Using Trees to Teach Math, Science, and Technology

Background:
During this activity your group will estimate tree height and circumference in two different ways – with and without technology. You will compare your values and report your data to NASA through the GLOBE Observer app. Tree height is the most widely used indicator of an environment's ability to grow trees. Observing tree height allows scientists to understand the gain or loss of biomass which can inform calculations of the carbon that trees and forests either take in from or release into the atmosphere.

Materials:

Device with the GLOBE Observer app installed
Clipboard
Clinometer
Tape measure
Pen or pencil

Activity 1: ***Using a Clinometer***

1.) Locate and select your study tree
   - Find a tree 7-15 meters away that you have a clear view of the top and bottom of the tree
   - The tree measured should be at least 5m (16.4ft) tall
   - The tree measured should be isolated trees or the tallest trees in a large grouping of trees

2.) Estimate the height of the tree:

3.) Record the following: Year _____ Month _____ Day ____ Hour (UT) _____

Recorded By: _____

Use the clinometer, tape measure, and your group to record the tree height. Measure three times and find the average.

Dominant Tree Species	Clinometer Reading (˚)	Tree Height (m) = Distance from Base of the Tree (m) plus height of Eyes (m)	Average Tree Height (m)	Height according to the app	Average Tree height according to the app
Tree # 1	45˚				
	45˚				
	45˚				

Activity 2: ***Using the app***

- Open the GLOBE Observer app on your device and select "Trees."
- Follow the short tutorial and the directions in the app to estimate tree height. Record the height on the table above (Measure it three times)
- Use a tape measure and measure/record tree circumference. Record the circumference (from breast height ~1.35 m up the tree) in the app and here:
  Tree #1 circumference (in cm):

Find a second tree and repeat:

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Reflection Questions:

1. Using illustrations, labels, and text explain the math behind calculating tree height and circumference.
2. How do the calculations you did by hand compare to the measurements generated by the app?
3. What are possible sources of error for each method of calculating tree height?

Resources:

- GLOBE Trees https://observer.globe.gov/do-globe-observer/trees
- How to Build a GLOBE Clinometer https://www.globe.gov/documents/355050/ba6cd381-02be-4525-8fd4-f061515b9862
- Purdue College of Science K-12 Outreach https://www.science.purdue.edu/K12/index.html
- How to make a clinomenter: https://www.youtube.com/watch?v=faF2zBUNJO4&feature=youtu.be
- Overall process: https://m.youtube.com/watch?v=o9F9HQnBXSU