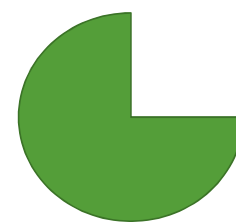




UNIT 1 LESSONS 3-6

PRECALCULUS B

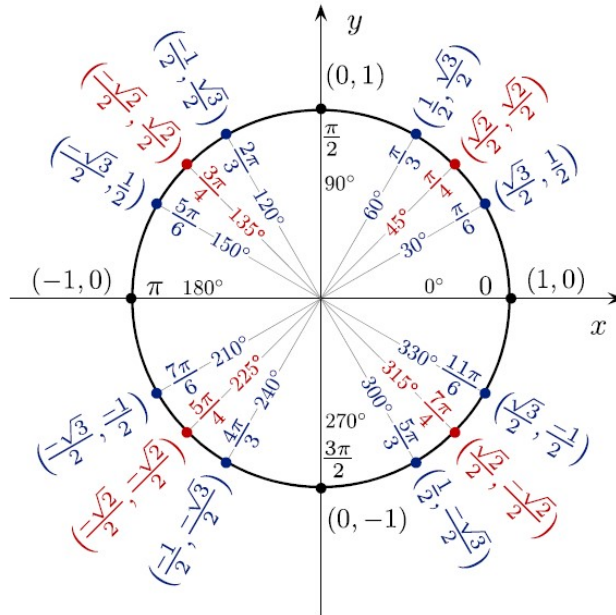


LESSONS:

- ❖ The Unit Circle
- ❖ Special Right Triangles
- ❖ Trig Functions by Quadrants



THE UNIT CIRCLE



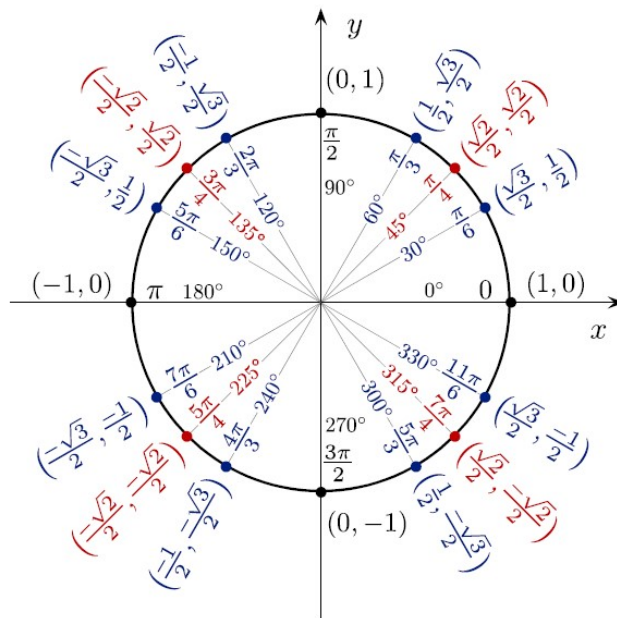
Graphic Source: Wikipedia

THE UNIT CIRCLE

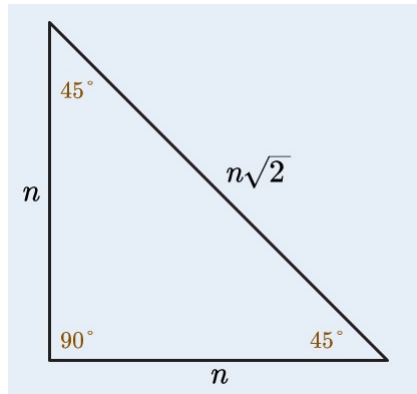
Angles are measured in Radians & Degrees.

Angles labeled for all the angles of the special right triangles:

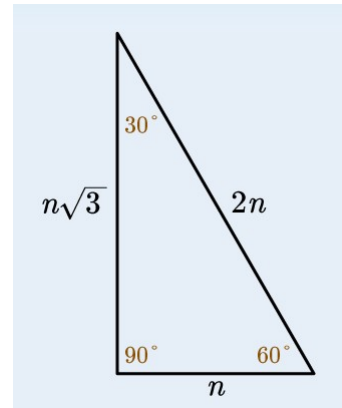
The 45-45-90 Triangle
The 30-60-90 Triangle



The 45-45-90 Right Triangle



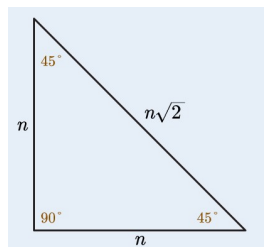
The 30-60-90 Right Triangle



Remember, the three angles of a triangle always add up to 180° .

