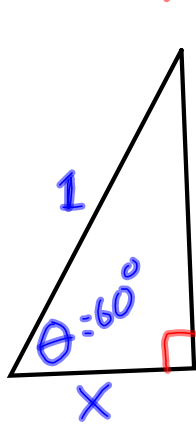


SOHCAHTOA

4.2 Trig. Function: The Unit Circle

Equation of a circle

$$x^2 + y^2 = r^2$$



$$(1) \cos 60^\circ = \frac{x}{1} \quad (1)$$

$$1 \cdot \cos 60^\circ = x$$

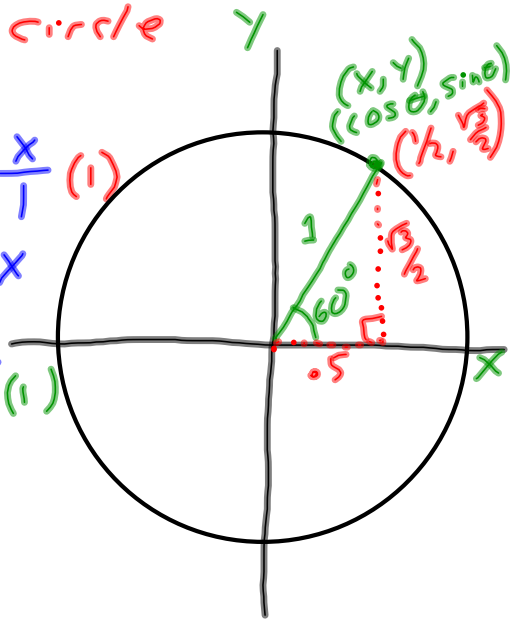
$$.5 = x$$

$$(1) \sin 60^\circ = \frac{y}{1} \quad (1)$$

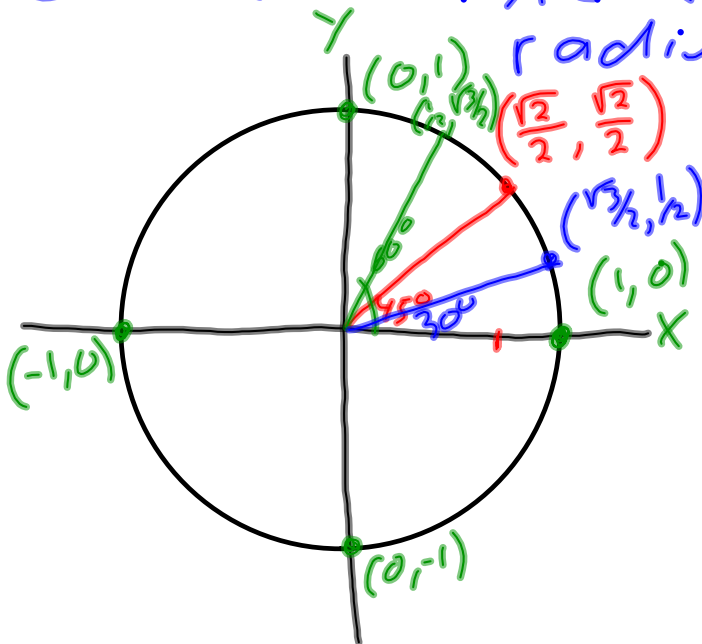
$$1 \cdot \sin 60^\circ = y$$

$$0.866 \approx y$$

$$\frac{\sqrt{3}}{2} = y$$



Unit Circle: A circle with radius = 1



In Trig. we use several "special angles" to measure.

30° 60°
45°

The Trigonometric Functions

$\sin \theta = y$	$\overset{\text{cosecant}}{\text{csc}} \theta = \frac{1}{y}$	} reciprocals
$\cos \theta = x$	$\overset{\text{secant}}{\text{sec}} \theta = \frac{1}{x}$	
$\tan \theta = \frac{y}{x}$	$\overset{\text{cotangent}}{\text{cot}} \theta = \frac{x}{y}$	

ex Find all six trig. values for $\theta = \frac{\pi}{6}$

$\sin \frac{\pi}{6} = \frac{1}{2}$	$\text{csc} \frac{\pi}{6} = 2$
$\cos \frac{\pi}{6} = \frac{\sqrt{3}}{2}$	$\text{sec} \frac{\pi}{6} = \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$
$\tan \frac{\pi}{6} = \frac{1}{\sqrt{3}} = \frac{1}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{3}$	$\text{cot} \frac{\pi}{6} = \frac{\sqrt{3}}{1} = \sqrt{3}$
$\text{csc} \frac{\pi}{6} = 2$	$\text{cot} \frac{\pi}{6} = \sqrt{3}$

ex Six trig. values for

$\theta = \frac{5\pi}{4}$

$\sin \frac{5\pi}{4} = -\frac{\sqrt{2}}{2}$	$\text{csc} \frac{5\pi}{4} = -\sqrt{2}$
---	---

$\cos \frac{5\pi}{4} = -\frac{\sqrt{2}}{2}$	$\text{sec} \frac{5\pi}{4} = -\sqrt{2}$
---	---

