

Math Lab: Constructing a Clinometer

In this lab you will create and use a clinometer. A clinometer is an instrument that measures the angle between the ground or the observer and a tall object, such as a tree or building.

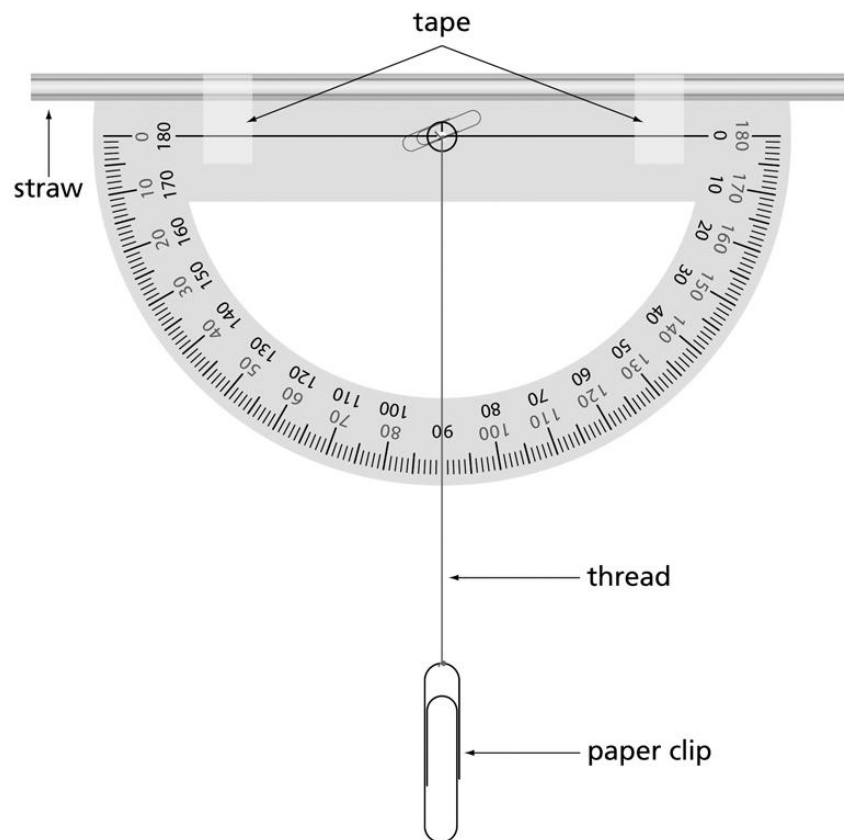
It is best to work with a partner. You will need a person to help you with steps 6 to 9 of the Procedure.

Materials

- 1 plastic protractor
- 1 soda straw
- 1 paper clip
- 1 toothpick or another paper clip
- 1 6-8 inch (15-20 cm.) length of thread
- 1 roll of fishing line or relatively inflexible string (length depends upon use)
- 2 pieces of tape (transparent, masking, duct)

Assembling the Clinometer

Your assembled clinometer is shown here. Use the illustration as a guide while following the steps outlined.



Procedure

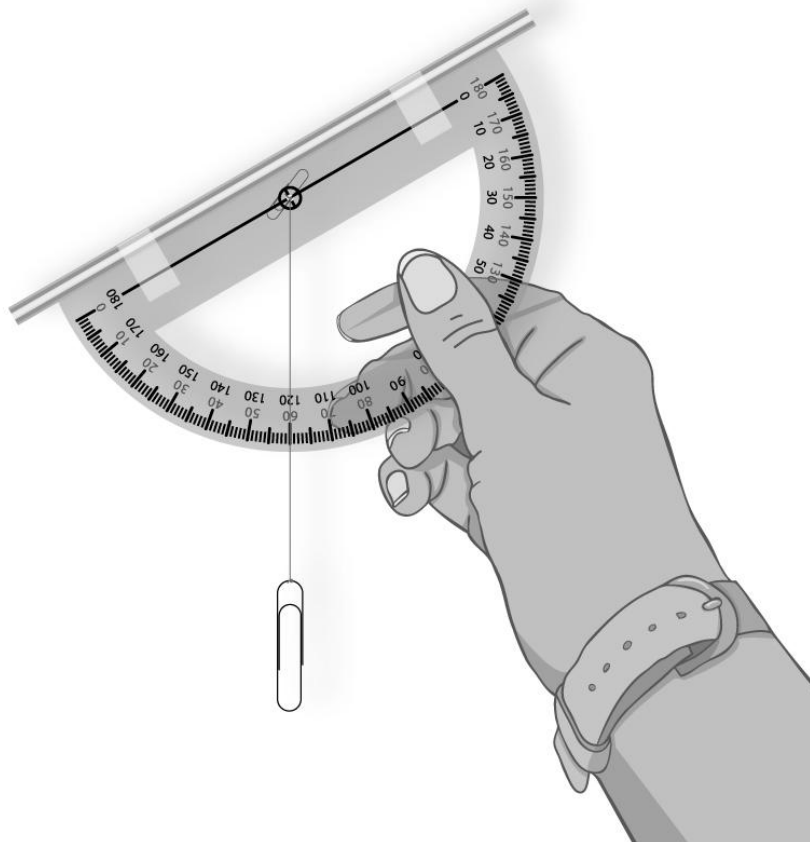
Step 1: Use tape to attach the straw along the base of the protractor.