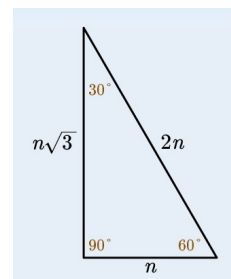
The 45-45-90 Right Triangle

Which could also be called
The $\pi/4 - \pi/4 - \pi/2$ Triangle



The 30-60-90 Right Triangle

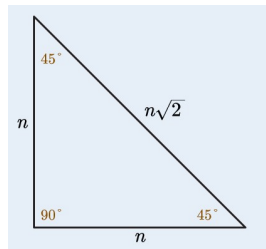
Which could also be called
The $\pi/6 - \pi/3 - \pi/2$ Triangle



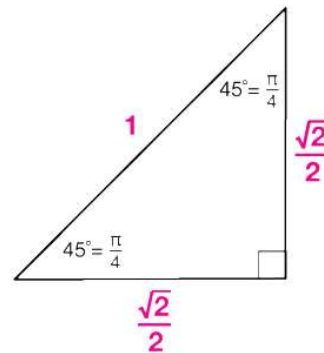
Remember, the three angles of a triangle always add up to 180° ... or 1π radians.

The 45-45-90 Right Triangle

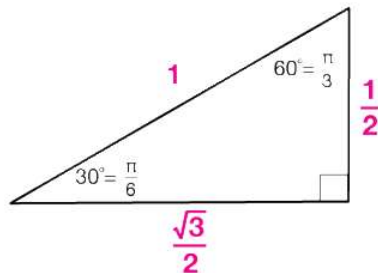
Which could also be called
The $\pi/4 - \pi/4 - \pi/2$ Triangle



But look at what these
general ratios become
when the hypotenuse is 1.

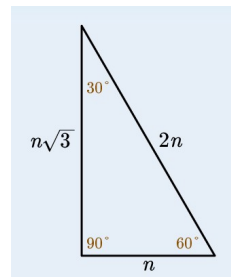


But look at what these
general ratios become
when the hypotenuse is 1.



The 30-60-90 Right Triangle

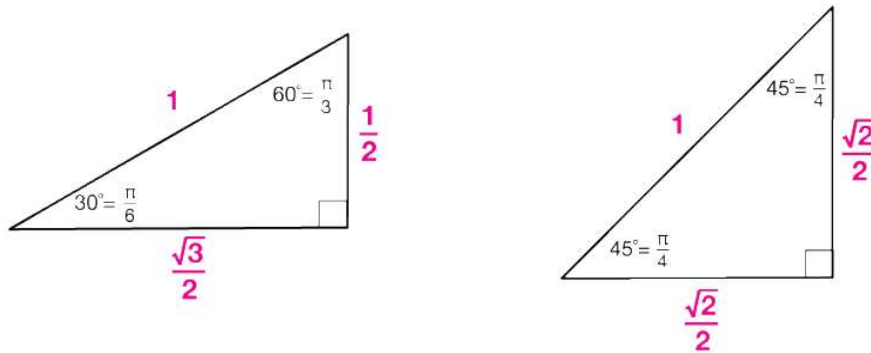
Which could also be called
The $\pi/6 - \pi/3 - \pi/2$ Triangle



But look at what these general ratios become when the hypotenuse is 1.

These are the numbers used on the UNIT CIRCLE !!

Which has a radius of 1 unit . . . And the radius becomes the hypotenuse !



Back to THE UNIT CIRCLE

Use this to find the exact ratio
for any trig function of any of
these special case angles.

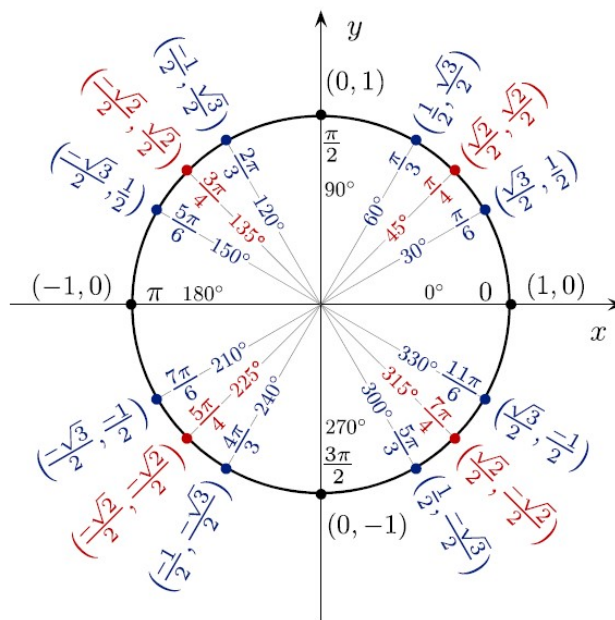
BUT . . .

