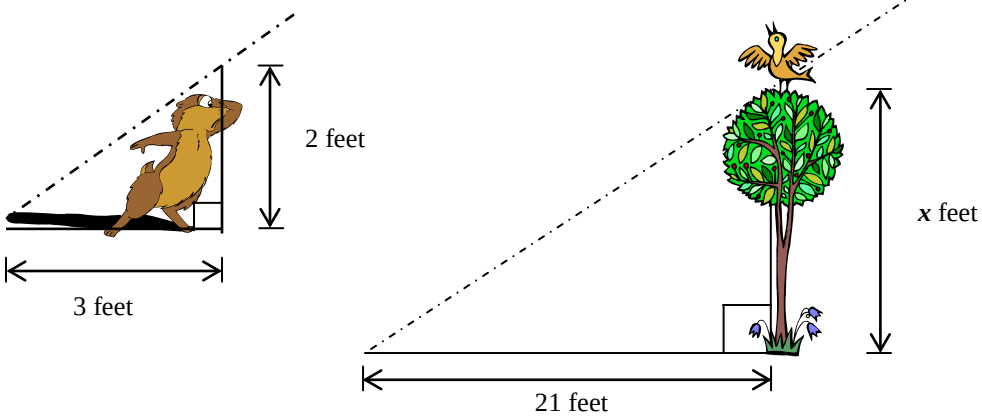
Using Similarity for Indirect Measurement

Suppose you and a friend want to find the height of a tree on a sunny day. Or perhaps you want to find the width of a lake. You could try to stretch a tape measure up the side of the tree as you stood on your friend's shoulders or stretch it as you swam across the lake. There is an easier way, called indirect measurement. One way to make an indirect measurement is to use similar figures.

The angles the sun makes as it causes each object to cast a shadow are the same for each object. Since the triangles are similar:

$$\frac{friend's\ height}{friend's\ shadow} = \frac{tree's\ height}{tree's\ shadow}$$

You can easily measure the shadows and your friend. The height of the tree is the only value in the proportion that you don't know, so calculate it!



Example: If a ground hog is 2 feet tall and casts a shadow of 3 feet at the same time that a tree cast a 21-foot shadow, what is the height of the tree?

$\frac{2}{3} = \frac{x}{21}$, so $3x = 42$, and we now know that $x = 14$.

Now use the indirect method to determine the height of 2 different size objects that you are unable to measure directly (school building, football goal post, flagpole, tall tree, etc.). You will need the following:

Measuring tape or meter sticks
Notebook for recording your measurements
Sunshine

Don't try this activity at midday because the sun will be directly overhead and won't cast shadows.

Name of object	Height of person	Shadow length of person	Shadow length of object	Calculated height of object
1.				
2.				

On the back of this paper, make a sketch and show your proportion for each object.