

**Topic:
Indirect
Measurements**

Lesson Essential Question:

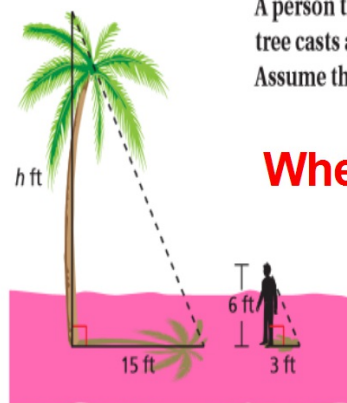
**How can we use similar figures to find
and describe indirect measures?**

**What is an
"indirect"
measurement?**

**the use of similar figures to find a
missing measure that is difficult to
find directly**

Example

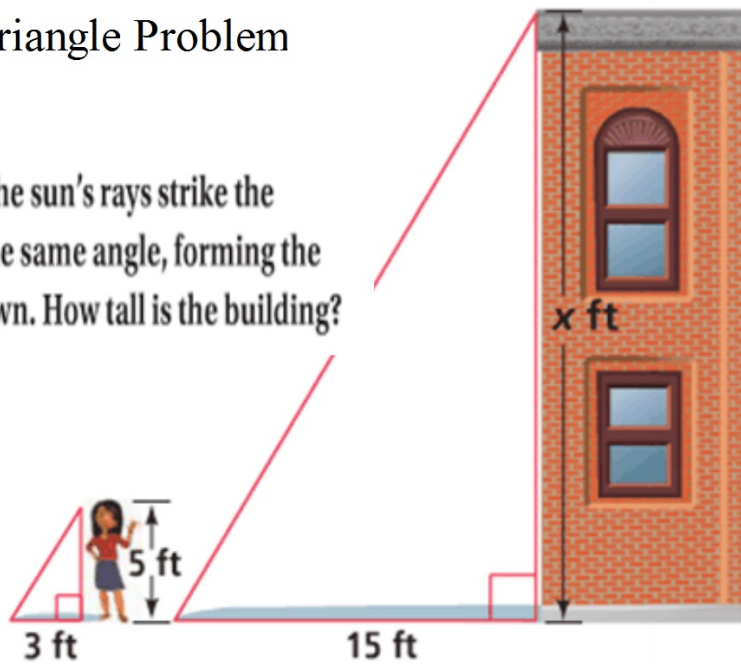
A person that is 6 feet tall casts a 3-foot-long shadow. A nearby palm tree casts a 15-foot-long shadow. What is the height h of the palm tree? Assume the triangles are similar.



Where's your proportion??

Similar Triangle Problem

Indirect Measurement The sun's rays strike the building and the girl at the same angle, forming the two similar triangles shown. How tall is the building?



Step 1) Color
your sides
different colors
Step 2) Name the
sides using a
ratio
Step 3) Write the
corresponding
number the same
ratio
Step 4) Cross
multiply and
divide

Shadows:

LEQ: How can I use the steps for find the missing side to solve shadow problems

Indirect Measurement:

it allows you to use properties of similar polygons to find distances or lengths that are difficult to measure directly.

Example

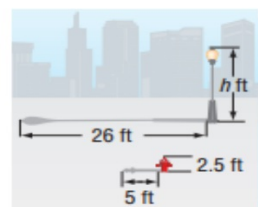
He measured his height and the length of his shadow then compared it with the length of the shadow cast by the pyramid.

$$\frac{\text{Thales' shadow}}{\text{pyramid's shadow}} = \frac{\text{Thales' height}}{\text{pyramid height}}$$

EXAMPLE Use Shadow Reckoning

1 CITY PROPERTY A fire hydrant 2.5 feet high casts a 5-foot shadow. How tall is a street light that casts a 26-foot shadow at the same time? Let h represent the height of the street light.

Shadow		Height
hydrant →	$\frac{5}{26} = \frac{2.5}{h}$	← hydrant
street light →		← street light
$5h = 2.5 \cdot 26$ Find the cross products.		
$5h = 65$ Multiply.		
$\frac{5h}{5} = \frac{65}{5}$ Divide each side by 5.		
$h = 13$		



Shadows:

How does it look?

LEQ: How can I use the steps for find the missing side to solve shadow problems

FERRIS WHEELS The Giant Wheel at Cedar Point in Ohio is one of the tallest Ferris wheels in the country at 136 feet tall. If the Giant Wheel casts a 34-foot shadow, write and solve a proportion to find the height of a nearby man who casts a $1\frac{1}{2}$ -foot shadow.