You will need to remember

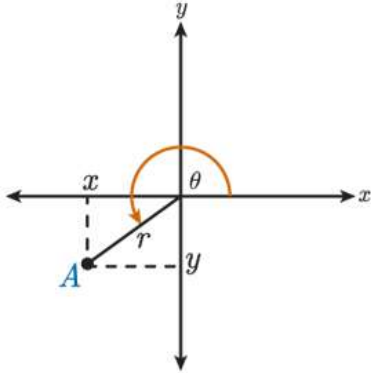
SOH-CAH-TOA

AND . . .

Know some vocabulary



STANDARD POSITION ANGLE



- Start the angle with one side along the positive x-axis.
- Put the vertex of the angle at the origin.
- Rotate counter-clockwise to the full size of the angle.
- Where the angle stops (or terminates) is the **TERMINAL SIDE**.

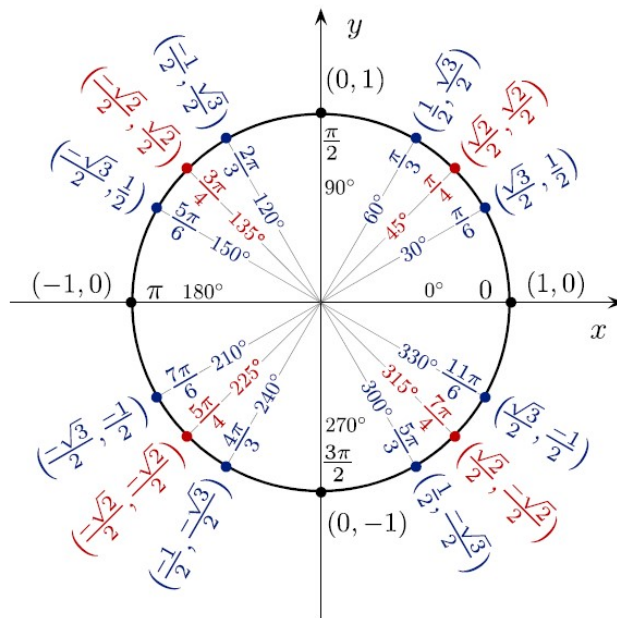
TRY IT:

SOH-CAH-TOA

What is $\sin 30^\circ$?

Hint:

Make the right triangle by drawing a vertical line from the point on the edge of the circle at 30° down to the x-axis.



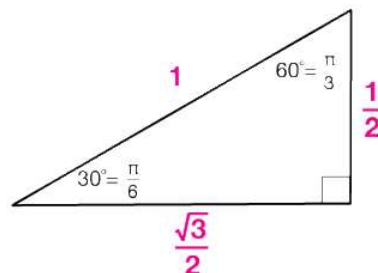
TRY IT:

SOH-CAH-TOA

What is $\sin 30^\circ$?

Hint:

Make the right triangle by drawing a vertical line from the point on the edge of the circle at 30° down to the x-axis.



Sine = opposite/hypotenuse

$$\sin 30^\circ = \frac{1/2}{1} = 1/2$$

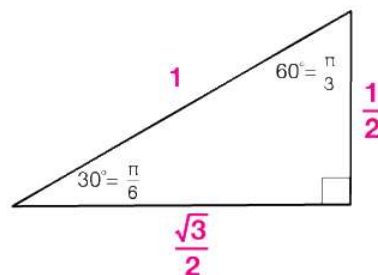
TRY IT:

SOH-CAH-TOA

What is $\cos 30^\circ$?

Hint:

-same angle,
different ratio



TRY IT:

SOH-CAH-TOA

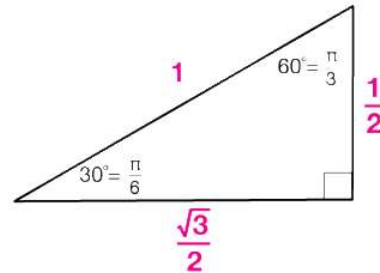
What is $\cos 30^\circ$?

