Name: _____ Date: _____

Measuring a Flagpole by Its Shadow

Circle group

How tall is the flagpole at your school? You cannot hold a tape measure up to the top. But you can find the height from the ground. You need a stick, a tape measure, and a sunny afternoon.

Stand a straight stick up on flat ground. Say it is 1 meter tall. Measure its shadow. Say it is 1.5 meters long. Now measure the flagpole's shadow right away, before the sun moves. Say it is 12 meters long.

The sun's light hits the stick and the pole at the same angle. Each one makes a triangle with its shadow. The two triangles have the same shape. One is small and one is big. These are called similar shapes. Their sides are in proportion. For the stick, the shadow is 1.5 times its height. It must be the same for the flagpole. Divide 12 by 1.5 and you get 8. The flagpole is about 8 meters tall.

For good results, measure at about the same time of day. Hold the stick straight up. Use level ground.

Questions

1. What three things do you need?

_____

_____

2. How long was the stick's shadow?

_____

_____

3. Why do the stick and the pole make triangles with the same shape?

_____

_____

4. How do you get the flagpole's height from its 12 meter shadow?

_____

_____

5. Why measure both shadows at about the same time?

_____

_____

6. What kind of ground should you use?

_____

_____

Words to know

similar: having the same shape but not always the same size
proportion: a fair comparison between two sets of numbers
level: flat, with no slope or hills

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

Measuring a Flagpole by Its Shadow

Triangle group

How tall is the flagpole in front of your school? You cannot easily hold a tape measure up to the top. But with a stick, a tape measure, and a sunny afternoon, you can find the height without leaving the ground.

Stand a straight stick upright on flat ground. Say it is exactly 1 meter tall. Measure the shadow it casts, and suppose it is 1.5 meters long. Now measure the flagpole's shadow right away, before the sun moves. Suppose it is 12 meters long.

The sun's light reaches the stick and the pole at the same angle, so each one makes a triangle with its shadow, and the two triangles have the same shape. One is small and one is large. Shapes like these are called similar, and their matching sides are in proportion. For the stick, the shadow is 1.5 times as long as the height. The same has to be true for the flagpole. So divide 12 by 1.5, and you get 8. The flagpole is about 8 meters tall.

For good results, measure both shadows at about the same time of day, hold the stick straight up, and use level ground. People have used this idea for a very long time, because it turns a hard measurement into a few simple steps.

Questions

1. What three things do you need to measure the pole's height this way?

_____

_____

2. How long was the stick's shadow in the example?

_____

_____

3. Why do the stick and the flagpole make triangles of the same shape?

_____

_____

4. How did the writer get the flagpole's height from its 12 meter shadow?

_____

_____

5. Why must both shadows be measured at about the same time?

_____

_____

6. What kind of ground should you use?

_____

_____

Words to know

upright: standing straight up
casts: throws or makes, as in a shadow on the ground
similar: having the same shape but not always the same size
proportion: a fair comparison between two sets of numbers
level: flat, with no slope or hills

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

Name: _____ Date: _____

Measuring a Flagpole by Its Shadow

Square group

How tall is the flagpole standing in front of your school? Because you cannot reach the top with a tape measure, the question seems difficult. Yet with a stick, a tape measure, and a sunny afternoon, you can determine the height without ever leaving the ground.

Stand a straight stick upright on level ground. Suppose it is exactly 1 meter tall, and suppose the shadow it casts measures 1.5 meters. Then, without delay and before the sun has had time to move, measure the shadow of the flagpole. Suppose that shadow is 12 meters long.

The sun's light strikes the stick and the pole at the very same angle, so each of them forms a triangle with its shadow, and the two triangles have the same shape even though one is small and the other is large. Shapes like these are called similar, and their matching sides are in proportion. For the stick, the shadow is 1.5 times as long as the height, and the same relationship must hold for the flagpole. Dividing 12 by 1.5 gives 8, so the flagpole is approximately 8 meters tall.

To obtain reliable results, measure both shadows at roughly the same time of day, keep the stick perfectly vertical, and choose level ground. People have relied on this idea for a very long time, because it converts a difficult measurement into a few simple steps.

Questions

1. Which three items are needed to find the pole's height this way?

_____

_____

2. How long was the stick's shadow in the example?

_____

_____

3. Why do the stick and the flagpole form triangles of the same shape?

_____

_____

4. How is the flagpole's height found from its 12 meter shadow?

_____

_____

5. Why must both shadows be measured at about the same time?

_____

_____

6. What kind of ground does the passage recommend?

_____

_____

Words to know

upright: standing straight up
casts: throws or makes, as in a shadow on the ground
similar: having the same shape but not always the same size
proportion: a fair comparison between two sets of numbers
level: flat, with no slope or hills

Talk together (every group has these)

1. Find one fact that every group read. How did your sheet say it?
2. What did your sheet tell you that you think another group's did not? Ask them.
3. What is one question about this topic that none of the sheets answered?

For the teacher: Measuring a Flagpole by Its Shadow

Each student sheet carries a shape, not a level. The same topic and facts, written three ways.

Circle: Measuring a Flagpole by Its Shadow

Easier · 167 words · Flesch-Kincaid grade 2

1. A stick, a tape measure, and a sunny afternoon.
2. 1.5 meters.
3. The sun's light hits both at the same angle.
4. Divide 12 by 1.5 to get 8 meters.
5. The sun moves, so the shadows would change.
6. Level ground.

Triangle: Measuring a Flagpole by Its Shadow

This passage · 208 words · Flesch-Kincaid grade 4.6

1. A stick, a tape measure, and a sunny afternoon.
2. 1.5 meters.
3. The sun's light reaches both at the same angle.
4. By dividing 12 by 1.5 to get 8 meters.
5. The sun moves, so the angle and the shadow lengths would change.
6. Level ground.

Square: Measuring a Flagpole by Its Shadow

Harder · 223 words · Flesch-Kincaid grade 8

1. A stick, a tape measure, and a sunny afternoon.
2. 1.5 meters.
3. The sun's light strikes both of them at the same angle.
4. By dividing 12 by 1.5, which gives 8 meters.
5. The sun moves, which would change the angle and the shadow lengths.
6. Level ground.