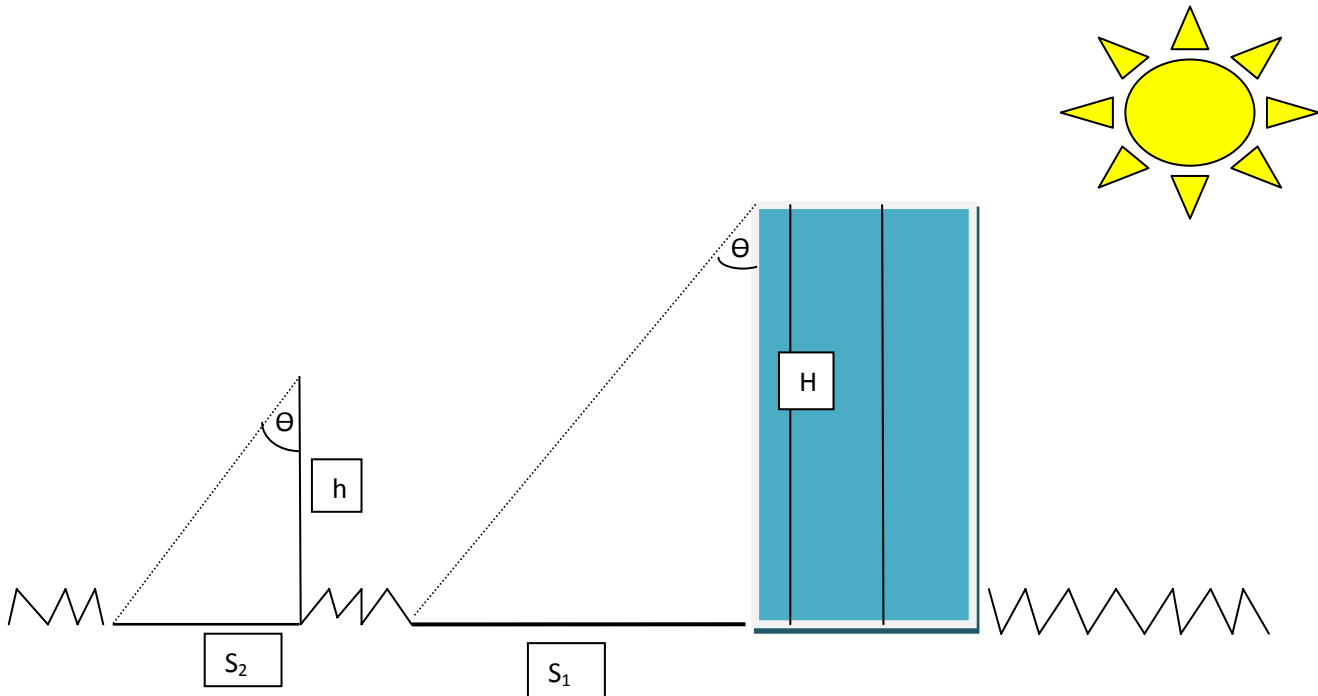


Similarity with Shadows Teacher Notes

Overview: Students will use the concept of similarity and proportions to find the height of various tall objects on campus. Students will use the measurement of their shadows and proportions to find the heights. Further concepts include graphing the ratio of height to shadow, using the Pythagorean Theorem to find the length of the hypotenuse (top of object to tip of shadow) and finally, using trigonometry to find the angle created from the sun hitting the object (θ in graphic below).



Ratio: We can find the length, s , by using the proportion: $\frac{H}{S_1} = \frac{h}{s_2}$ OR $\frac{H}{h} = \frac{S_1}{s_2}$

Materials:

TI-Nspire calculator loaded with activity: Shadows for Handheld.tns

Meter sticks

Chalk

Colored Pencils

Sunny Weather

Problem 1 Notes:

You may want to lead the class together through one example of measuring your own height, shadow and the shadow of a tall object. These numbers can be used in your own samples in upcoming problems but should not count toward the minimum limit of 5 sets of data per group. You may want to put a time limit on this activity so that students stay on task and finish at the same time. To help students get the 5 data sets, you may want to put some examples on the board from groups that seem to be measuring accurately. Then, students can pick and choose which data they want to add to their own set.

Be sure to show students how to type text in Column A when they add the object name. Students need to start with quotation marks so that the computer recognizes the input as text.




Problem 2 Notes:








Be sure to use your own data as the sample. If students have not learned the Pythagorean Theorem, you have options:

1. Automatically calculate this length by using the diamond row in Column G in the spreadsheet (from computer). $= \text{square root } (d1^2 + e1^2)$
2. Show students the formula and what to input on calculator page.
3. Have students use their handheld to draw the triangle and calculate the length of the missing side (hypotenuse).
4. Skip this piece of the activity.

For the angle activity, you can go into any amount of detail about trigonometry that you feel is appropriate for your class and their mathematical level(s). You may just want to show them how to use the keys or you can give some background about this branch of mathematics.

You need to use the *inverse tangent* function to find θ . The keystrokes for finding this angle are:

  "object's shadow length"  "object's height" 

Keep in mind that some handhelds may not be set to calculate in degrees so you will have to change the settings by pressing:       

Page 1.3: I recommend that you practice with this construction before the activity. Then, I would walk students together through creating the triangle with their own height/shadow measurements. You can also modify my instructions to use whatever construction technique is comfortable for you. You can use angle measurement also but this would change the data in the table. Use your own discretion as to what method works for you and your comfort with the handheld functionality.

Problem 3 Notes:

Work and answers are shown on the teacher edition of the worksheet. Use your own method for work (individual, pairs, cooperative groups, etc.). Feel free to change the instructions and problems as needed.

Problem 4 Notes:

Use these ideas as appropriate. You can also send students home with problems from the text on similar triangles. These problems can be used for homework, extensions, extra credit, etc.

HAVE FUN!