- 1) Draw a picture
- 2) Color code.
- 3) write down the colors of your proportion
- 4) make a proportion
- 5) Cross multiply and solve

$$\frac{\text{height}}{\text{shadow}} = \frac{\text{height}}{\text{shadow}}$$

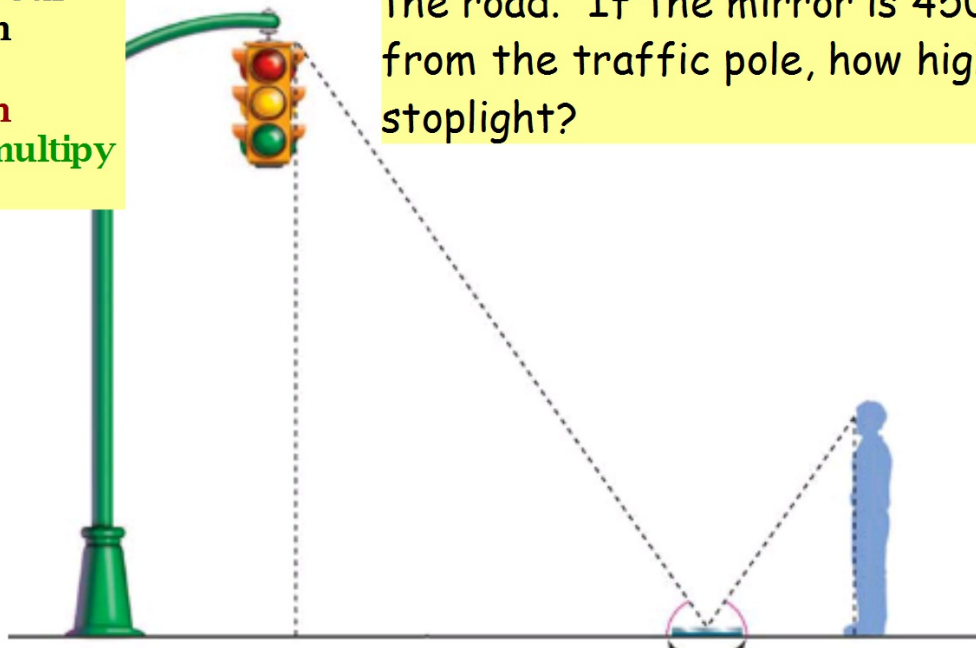
OR

$$\frac{\text{height}}{\text{height}} = \frac{\text{shadow}}{\text{shadow}}$$

draw a picture -

- 1) Color code
- 2) write down the colors of your proportion
- 3) make a proportion
- 4) Cross multiply and solve

Jim's height is 150cm. He is standing 100 cm from a mirror in the road - I have no idea why a mirror would be in the road. If the mirror is 450 cm from the traffic pole, how high is the stoplight?



x
100 cm
150 cm
450 cm

If the height of a tree is 7.2 m and casts a shadow of 2.4 m, and John's shadow is 1 meter, what is John's height?

draw a picture

- 1) Color code.
- 2) write down the colors of your proportion
- 3) make a proportion
- 4) Cross multiply and solve

1

2.

7.

MORE SIMILAR TRIANGLES PROBLEMS

1. A meter stick casts a shadow 1.4 meters long at the same time a flagpole casts a shadow 7.7 meters long. How tall is the flagpole?

draw a picture

1) **Color code.**

2) write down
the colors of
your proportion

3) **make a
proportion**

4) **Cross multiply
and solve**



draw a picture

- 1) **Color code.**
- 2) write down the colors of your proportion
- 3) **make a proportion**
- 4) **Cross multiply and solve**

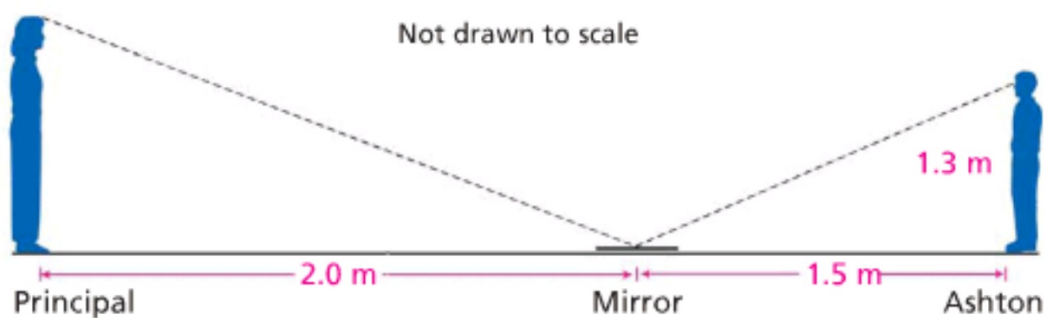
A rock concert is being televised. The bass player, who is 75 inches tall, is 15 inches on a TV monitor. The image of Bruno Mars is 13 inches tall on the monitor. How tall is the Bruno?