Hint:

-same angle, different ratio

****Leave it as the exact radical!!**

Don't change it to a decimal unless it's asked for.



Cosine = adjacent/hypotenuse

$$\cos 30^\circ = (\sqrt{3}/2)/1 = \sqrt{3}/2$$

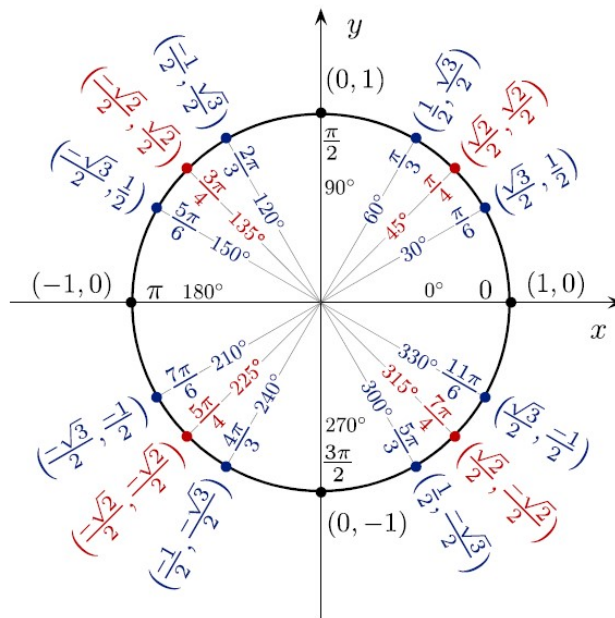
TRY IT:

SOH-CAH-TOA

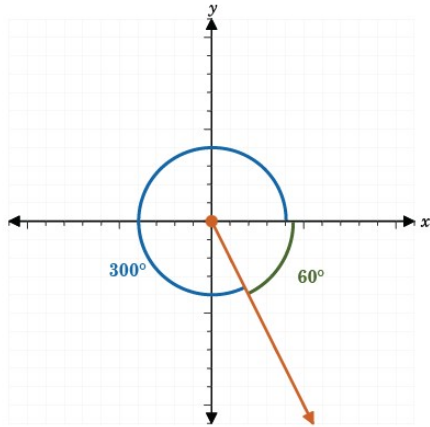
What is $\cos 120^\circ$?

Hint:

For obtuse angles, use the reference angle.



REFERENCE ANGLE



When an angle is greater than 90° , the challenge is how to draw the right triangle.

The **REFERENCE ANGLE** is the angle that is closest to the x-axis from the terminal side.

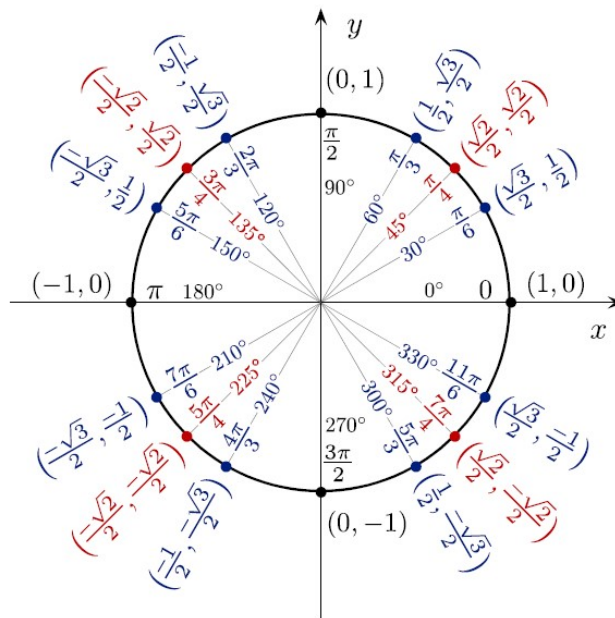
For example, a 300° angle has a reference angle of 60° .

TRY IT:

SOH-CAH-TOA

What is $\cos 120^\circ$?

See that the coordinates at 120° are the same as at 60° , except for the signs!

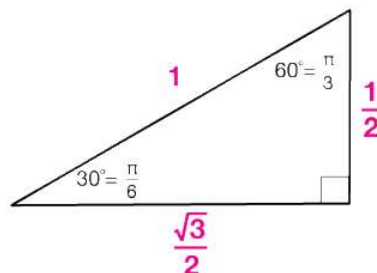


TRY IT:

SOH-CAH-TOA

What is $\cos 120^\circ$?

