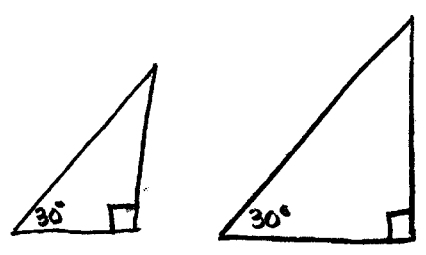


Lecture #2
MAT 123

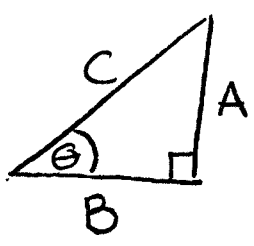
● Right Triangle Trigonometry



similar Δ 's
thus the ratios of
their sides (sin, cos, tan)
will be the same.

once we know that two of the angles are equal, we know the third angles are also equal (since we know the total degrees in a Δ is 180°)

Recall:



SOH CAH TOA

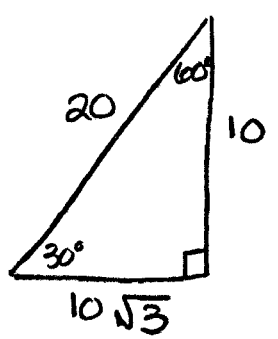
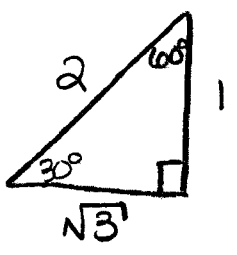
$$\sin \theta = \frac{A}{C}$$

$$\cos \theta = \frac{B}{C}$$

$$\tan \theta = \frac{A}{B}$$

Special Right Δ 's:

① 30-60-90



(* Since these two Δ 's are similar the ratios of the sides stay the same!

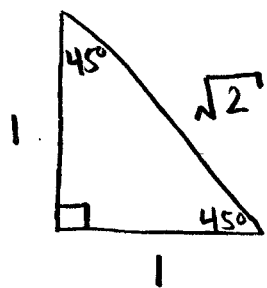
$$\sin 30^\circ = \frac{1}{2} \quad \sin 60^\circ = \frac{\sqrt{3}}{2}$$

$$\cos 30^\circ = \frac{\sqrt{3}}{2} \quad \cos 60^\circ = \frac{1}{2}$$

$$\tan 30^\circ = \frac{1}{\sqrt{3}} \quad \tan 60^\circ = \sqrt{3}$$

these will be on the test, and you are expected to know them! (without a calculator!)

② $45^\circ - 45^\circ - 90^\circ$



$$\sin 45^\circ = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

$$\cos 45^\circ = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

$$\tan 45^\circ = 1$$

Need to have these memorized as well

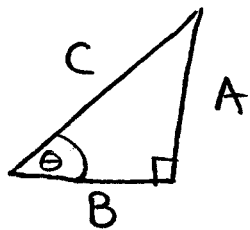
* Remember $\rightarrow \tan \theta = \frac{\sin \theta}{\cos \theta}$

Helpful Chart:

	30°	45°	60°
sin	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$
cos	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$
tan	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$

Memorize!!!

Pythagorean Identity:



$$\frac{A^2 + B^2 = c^2}{c^2} \Rightarrow \left(\frac{A}{c}\right)^2 + \left(\frac{B}{c}\right)^2 = 1$$



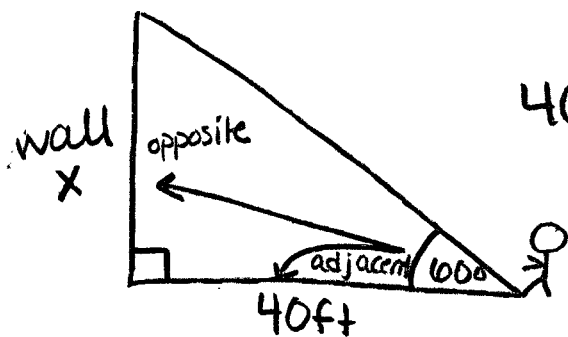
$$\sin^2 \theta + \cos^2 \theta = 1$$

Note: $\sin^2 \theta = (\sin \theta)^2$
 $\cos^2 \theta = (\cos \theta)^2$ (this is just notation)

Word Problems (with trig)

(Lecture #2)

- ① A person stands 40 ft. from the base of a wall, and measures the angle of elevation to the top as 60° . How tall is the wall?



