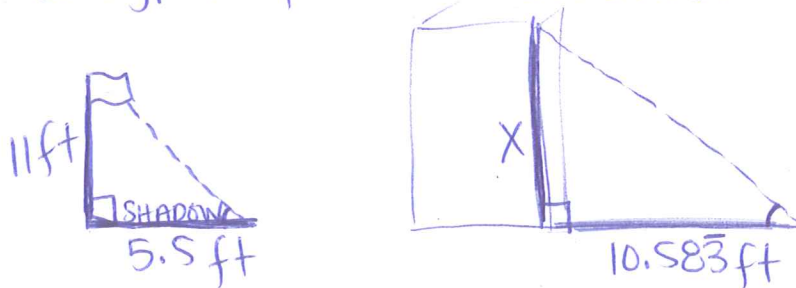
$$x = 52.5 \text{ ft}$$

Triangle Similarity Indirect Measurement

Shadow Problem: (Draw a picture/need convert)

A flagpole that is 11 feet tall casts a 5 and a half foot shadow. At the same time of day, a nearby building casts a 10 feet, 7 in. shadow. How tall is the building?

convert everything to feet \Rightarrow we can't have 2 types of measurements.



$$5\text{ft } 6\text{in} = 5.5\text{ft}$$

$$10\text{ft. } 7\text{in} = 10\frac{7}{12} \approx 10.58\bar{3}$$

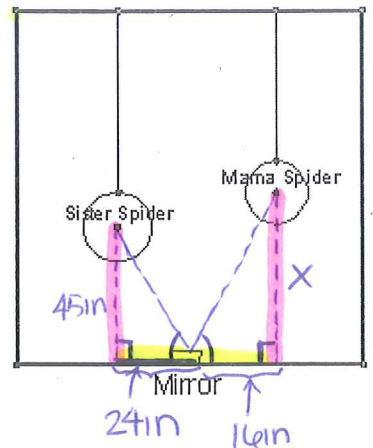
$$\frac{11}{x} = \frac{5.5}{10.58\bar{3}}$$

$$5.5x = 116.41\bar{6}$$

$$x = 21.17\text{ ft}$$

Mirror Problem:

A family of spiders has found a mirror on the ground and they have been positioning themselves to see each other in the mirrors. Mama and Sister spider are shown below. Sister spider, who is 45 inches off the ground, can see Mama spider in the mirror that is on the ground between them. The mirror is 24 inches from the point directly below Sister spider and 16 inches from the point directly below Mama spider. How far is Mama spider from the ground? Please write in all the measurements in the correct places in the diagram.



$$\frac{45}{x} = \frac{24}{16} \Rightarrow \text{sister spider}$$

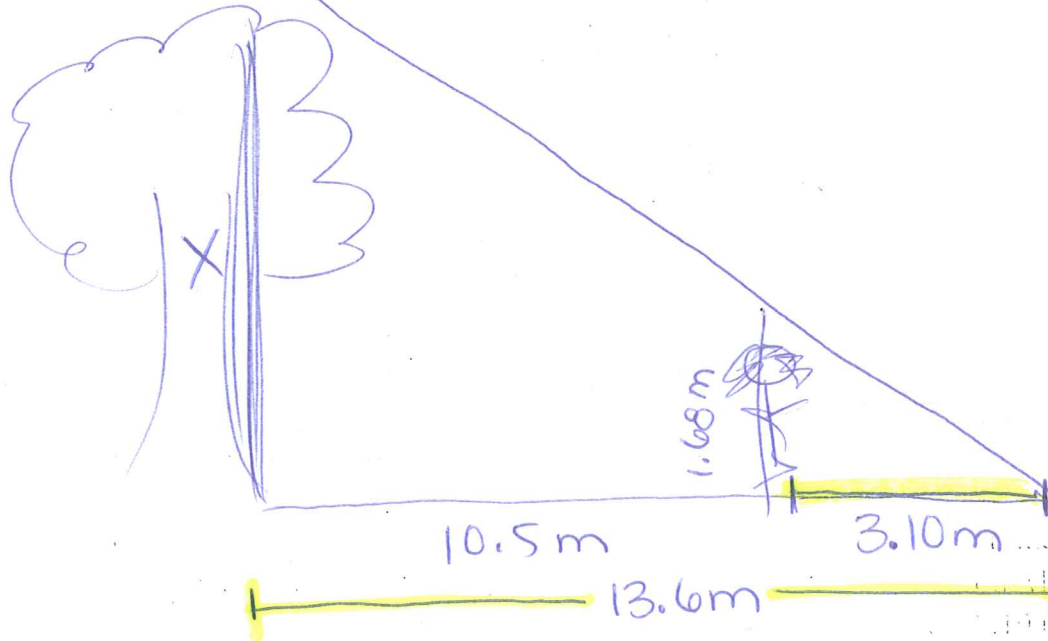
$$\frac{45}{x} = \frac{24}{16} \Rightarrow \text{mama spider}$$

$$24x = 720$$

$$x = 30\text{ in}$$

Triangle within a Triangle Problem:

Mary Ellen, who is 1.68 meters tall, wants to find the height of a tree in her backyard. From the tree's base, she walks 10.5 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 3.10 meters from the end of the shadows. How tall is the tree?



*use full Δ side

$$\frac{\text{large } \Delta \Rightarrow 13.6}{\text{small } \Delta \Rightarrow 3.1} = \frac{\text{height } X}{1.68}$$

$$3.1x = 22.848$$

$$x = 7.37\text{m}$$