Remember to look at 60°
But use the signs from the
Unit Circle!

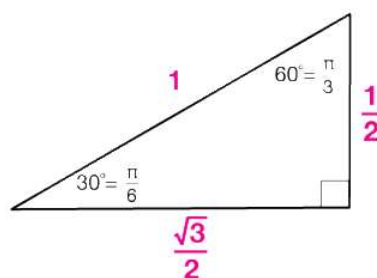


TRY IT:

SOH-CAH-TOA

What is $\cos 120^\circ$?

Remember to look at 60°
But use the signs from the
Unit Circle!



Cosine = adjacent/hypotenuse

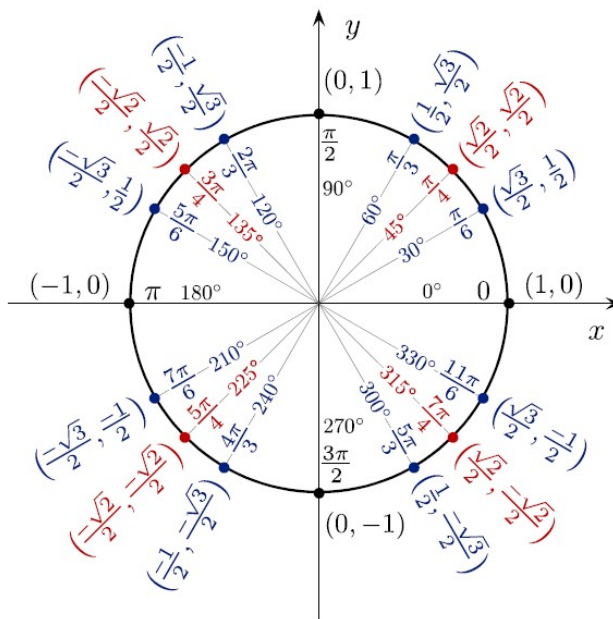
$$\cos 120 = -\frac{1}{2} / 1 = -\frac{1}{2}$$

TRY IT:

SOH-CAH-TOA

What is $\tan 5\pi/4$?

Look at the reference angle, and watch the signs!

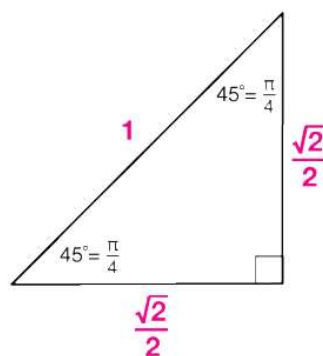


TRY IT:

SOH-CAH-TOA

What is $\tan 5\pi/4$?

Use the reference angle, but match the signs to the Unit Circle!

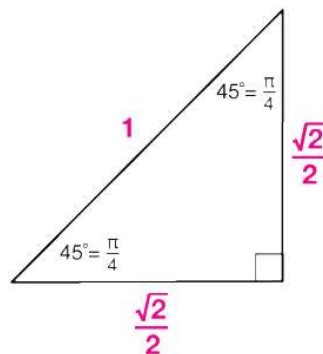


TRY IT:

SOH-CAH-TOA

What is $\tan 5\pi/4$?

Use the reference angle,
but match the signs to the
Unit Circle!



Tangent = opposite/adjacent

$$\tan 5\pi/4 = (-\sqrt{2}/2) / (-\sqrt{2}/2) = 1$$

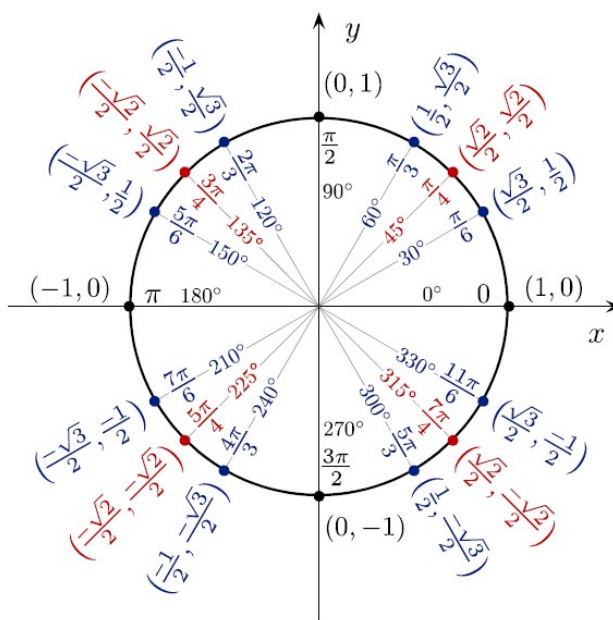
TRY IT:

SOH-CAH-TOA

What is $\sin 300$?

