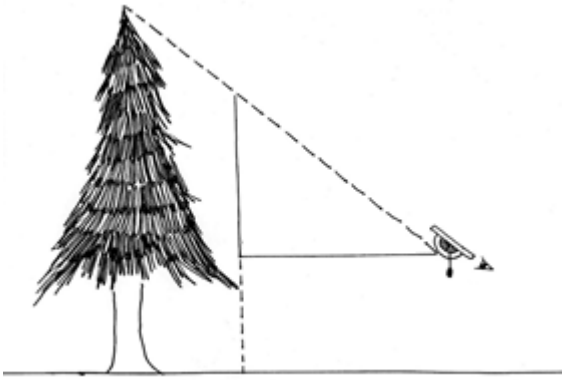
3D Educational Resources

CLINOMETERS – HOW HIGH IS THAT? (SIMPLE METHOD)



Clinometers were used by early surveyors, explorers and scientists to quickly estimate the incline and height of any objects they encountered. While not as common these days, they are still a useful tool. Find out how you can use a clinometer to determine how tall something is in your everyday life!

ONTARIO CURRICULUM LINKS

Through this activity, your students will learn about clinometers and a simple way that you can use it to determine height. This activity can be connected to multiple aspects of the Ontario school curriculum, our suggested links are:

- Grade 5: Mathematics (Geometry and Spatial Sense)
- Grade 7: Mathematics (Geometry and Spatial Sense)

Grades
5 – 8

Age Range
9 – 13 years

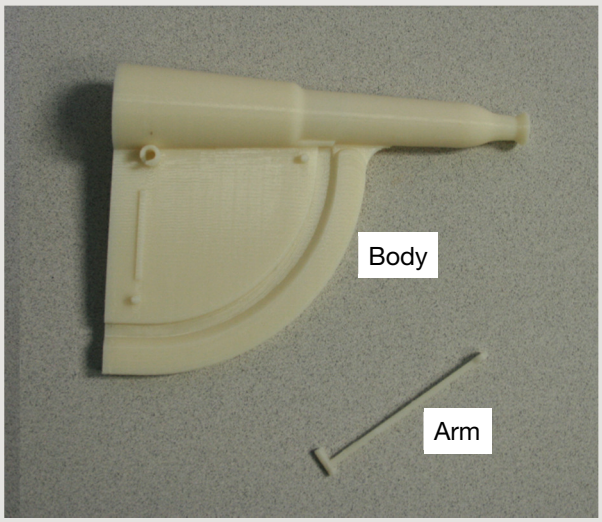
MATERIALS

1 – Glue stick
1 – Tape measure
1 – 3D printout of clinometer
1 – Printout of clinometer label