$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$$

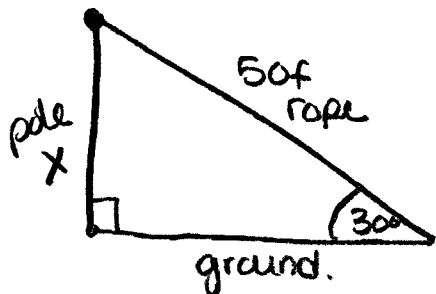
$$40 \cdot \tan 60^\circ = \frac{x}{40} \cdot 40$$

$$40 \cdot \tan 60^\circ = x$$

$$40(\sqrt{3}) = x$$

$$\boxed{x = 40\sqrt{3}} \leftarrow \text{Answer}$$

- ② A pole is supported by a rope that runs from the top of the pole to the ground. The rope is 50 ft. long and makes an angle with the ground of 30° . How tall is the pole?



$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$50 \cdot \sin 30^\circ = \frac{x}{50} \cdot 50$$

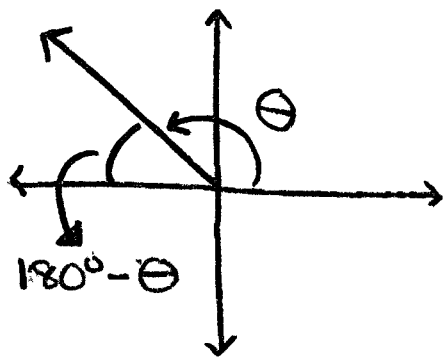
$$50 \cdot \sin 30^\circ = x$$

$$50 \left(\frac{1}{2}\right) = x$$

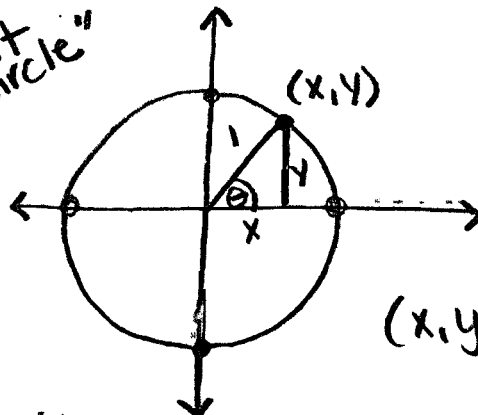
$$\frac{50}{2} = x$$

$$\boxed{25 = x} \leftarrow \text{Answer}$$

What about other angles and trigonometry?



"unit circle"



$$\sin \theta = \frac{y}{1} = y$$

$$\cos \theta = \frac{x}{1} = x$$

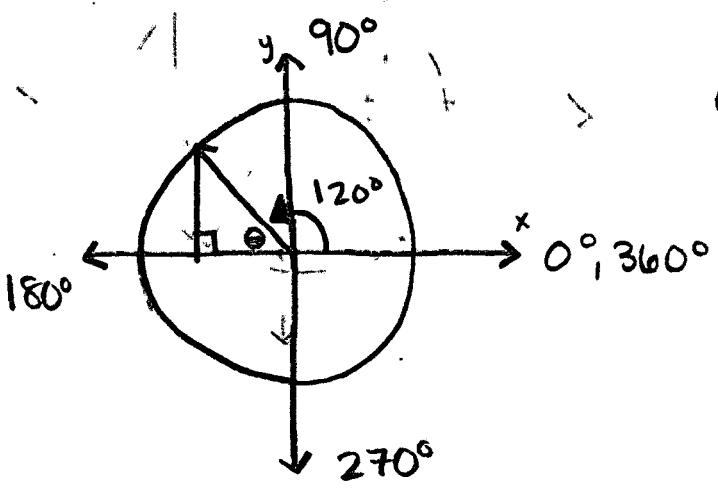
$$(x, y) \rightarrow (\cos \theta, \sin \theta)$$

* We can use the unit circle to find the sin, cos, tan of other angles.

example:

What is $\sin 120^\circ = ?$

we call this the reference angle.



$$\theta = 180^\circ - 120^\circ = 60^\circ$$

$$\sin 60^\circ = \frac{\sqrt{3}}{2}$$

Don't forget about the sign!

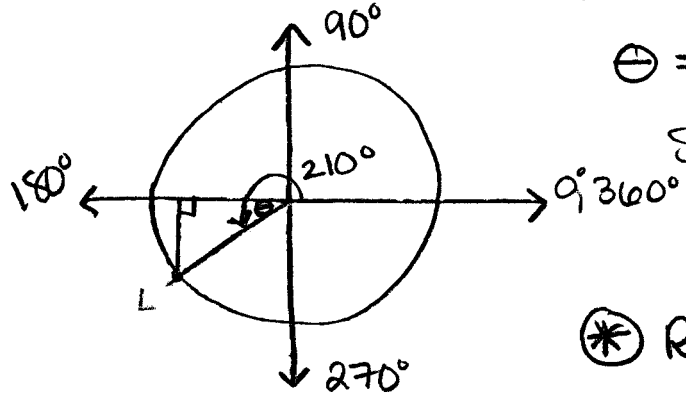
$$\cos 120^\circ = -\cos 60^\circ = -\frac{1}{2}$$

