The Tangent Ratio
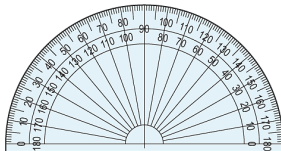
High School Geometry

Instructor: Ben Huang

Prerequisite Tools: ruler, compass, and protractor

Question: How tall is the Washington Monument?

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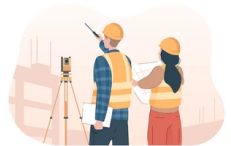**According to Wikipedia**: 555 ft

Wait a minute...
How do we know this data is reliable?

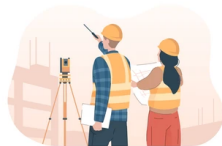If we want to measure the
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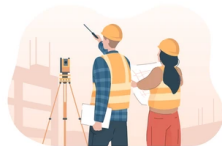
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Video: A simple device to measure the angle of elevation

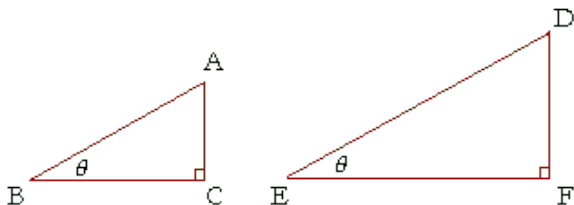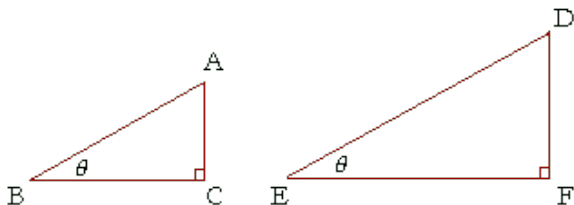**The Mathematical Tool**: The Tangent Ratio

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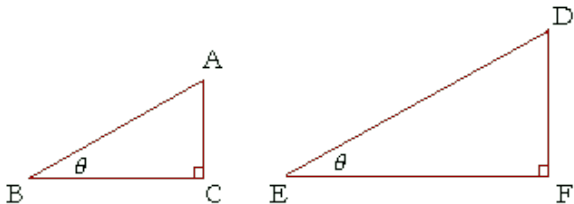**The Mathematical Tool**: The Tangent Ratio

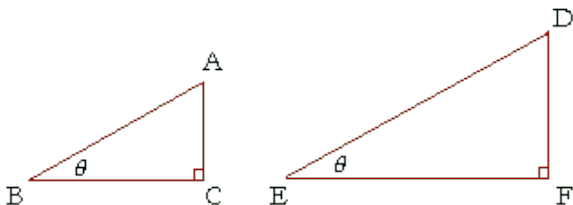$\triangle ABC \sim \triangle DEF$ (by the AA condition)

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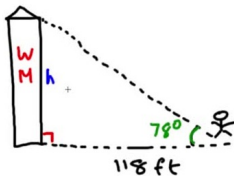$$\triangle ABC \sim \triangle DEF \text{ (by the AA condition)}$$

$$\frac{CA}{CB} = \frac{FD}{FE}$$

Definition: In a right triangle,

$$\tan(\theta) = \frac{\text{opposite side (opp)}}{\text{adjacent side (adj)}}$$

Problem: A surveyor is standing 118 feet from the base of the Washington Monument. The surveyor measures the angle of elevation from the ground to the top of the monument to be $78°$. Find the height h of the Washington Monument to the nearest foot.
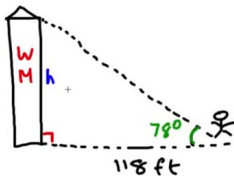
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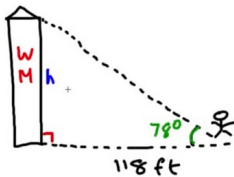

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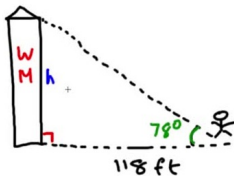

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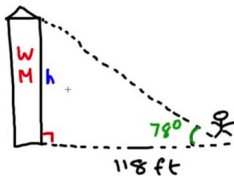$$\tan(78°) = \frac{h}{118}$$

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$$h = 118 \tan(78°)$$

To wrap up, let's find the approximate value of $\tan(78°)$ together!
GeoGebra

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What's beyond: In calculus, you will learn a method to find the value of tangent that is measure-error free via *infinite series*.