What is $\cos 300$?

Look at the
reference angle, and
watch the signs!



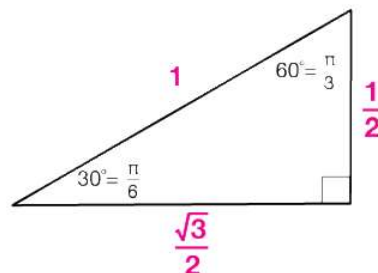
TRY IT:

SOH-CAH-TOA

What is $\sin 300^\circ$?

What is $\cos 300^\circ$?

Remember to look at 60°
But use the signs from the
Unit Circle!



Sine = opposite/hypotenuse

$$\sin 300 = -\sqrt{3}/2$$

Cosine = adjacent/hypotenuse

$$\cos 300 = 1/2$$

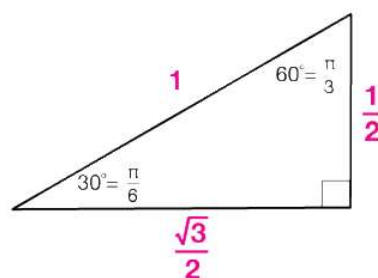
TRY IT:

SOH-CAH-TOA

What is $\sin 300^\circ$?

What is $\cos 300^\circ$?

Remember to look at 60°
But use the signs from the
Unit Circle!



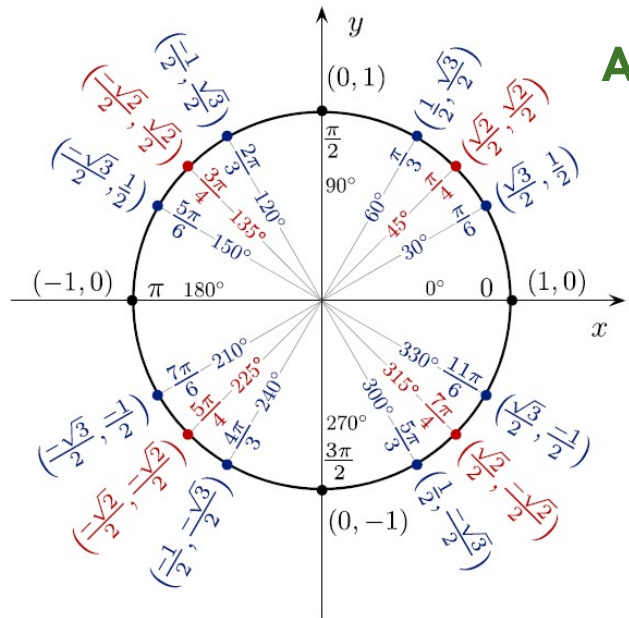
Cosine = adjacent/hypotenuse

$$\cos 120 = -1/2 / 1 = -1/2$$

An easy way to remember the signs for each Quadrant . . .

Spell CAST
(for our cast of ratios)

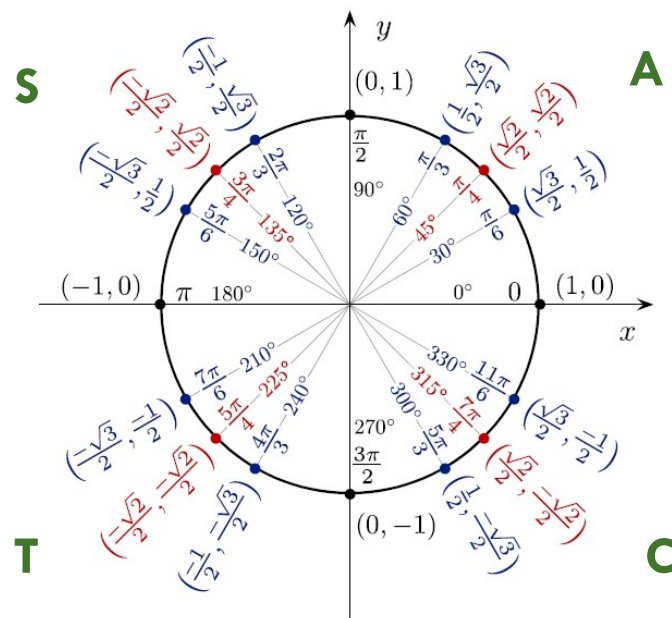
Put **A** in Quadrant I where all ratios are positive.