* note: we always form the reference angle with the x-axis and the terminal side of the original angle.

example:

What is $\sin 210^\circ = ?$

reference angle

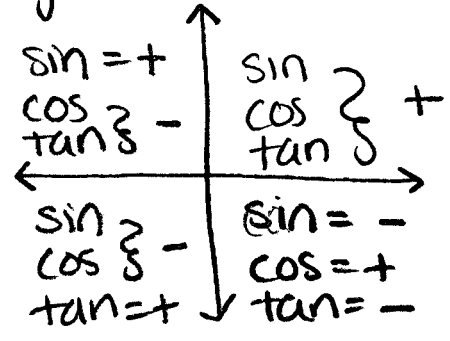
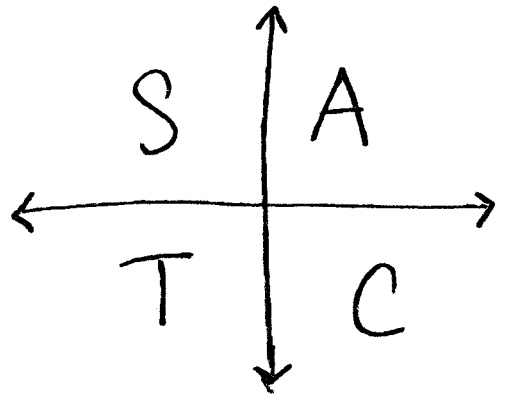


$$\theta = 270^\circ - 180^\circ = 30^\circ$$

$$\begin{aligned} \sin 210^\circ &= -\sin 30^\circ \\ &= -\frac{1}{2} \end{aligned}$$

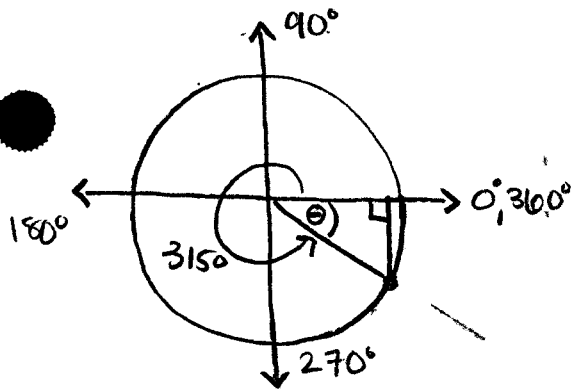
* Remember

"All Students Take Calculus" to help remember the signs of trig functions in each quadrant.



example:

What is $\cos 315^\circ = ?$



$$\theta = 360^\circ - 315^\circ = 45^\circ$$

$$\cos 315^\circ = \cos 45^\circ = \frac{\sqrt{2}}{2}$$

reference angle.

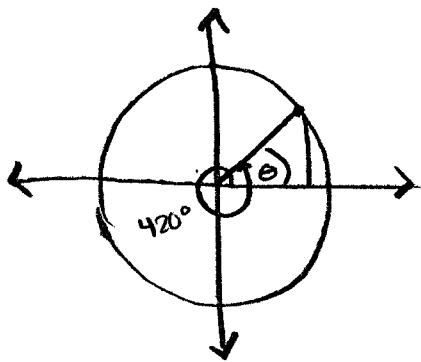
What is $\sin 315^\circ = ?$

note same reference angle.

$$\sin 315^\circ = -\sin 45^\circ = -\frac{\sqrt{2}}{2}$$

example:

What is $\sin 420^\circ = ?$



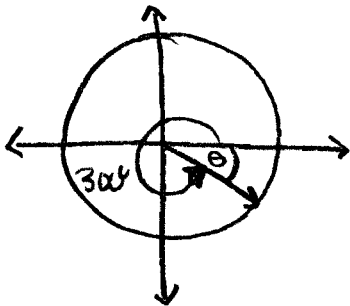
$$\theta = 420^\circ - 360^\circ = 60^\circ$$

$$\sin 420^\circ = \sin 60^\circ = \frac{\sqrt{3}}{2}$$

reference angle.

example:

What is $\sin 300^\circ = ?$



$$\theta = 360^\circ - 300^\circ = 60^\circ$$

$$\sin 300^\circ = -\sin 60^\circ = -\frac{\sqrt{3}}{2}$$

reference angle.

example:

What is $\tan 135^\circ = ?$

$$\begin{aligned} \tan 135^\circ &= -\tan 45^\circ \\ &= -1 \end{aligned}$$

$$\begin{aligned} \theta &= 180^\circ - 135^\circ \\ \theta &= 45^\circ \end{aligned}$$