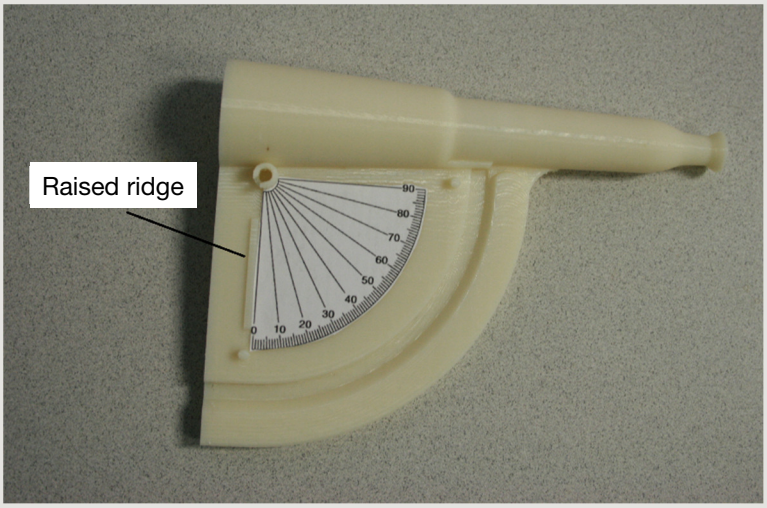
INSTRUCTIONS

Constructing the clinometer

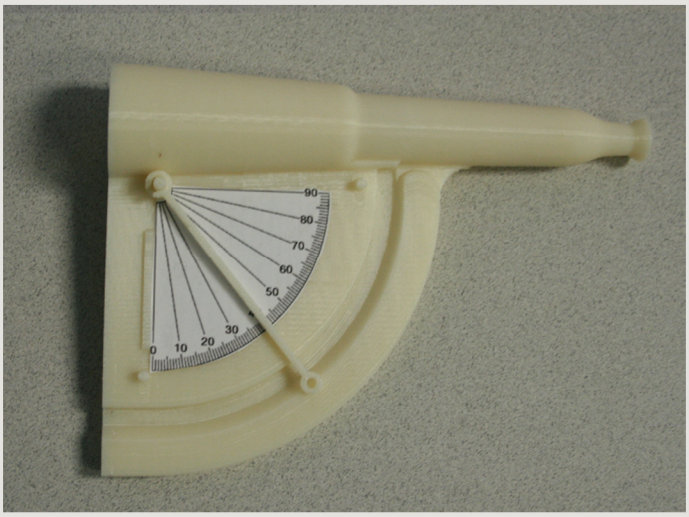
1. The following naming convention will be used in these instructions:



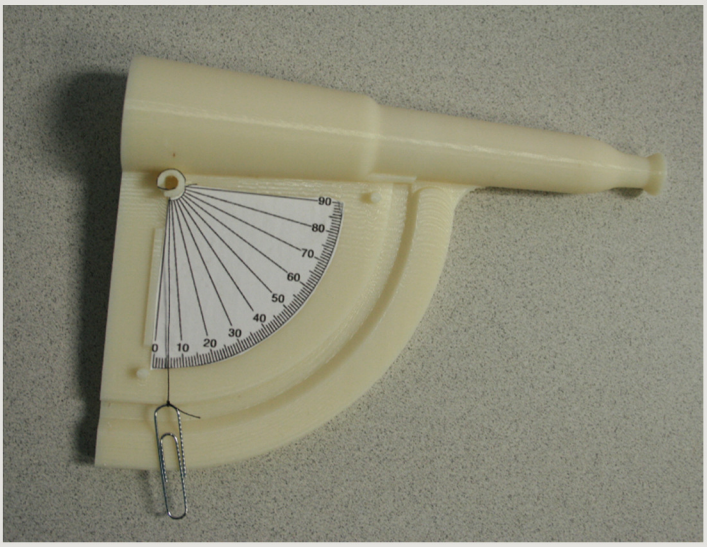
2. Paste the clinometer label on to the body of clinometer with the glue stick. Place the label so that the edge of the “0” line is flat against the raised ridge and the round cut-out portion at the top of the label is flush against the hole (see image below). This ensures that the measurements are accurate.



3. Insert the arm of the clinometer into the hole found on in the body of the clinometer. Make sure that the shorter end goes in first. If the arm does not move freely you might have put it in backwards.



Note: If you do not wish to use the arm (or if the arm breaks), an alternate way to do step 3 is to tie a piece of thread around the rim of the hole on the body of the clinometer and, on the other end of the thread, attach a weight (such as a paper clip or washer).

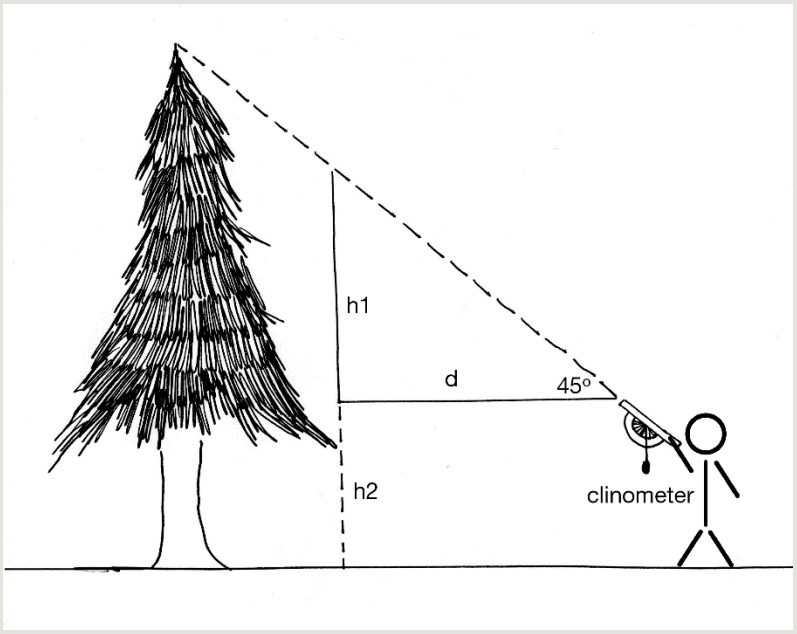


4. As you tilt the clinometer the arm of the clinometer will point down. The number that it points to represents the angle that the clinometer is tilted above the horizon. Try it out! Make sure to hold the clinometer in a way so that the arm does not drag along the surface of the main body.