Step 2: Tie a paper clip to one end of the piece of thread.

Step 3: Secure the other end of the thread through the hole in the centre of the base of the protractor. You may need to ask someone to help you drill a small hole if one does not exist. Be sure to drill the hole in the centre of the baseline (or zero line).

Step 4: Tie this end of thread to a toothpick or paper clip.

Does your clinometer resemble the one in the illustration above? If so, you are now ready to use your clinometer. Follow the procedure below for using the clinometer to measure the height of a tall structure.



hand: iStockphoto/Thinkstock

Step 5: Go outdoors and find a tall structure whose height you can measure. This could be a tree, a flagpole, or even your own house.

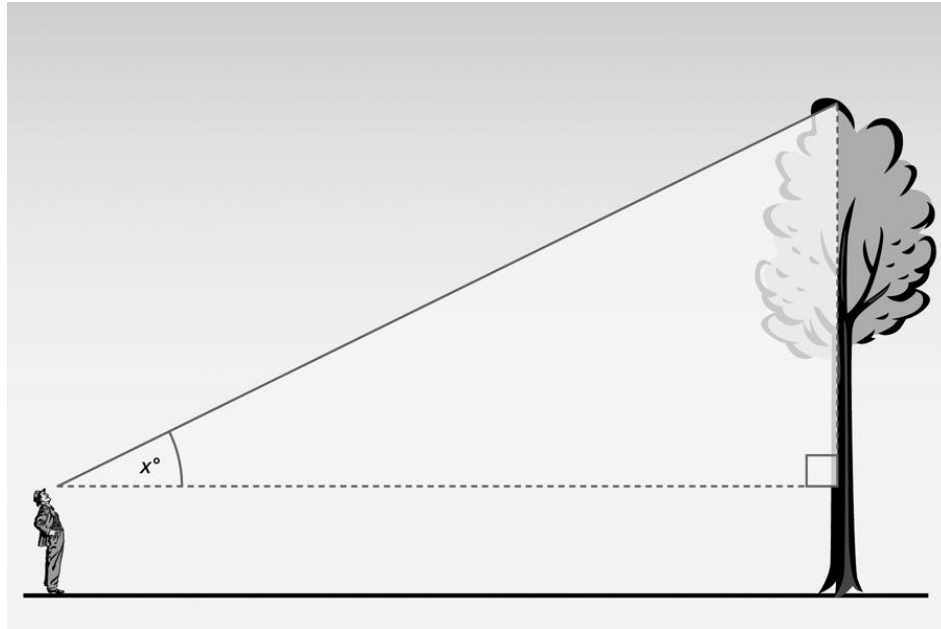
Step 6: Pick a spot away from the structure where you can still see the top of the structure.

Step 7: Have a partner use a measuring tape to measure the distance from the base of the structure to where you are standing.

Step 8: Look at the top of the structure through one end of the straw that is attached to your clinometer.

Step 9: Have your partner note the angle through which the string is hanging.

Analysis



man, tree: Image Club ArtRoom/Getty Images

1. What angle on the protractor does the string pass through when the soda straw is parallel to the ground?
2. If the string passes through 60° when you look through the straw at the top of the tree, then what would be the angle of x° in the diagram?
3. In the diagram shown, what parts of the triangle will you know after following the procedure above?
4. What trigonometric ratio would you set up to solve for the height of the tree?
5. What other measurement do you need to know in order to determine the height of the tree?

You will come back to these measurements in the lesson to calculate the height of the structure you have chosen.