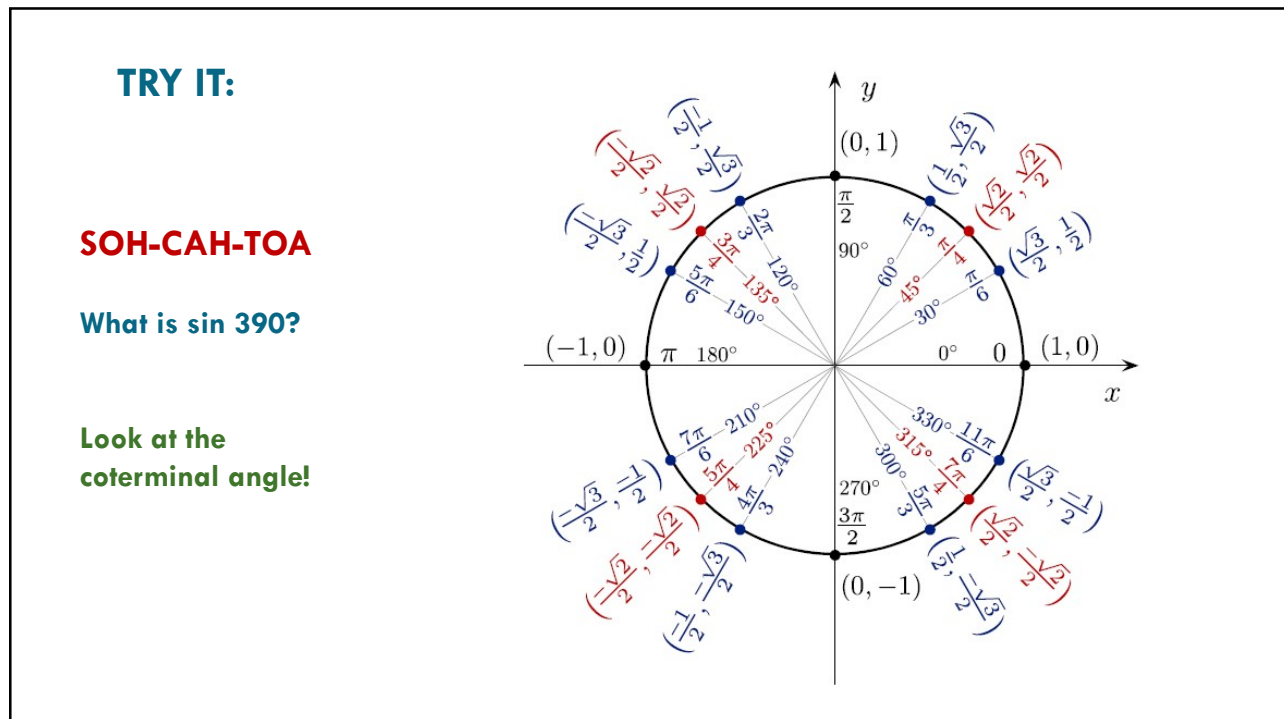
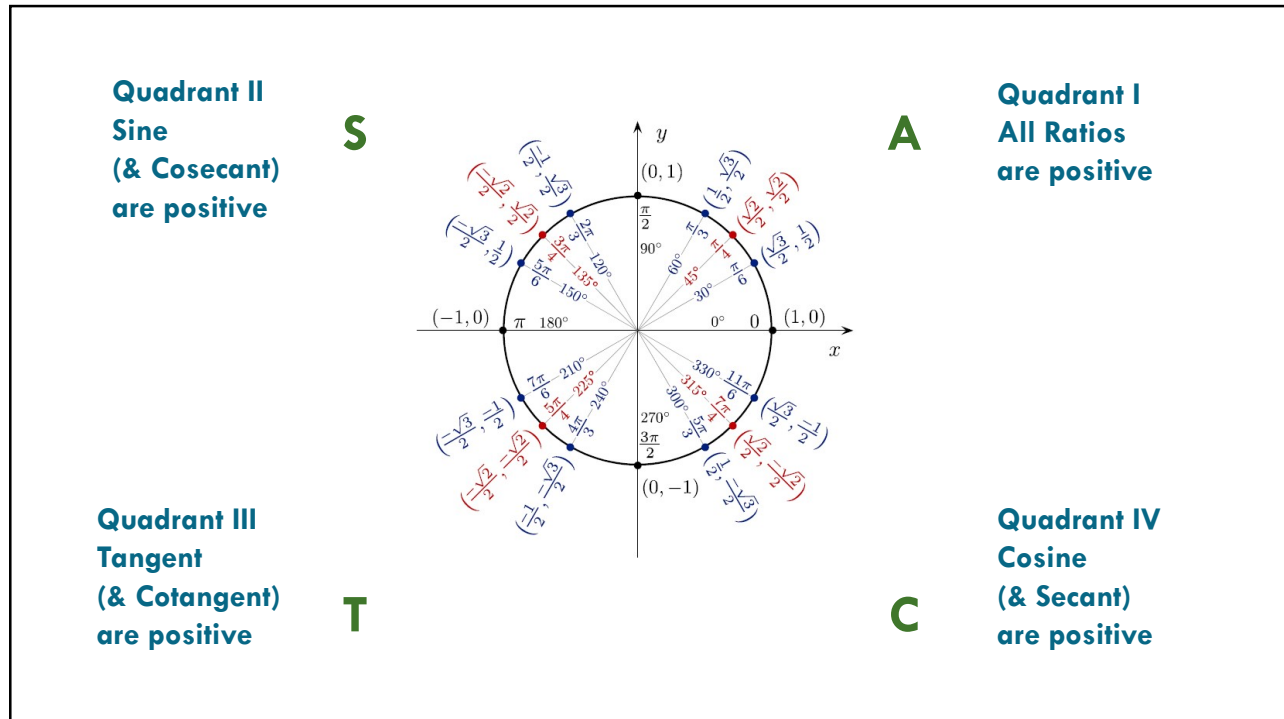