1. The Washington Monument is the tallest structure in Washington, D.C. At the same time the monument casts a shadow that is about 500 feet long, a 40-foot flagpole nearby casts a shadow that is about 36 feet long. Make a sketch. Find the approximate height of the monument.
2. Darius uses the shadow method to estimate the height of a flagpole. He finds that a 5-foot stick casts a 4-foot shadow. At the same time, he finds that the flagpole casts a 20-foot shadow. Make a sketch. Use Darius's measurements to estimate the height of the flagpole.

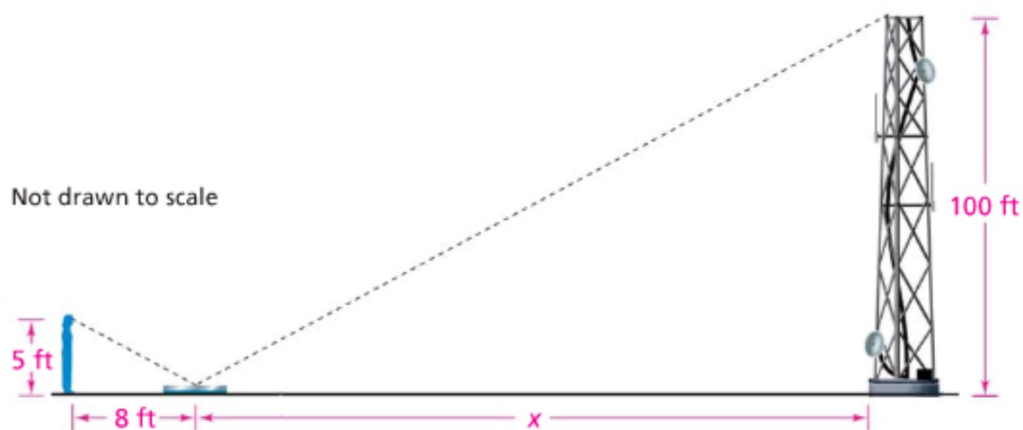


3. The school principal visits Ashton's class one day. The principal asks Ashton to show her what they are learning. Ashton uses the mirror method to estimate the principal's height. This sketch shows the measurements he records.



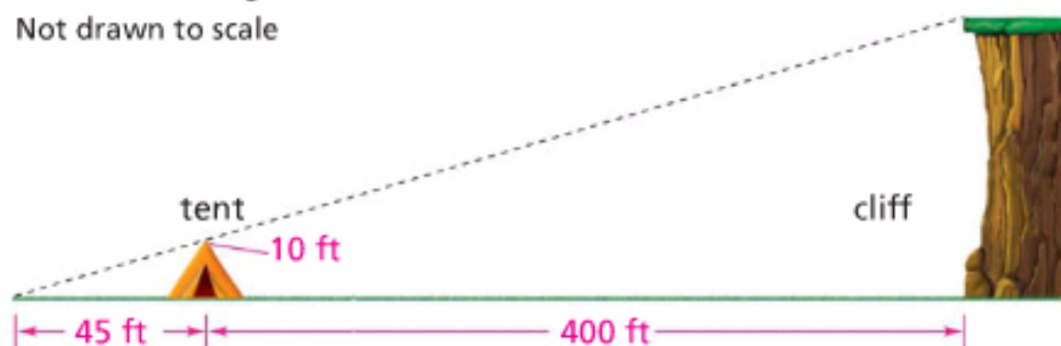
- What estimate should Ashton give for the principal's height?
- Is your answer to part (a) a reasonable height for an adult?

4. Stacia stands 8 feet from a mirror on the ground. She can see the top of a 100-foot radio tower in the center of the mirror. Her eyes are 5 feet from the ground. How far is the mirror from the base of the tower?



5. Judy lies on the ground 45 feet from her tent. Both the top of the tent and the top of a tall cliff are in her line of sight. Her tent is 10 feet tall. About how high is the cliff?

