Lesson 11.3: Indirect Measurement with Similar Triangles

In this lesson you will:
- learn how to use similar triangles to measure tall objects and large distances indirectly

Suppose you want to find the height of a tall object such as a flagpole. It would be difficult to measure the flagpole directly—you would need a very tall ladder and a very long tape measure! In this lesson you will learn how you can use similar triangles to find the heights of tall objects indirectly.

Investigation 11.3: "Mirror, Mirror"

Suppose you wanted to measure the height of a flagpole. You can use a mirror and what you know about similar triangles to make an indirect measurement of the flagpole.

Suppose you mark crosshairs on a mirror and then set the mirror (point *X*) on the ground several yards from the flagpole (point *B*). Then you (point *P*) step back from the mirror, staying in line with the mirror and the object, until you see the reflection of the top of the object at the crosshairs on the mirror. Then have another person measure and record the distances *PX* and *BX* and your height at eye level (*PE*).
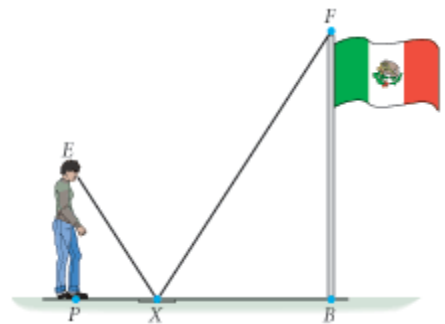
A.) If you think of $\overline{FX}$ as a light ray that bounces back to the observer's eye along $\overline{XE}$, what is true about $\angle FXB$ and $\angle EXP$? Why?

B.) What is true about $\angle B$ and $\angle P$? Why?

C.) Name two similar triangles. Tell why they are similar.

D.) Set up a proportion using corresponding sides of similar triangles that you could use to calculate *FB*.

E.) Mr. Thompson did the experiment above. His eye level height is 1.52 meters. When the mirror is set up, he is standing 2 meters from the crosshairs on the mirror, and the distance from the crosshairs on the mirror to the flagpole is 6.5 meters. Approximately how tall is the flagpole?

You can use indirect measurement in many other cases as well, as seen in the two examples below.

•Example 1: 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? Show your thinking.

5.25 ft

6 ft

x ft

18 ft
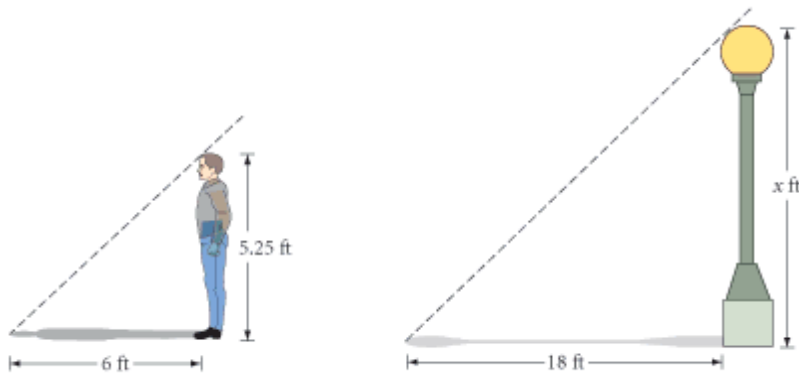
•Example 2: Driving through the mountains, Dale has to go up and over a high mountain pass. The road has a constant incline of 7¾ miles to the top of the pass. Dale notices from a road sign that in the first mile he climbs 840 feet. How many feet does he climb in all?

⇒ASSIGNMENT: _____