$\tan \frac{5\pi}{4} = 1$	$\text{cot} \frac{5\pi}{4} = 1$
---------------------------	---------------------------------

$$-\frac{2}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = -\frac{2\sqrt{2}}{2} = -\sqrt{2}$$

Find (if possible) $\odot(1,0)$

Six trig. values for $\theta = 0$

$$\sin 0 = 0$$

$$\csc 0 = \frac{1}{y} = \frac{1}{0} = \text{undef.}$$

$$\cos 0 = 1$$

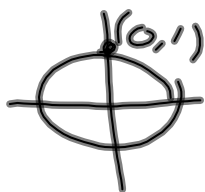
$$\sec 0 = \frac{1}{x} = \frac{1}{1} = 1$$

$$\tan 0 = \frac{y}{x} = \frac{0}{1} = 0$$

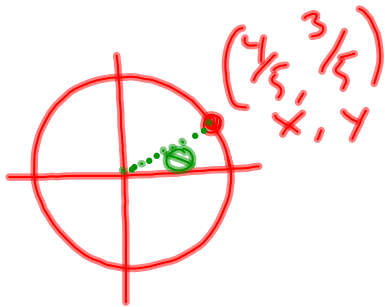
$$\cot 0 = \frac{x}{y} = \frac{1}{0} = \text{undef.}$$

ex

$$\tan 90^\circ = \frac{y}{x} = \frac{1}{0} = \text{undefined}$$



ex Given the point on the unit circle, find all six trig. values



$$\sin \theta = \frac{3}{5}$$

$$\csc \theta = \frac{1}{\frac{3}{5}} = \frac{5}{3}$$

$$\cos \theta = \frac{4}{5}$$

$$\sec \theta = \frac{5}{4}$$

$$\tan \theta = \frac{\frac{3}{5}}{\frac{4}{5}} = \frac{3}{4}$$

$$\cot \theta = \frac{4}{3}$$

Domain, Range and
Periodic Nature of Sine
and Cosine

Domain (input) $\rightarrow \theta = \mathbb{R}$

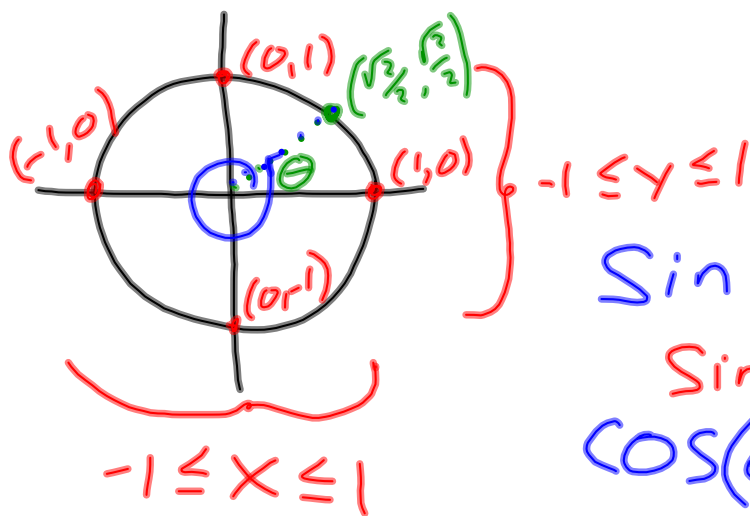
Range (output)

\uparrow all real numbers

$$\rightarrow -1 \leq \sin \theta \leq 1$$

$$\rightarrow -1 \leq \cos \theta \leq 1$$

Periodic Nature



$$\sin(\theta + 360^\circ n) = \sin \theta$$

$$\sin(\theta + 2\pi n) = \sin \theta$$

$$\cos(\theta + 360^\circ n) = \cos \theta$$

$$\cos(\theta + 2\pi n) = \cos \theta$$

ex

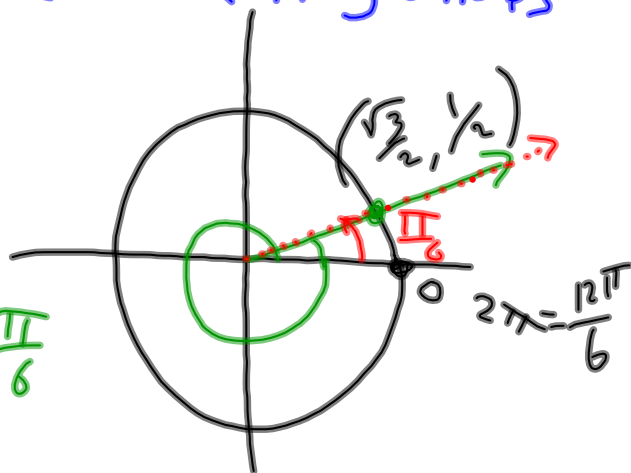
$$\sin \frac{13\pi}{6}$$

$$= \frac{1}{2}$$

or

$$\sin \frac{13\pi}{6} - 2\pi = \sin \frac{\pi}{6}$$

Coterminal Angles
have same trig values



ex

$$\cos 480^\circ$$

$$\cos 480^\circ = \cos 120^\circ$$

$$= -\frac{1}{2}$$