Not drawn to scale



Science A giant model heart on display at the Franklin Institute Science Museum in Philadelphia is shown below. The heart is the ideal size for a person who is 220 ft tall. About what size would you expect the heart of a man who is 6 ft tall to be?



Some Examples

A giraffe is 18 feet tall and cast a shadow of 12 feet. Corey cast a shadow of 4 feet. How tall is Corey?

1. Draw your figure
2. Set up a proportion
3. Solve

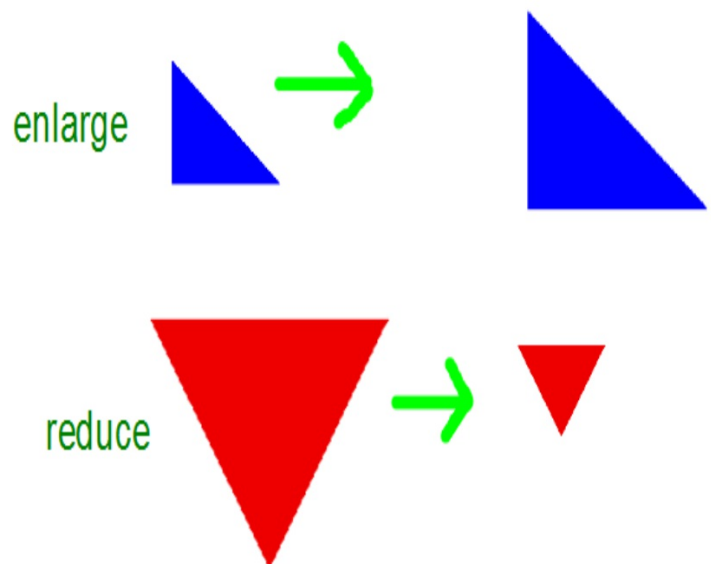
A flagpole cast a shadow of 28 feet long. A person standing by cast a shadow of 8 feet long. If the person is 6 feet tall, how tall is the flagpole?

1. Draw your figure
2. Set up a proportion
3. Solve

LEQ: How do we use scale factor to enlarge or reduce an object? What does it mean to draw an object to scale?

Reducing or enlarging a figure proportionally is called a **dilation**.

The **scale factor** tells how many times larger or smaller a similar figure is than its original.



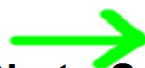
enlarge



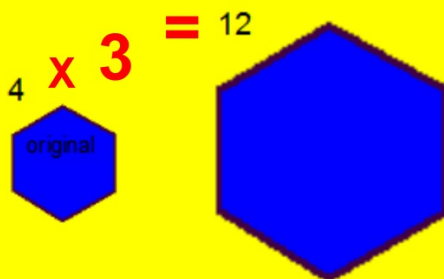
Small to Big
Multiply



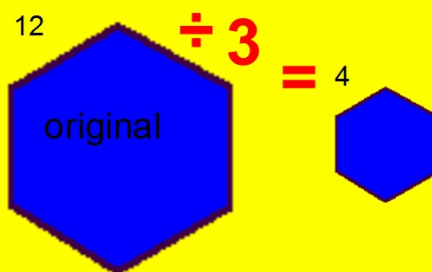
reduce



Big to Small
Divide



The scale factor for this figure would be 3.



The scale factor for this figure would be $\frac{1}{3}$.



So we if make a formula for
scale factor, $2 \times ? = 8$



it would be...

original x scale factor = dilation

The state of Kentucky is 420miles by 200 miles. If the map scale factor is 1in = 100 miles. What would be the dimensions for the map?



7)



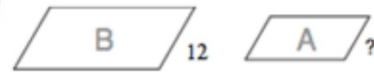
scale factor from A to B = 2 : 7



A is 2 = 6

B 7 x

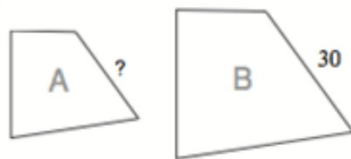
8)



scale factor from A to B = 2 : 3



9)



scale factor from A to B = 5 : 6



11)



scale factor from A to B = 2 : 3



10)



scale factor from A to B = 1 : 7



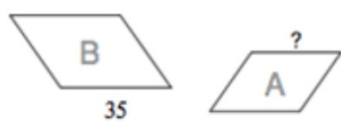
12)



scale factor from A to B = 1 : 2



13)



scale factor from A to B = 6 : 7



14)



scale factor from A to B = 1 : 3

