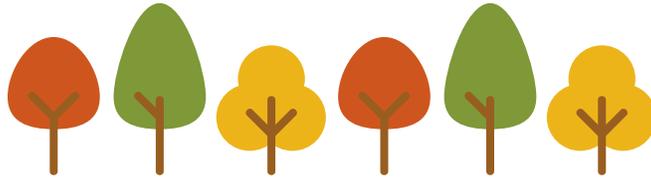


# APPENDIX A: MEASURING THE FOREST



While not everyone lives near a forest, we are never too far from neighbourhood trees. In this activity, we will be exploring the trees that live around us and the techniques we can use to determine just how large they really are. For more information about this activity, make sure to watch *Measuring the Forest*, the first Ontario Envirothon Virtual Lab video.

When exploring nature and enjoying the trees, please remember to be mindful of others, practice physical distancing protocols and follow [public health guidelines](#). Reminder: Parks in some cities or municipalities may be closed, be sure to check if they are open before heading out.

## Materials:

- Notebook/paper & pencil/pen
- Tree Identification Guide (see Activity 1 for online tree ID resources)
- Clinometer, don't have one? Make your own!
  - 180° protractor (half circle), ideally one with a hole in it ([printable image](#))
  - Straw, or tightly rolled paper
  - Tape or glue
  - String
- Small weight (paper clip, metal washer, etc)
- Measuring Tape
- Calculator

## Activity 1: Tree Identification

1. Find a tree. This tree could be in a local park, along a hiking trail, or even in your own backyard.
2. Identify the species and record the information in your notebook.
  - a. Use a dichotomous key such as [this one](#) from EEK! or [TreeBee](#) (need help to use Tree Bee? See [this tutorial](#) from the UW Ecology Lab). These tools will only work if there are leaves on the tree!
  - b. Use a visual guide such as the [Woody Plants of the Northern Forest](#) digital atlas, or the [University of Guelph's Arboretum's](#) website. These guides have more information about twig and bark identification but require more detective work on your end.

## Activity 2: Make Your Own Clinometer

One of the most common tools to used measure height is the clinometer. While these tools can be quite expensive the theory behind them is simple. Using some common school supplies and household objects, we can do some easy trigonome-tree to determine the height of a tree!

### Clinometer Assembly

1. Tape straw or rolled up paper along the straight edge of the protractor. The straw should pass through the two 0 marks on opposite ends of the protractor. This is the sight you will look down to view the tree.
2. Tie string through the hole in the protractor. If the hole is not centred below the 90° mark, or if your protractor does not have a hole, tape (or glue) the string to the protractor where the hole should be. Make sure the string dangles a few centimeters below the protractor when held straight side-up
3. Attach the small weight to the dangling end of the string. This will pull the string straight down along the angle mark when you hold your clinometer with the curved side facing the ground. This tells you what angle the clinometer is being held at.

### How to use your Clinometer

The clinometer uses distance and angles to measure a tree's height. The tool itself measures the angle between the tree at eye level and the top, based on where you are standing. Knowing both your distance from the tree and the angle determined by the clinometer, you can then determine the height of the tree.

To use your (homemade) clinometer, watch this [Measuring the Forest Video](#) or follow these instructions:

1. Using the tree you identified earlier walk back until you can see the top of the tree. Record the distance between you and the trunk of the tree.
2. Line the sight with the tree top Record the angle where the string lays on the protractor. To find the first value, use this equation:  $\tan(\text{angle to tree top}) * [\text{distance from tree}] = \text{Value 1}$
3. Line the sight with the tree top Record the angle. To find the second value, use this equation:  $\tan(\text{angle to tree base}) * [\text{distance from tree}] = \text{Value 2}$
4. If the tree base is:
  - a. Below your eye level, add the two values
  - b. Above your eye level, subtract the two values.

**Congratulations! You have determined the height of a tree.  
Don't forget to record your results!**



## Activity 3: Determining Diameter of a Tree

Measuring a tree's diameter is an important step in sampling a forest (see p. 25 of the [Forestry Study Module](#) for more on forest sampling). Ideally, a tree's diameter is taken at breast height, which is around 1.3 m above the forest floor. The resulting measurement is the diameter at breast height, or DBH. The main reasons for measuring at this height are that it is accessible and easy to reach, it is mostly consistent worldwide, and helps to avoid the swelling found at a tree's base.

### Determining DBH

1. Wrap your measuring tape around the tree at breast height.

***Bonus step: while you are there give the tree a hug!***

2. Write down the measurement, this is the circumference of the tree.
3. To calculate the diameter, use the following equation:

$$d = C/\pi$$

where C = circumference and d = DBH

4. Hooray! You now have the DBH of your chosen tree! Don't forget to record it, along with the other information collected in your notebook.



Way to go, you finished the first Ontario Envirothon Lab Open Activity! Before you go we have a few questions for you to consider, we encourage you to share your answers with us on the [Ontario Envirothon Facebook Page](#)!

1. What can you deduce about a tree from its height? What about its diameter?
2. Deciduous trees are starting to leaf out this time of year. Does your tree have leaves yet? How do the leaves look in comparison to other nearby trees?
3. Research one of the trees you measured. Do you think it was planted there intentionally, or did it grow there naturally? Why? If you think it was intentionally planted, why do you think that species was selected?

