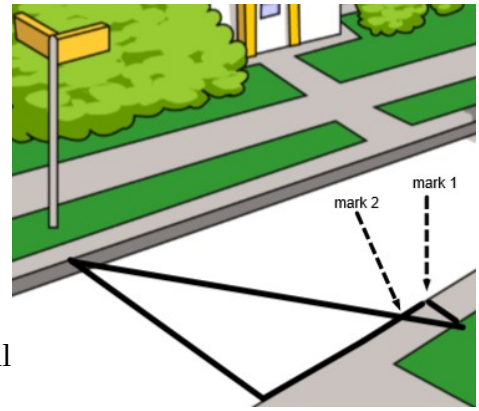
(Practical) Problem Solving with Similar Triangles



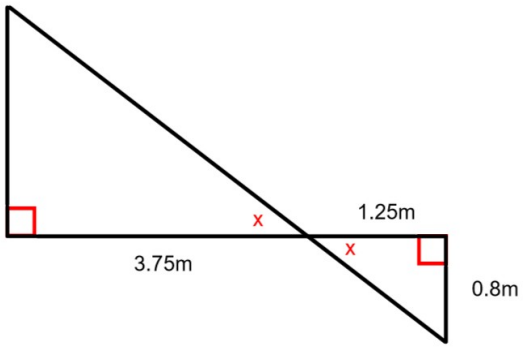
Example 1: How to measure the width of a road (without getting run over):

Find an object straight across the road.

Walk along the edge of the road for a set distance, and mark this point.

Walk **straight** back from the road a set distance. From this point, turn towards the object on the other side of the road and walk until you hit the edge of the road. Mark this point.

Here's an example of how the calculations would work:



You walked 5m along the road, then walked 0.8m back from the road. The marked point in between splits your walk along the road into 3.75 and 1.25m.

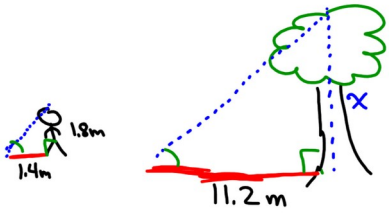
These triangles are similar because they both contain a right angle ("straight" across and "straight" back), and the angles at the marked point are opposite angles, so they are the same as well.

$$\frac{d}{0.8}=\frac{3.75}{1.25}$$
$$\frac{d}{0.8}=3$$
$$d=3\times 0.8$$
$$d=2.4$$

The road is 2.4m wide.

Example 2: Working with shadows.

A tree casts a shadow that is 11.2m long. At the same time, a student measuring 1.8m tall casts a shadow that is 1.4m long. Determine the height of the tree.



The triangles are similar because they both contain a right angle (at the base of the student/tree) and the angle made by the sunlight to the tip of the shadow is also the same.

$$\frac{x}{1.8}=\frac{11.2}{1.4}$$

$$\frac{x}{1.8}=8$$

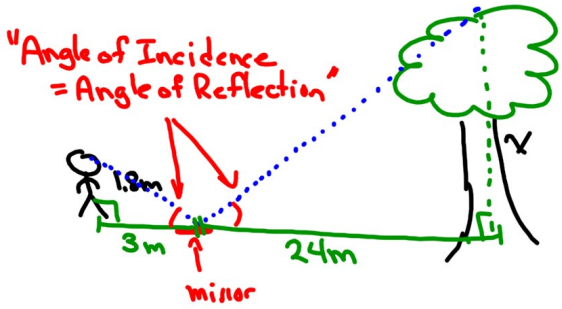
$$x=8\times 1.8$$

$$x=14.4$$

The tree is 14.4m high.

Example 3: Using Mirrors.

To verify the height of the tree, the student places a mirror on the ground 24m from the base of the tree. They back up until they can see the tip of the tree appear in the mirror, and measure they have walked 3m from the mirror.



These triangles are similar because they both contain a right angle and the angles "at the mirror" are the same because light reflects off a mirror at the same angle it hits it. (Ask your science teacher if you don't believe me!)

$$\frac{x}{1.8}=\frac{24}{3}$$

$$\frac{x}{1.8}=8$$

$$x=14.4$$

The tree is 14.4m high.

Practice: pg. 386 #4, 5, 6, 7, 10, 12, 14