The Tree Problem

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How tall is that tree?

Have you ever looked at a tree and wondered how tall it is?
Take a minute to brainstorm how we could use math to measure the heights of trees without a ladder and a tape measure.

Goal/Objective: We will explore 2 different ways that we can relatively measure the unknown height of objects.

Methods of Measuring

1

Stick Measure

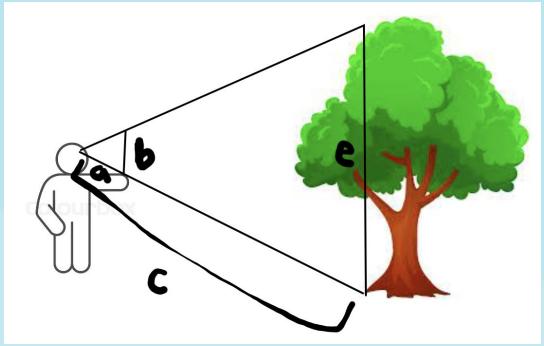
In this case, we will measure the height of a stick and compare it to the height of a tree behind it by creating congruent triangles.

2

Shadow Measure

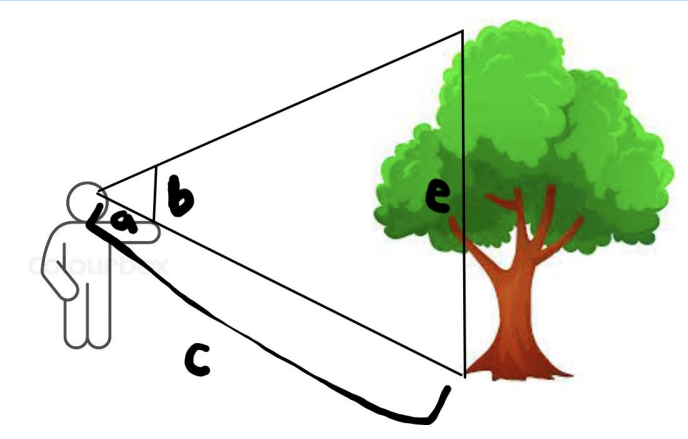
With this method, we will measure the shadow of ourselves and the shadow of the tree then set up proportions.

Method 1: Stick Measurement



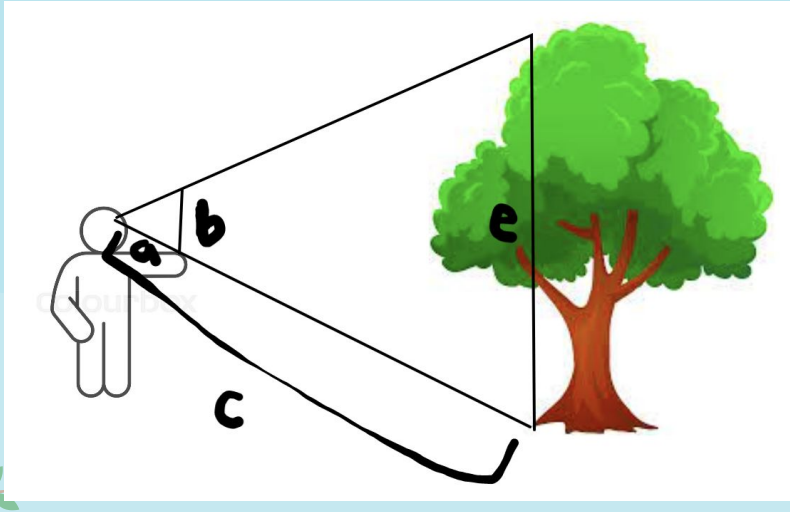
1. Find a ruler or a straight stick that has a length longer than your arm.
2. Measure the distance from your eye to your palm when you hold your arm straight out.
3. Vertically hold the stick, making sure that it is arm's length and that the length of it above your hand equals the distance from your hand to your eye.
4. Take steps back away from the tree until the stick above your hand covers the tree exactly.
5. Measure the distance of the straight line from your eye to the bottom of the tree.
6. Plug into the formula (b/a) x c where:
   a= the distance from your eye to your hand (bottom of the stick)
   b= the height of your stick (from where you are holding it and up)
   c= the distance from your eye to the bottom of the tree

My Method 1 Example



stick length: 24 in
eye to stick base: 24 in
eye to pole base: 196 in
so...
pole length: 196 in

Why does this work?

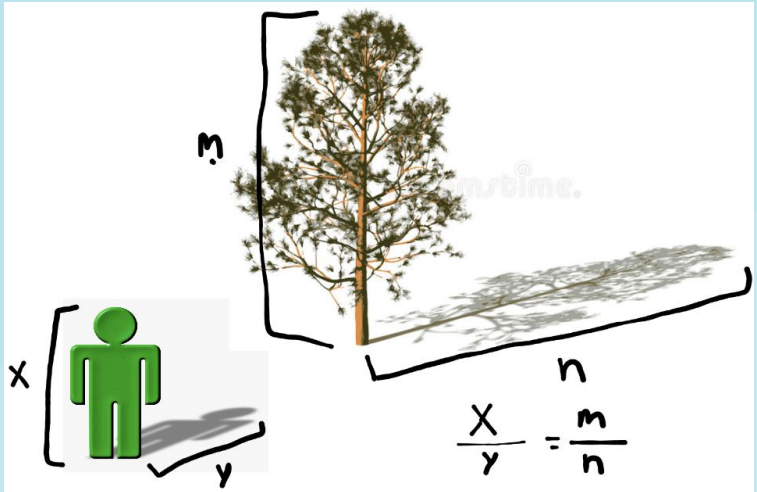


Think about what we already know about triangles and their congruency.

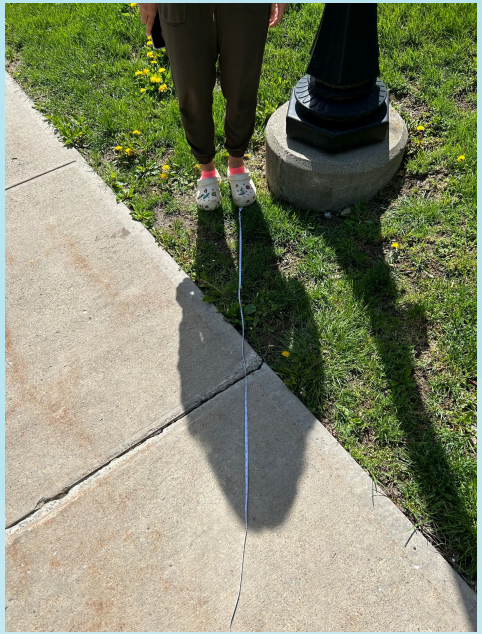
Use mathematical concepts about geometry to explain why this method works.

Method 2: Shadow Measurement

1. Measure your height (x)
2. Measure the length of your shadow (y)
3. Measure the length of the tree's shadow (n)
4. Plug into the equation: x/y = m/n where:
   x= your height
   y= your shadow length
   m= tree's height
   n= length of tree's shadow
5. Solve for m by cross multiplying



My Method 2 Example



my height (x)= 65 in

my shadow length (y)= 52 in

tree's shadow length (n)= 158 in

x/y = m/n
65/52 = m/158
m= 197.5 in

Why does this work?

Use mathematical reasoning to explain why measuring the shadows and creating proportions works.

Do you think one method works better than the other? Why or why not?

Try it Out

Find a tree that you would like to find the height of. Try out both of the methods we learned today and write down your two answers. Compare the answers and write which method you prefer and why.