L4 – Using Trig to Solve for Angles Unit 3
MPM2D
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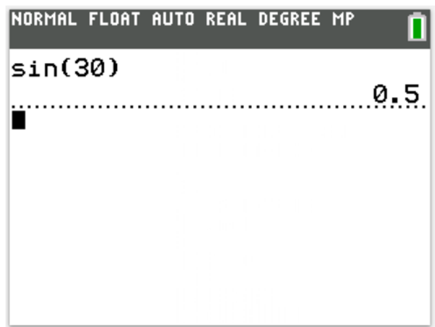
Part 1: Inverse Trig Functions

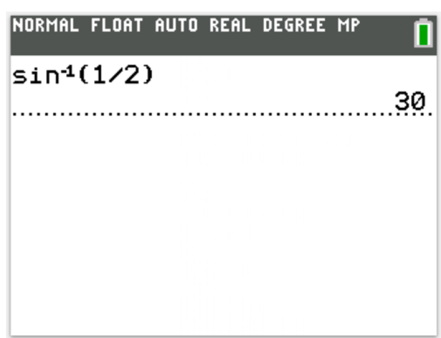
sin, cos, and tan are trig functions that take ANGLES as an input and then give a RATIO as an output.

For example, if you have a right triangle with a reference angle of $30°$, you can get your calculator to tell you what the ratio of the opposite side to the hypotenuse should be using the sine function.



$\sin^{-1}$, $\cos^{-1}$, and $\tan^{-1}$ are inverse trig functions that take RATIOS as an input and give an ANGLE as an output.

For example, if we knew the ratio of the opposite side to the hypotenuse, from some reference angle θ, in a right triangle was $\frac{1}{2}$, we could solve for θ using the inverse sine function:



This would be read as, "the inverse sine of 1 over 2 is 30 degrees."

Notes before continuing…

The -1 in $\sin^{-1}$, $\cos^{-1}$, and $\tan^{-1}$ is not an exponent, it is a notation that indicates it is an inverse function NOT a reciprocal function.

Inverse means OPPOSITE.

sin and $\sin^{-1}$ are inverse functions that perform opposite operations just like adding and subtracting.

Part 2: Using Inverse Trig Functions to Solve for Angles

Example 1: Solve for angle θ

a) $\sin\theta = \frac{10}{27}$

$\theta = \sin^{-1}\left(\frac{10}{27}\right)$

$\boxed{\theta \simeq 21.74^\circ}$

b) $\cos\theta = 0.25$

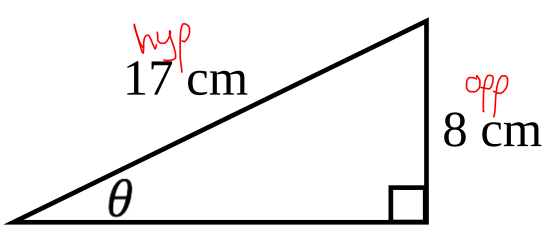
$\theta = \cos^{-1}(0.25)$

$\boxed{\theta \simeq 75.52^\circ}$

Example 2: Find the measure of the indicated angle in each diagram

Note: *When using SOHCAHTOA to solve for an angle in a right triangle, choose carefully which inverse trig ratio to use based on which side lengths are given. Label the opposite, adjacent, and hypotenuse from the desired angle to help choose correctly.*