Measuring height

Note: This activity is best done with 2 people working together.

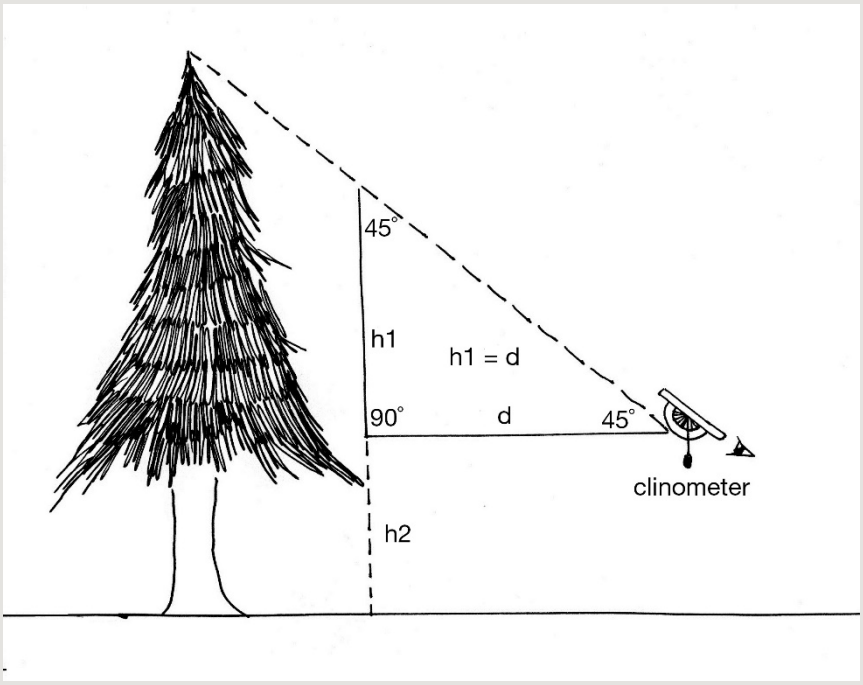
1. Pick a nearby object that you wish to measure the height and face it.
2. Look through the clinometer and slowly tilt it up until it reaches 45 degrees.
3. Walk toward the object while maintaining the clinometer at a 45 degree angle. This is where the second person can help out by making sure that the person with the clinometer does not trip over anything.
4. Stop walking once the top of the object is seen through the centre of the view piece of the clinometer.



5. Measure the distance between the person with the clinometer and the object (d in the image above). This is equal to the height of the object from the level of the clinometer (h1). Why is this?
6. This height that you determined is not the actual height of the object. To get the actual height you need to add the distance from the ground to whatever level the clinometer was at when the measurement was made (h2 in the image above).

SCIENTIFIC EXPLANATION

Trigonometry is the basis of how the clinometer works. In this activity, the individual walks with the clinometer at a 45 degree angle until the top of the object is seen, for this explanation we'll assume that it is a tree. At this point, it forms a triangle which has one angle at 90 degrees and the other two at 45 degrees. This is an isosceles triangle and the two sides of the triangle that touch the 90 degree angle are of equal length (see diagram below). These two distances represent the distance between the clinometer and tree (d), and the height between the clinometer and top of the tree (h1), which is how you determine the h1 in this activity.



As indicated in the instructions, h1 is the not the actual height of the object, it is the distance between the level of the clinometer when it made its measurement and the top of the tree. To get the actual height of the tree, you'll need to add h2, the distance between the ground and the level of the clinometer (see diagram above).

Ingenium – Canada's Museums of Science and Innovation has more than 110 000 artifacts in its collection, including many ones related to clinometers. You can explore other objects in the collection at: ingeniumcanada.org/ingenium/collection-research/collection.php.