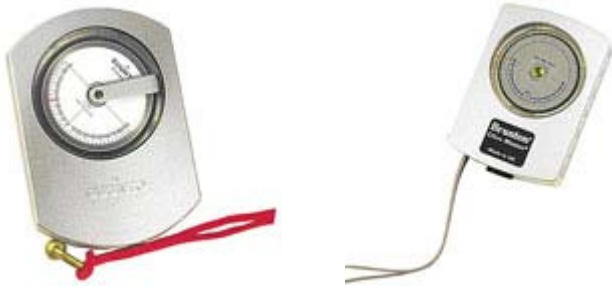


# Clinometers



level. So when taking slope or grade measurements, make sure to aim the clinometer at the equivalent "eye level" height on the object you are sighting.



## Introduction

Clinometers are used all over the world by foresters, surveyors, engineers, cartographers, geologists, miners, architects and others who need to measure heights, vertical angles and slopes quickly and easily.

## How to use a clinometer:

Hold the clinometer to your eye and with both eyes open, look simultaneously through the lens and alongside the housing. A horizontal sighting line will appear. Raise or lower the clinometer (by tilting your head) to place the sighting line on your target. Read the number closest to the sighting line.

Some people have a condition called heterophoria, which means there is a misalignment of the axis of both eyes. A way to test this is to first use your clinometer to sight an object with both eyes open. Then close the eye not looking at the clinometer scale. Use your one eye to look both at the sight line on the clinometer and the object to line them up. If your measurement is substantially different, you most likely have heterophoria and should keep one eye closed when using the clinometer.

One important thing to remember is that when you use a clinometer it is not at ground level, it is at eye

There are several scales used on clinometers:

- **Percent** scale will give difference in percent grade from horizontal (rise/run).
- **Degrees** scale will give you difference in degrees from horizontal.
- **Topographic** scale will give you a direct height measurement (in ft) of an object when standing exactly 1 chain length away (1 chain length = 66 feet).
- **Metric** scale is similar to topographic, but in metric units (meters). One scale will give you height when you are 15 meters away from the object and the other scale will give you height when you are standing 20 meters away.
- **Secant** scale aids in finding either the true horizontal distance or the slope distance when one or the other is known.

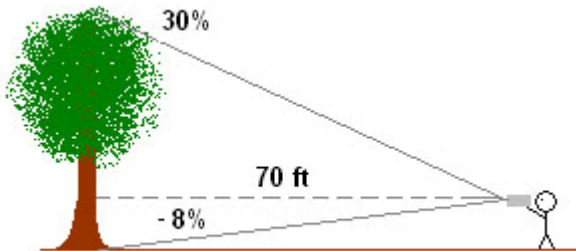
## Height Measurement with Percent Scale

With the percent scale you can get height measurements when you are standing a known horizontal distance from an object. You will just need a top and bottom measurement of the object and do a few simple calculations:

$$(\% \text{ to top}) - (\% \text{ to bottom}) = \text{total \% height}$$

$$(\text{total \% height}) \times (\text{horizontal baseline distance}) = \text{height of the object}$$

Example:

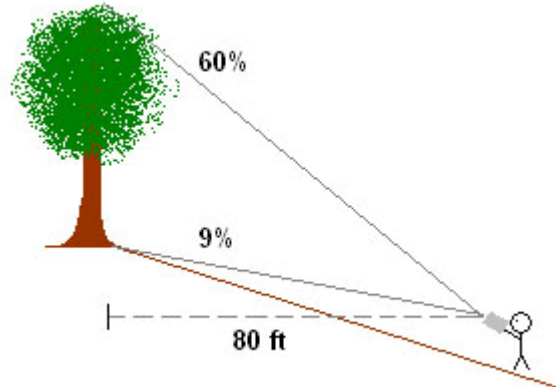


$$\% \text{ to top} = 30\% \quad \% \text{ to bottom} = -8\% \quad \text{Baseline} = 70'$$

$$30\% - (-8\%) = 38\% \rightarrow 38\% \times 70' = 26.6' \text{ tree height}$$

If standing on a slope you can use the same calculation but you will need to make sure you use your true "horizontal distance" to the object (slope distance will be different than horizontal distance).

Example:



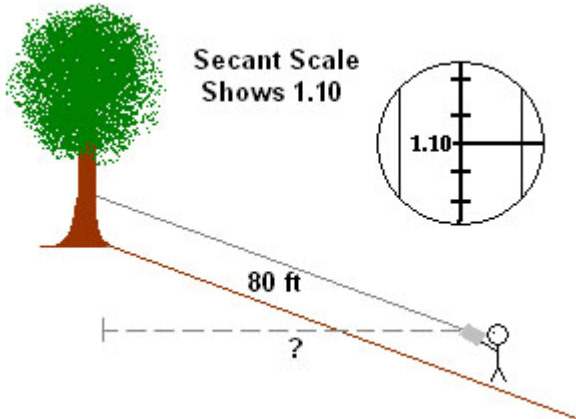
$$\% \text{ to top} = 60\% \quad \% \text{ to bottom} = 9\% \quad \text{baseline distance} = 80'$$

$$60\% - 9\% = 51\% \rightarrow 51\% \times 80' = 40.8' \text{ tree height}$$

## Using the Secant Scale to Find Horizontal or Slope Distance

If the slope distance is known, the secant scale can be used to find the horizontal distance and vice versa. This can be helpful if you need to measure an object's height on a slope but you only know the slope distance (the horizontal distance is used with the percent scale to find height, as shown above).

Example:



Known slope distance = 80' Measured slope secant value = 1.10

$$80' / 1.10 = 72.7' \text{ horizontal distance}$$

This can also be done the other way around if the horizontal distance is known and the slope distance is needed (known horizontal distance x secant reading = correct slope distance).

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