a) Solve for θ

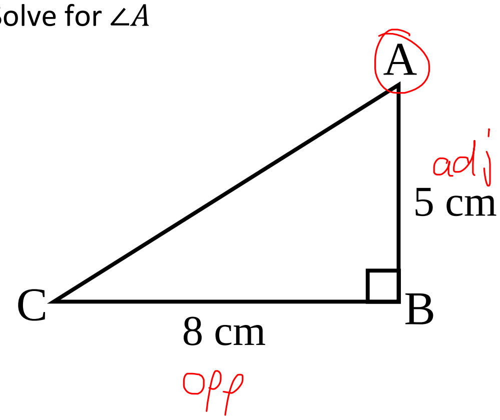


$\sin\theta = \frac{8}{17}$

$\theta = \sin^{-1}\left(\frac{8}{17}\right)$

$\boxed{\theta \simeq 28.07}$

b) Solve for $\angle A$

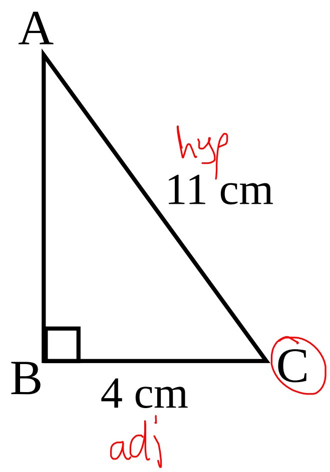


$\tan(A) = \frac{8}{5}$

$A = \tan^{-1}\left(\frac{8}{5}\right)$

$\boxed{A \simeq 57.99^\circ}$

c) Solve for $\angle C$

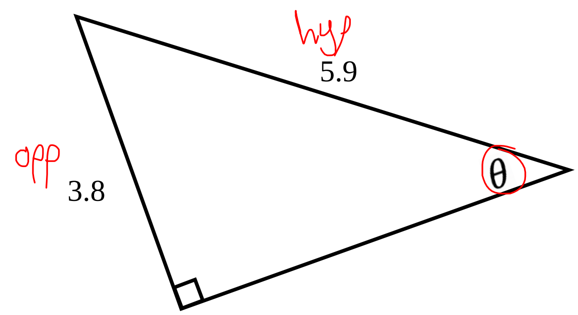


$$\cos(C) = \frac{4}{11}$$

$$C = \cos^{-1}\left(\frac{4}{11}\right)$$

$$\boxed{C = 68.68^\circ}$$

d) Solve for θ



$$\sin(\theta) = \frac{3.8}{5.9}$$

$$\theta = \sin^{-1}\left(\frac{3.8}{5.9}\right)$$

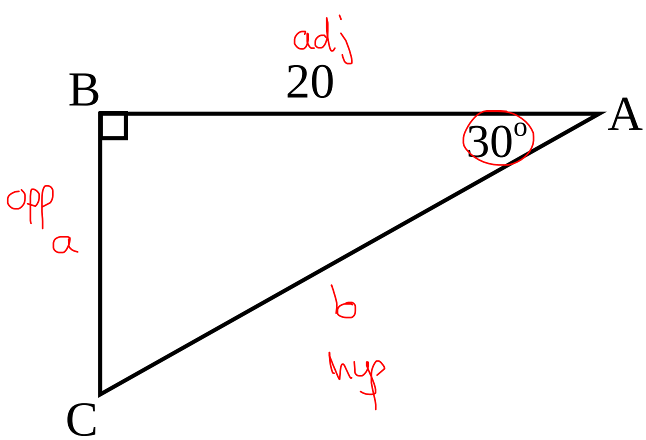
$$\boxed{\theta \simeq 40.10^\circ}$$

Part 3: Solving a Triangle

Solving a triangle is to calculate all of its unknown angle and side measures.

Example 3: Solve each of the following triangles

a) Solve ΔABC



$$\angle C = 90^\circ - 30^\circ$$

$$\angle C = 60^\circ$$

$$\tan(30^\circ) = \frac{a}{20}$$

$$a = 20\tan(30^\circ)$$

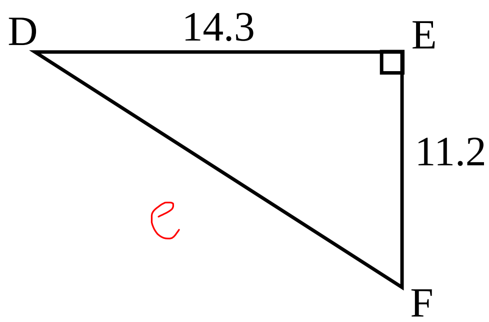
$$\boxed{a \simeq 11.55}$$

$$\cos(30^\circ) = \frac{20}{b}$$

$$b = \frac{20}{\cos(30^\circ)}$$

$$\boxed{b \simeq 23.09}$$

b) Solve ΔDEF



$14.3^2 + 11.2^2 = e^2$

$e = \sqrt{14.3^2 + 11.2^2}$

$\boxed{e \simeq 18.16}$

$\tan(D) = \frac{11.2}{14.3}$

$D = \tan^{-1}\left(\frac{11.2}{14.3}\right)$

$\boxed{D \simeq 38.07^\circ}$

$\tan(F) = \frac{14.3}{11.2}$

$F = \tan^{-1}\left(\frac{14.3}{11.2}\right)$

$\boxed{F \simeq 51.93^\circ}$