An easy way to remember the signs for each Quadrant . . .

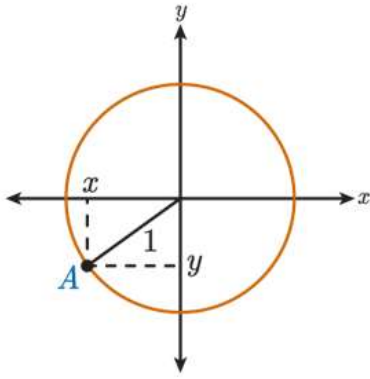
Spell CAST
(for our cast of ratios)

Arrange the rest counter-clockwise.





COTERMINAL ANGLE



When a given angle measurement goes more than a full circle, just keep going until you see where it stops on the unit circle!

Or subtract a full circle (360° or 2π radians) until you get a unit circle angle.

NOTE: If you are given a negative angle, go clockwise!!

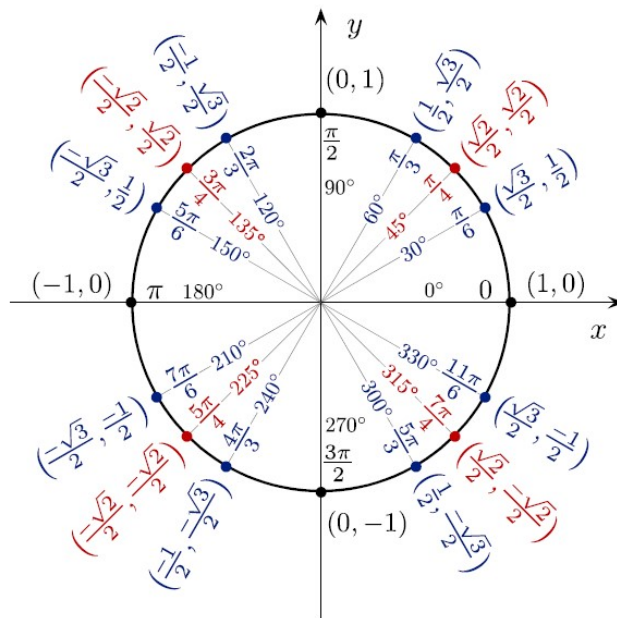
TRY IT:

SOH-CAH-TOA

What is $\sin 390^\circ$?

The coterminal angle is 30° because $390 - 360 = 30$

So, $\sin 390 = \sin 30 = 1/2$

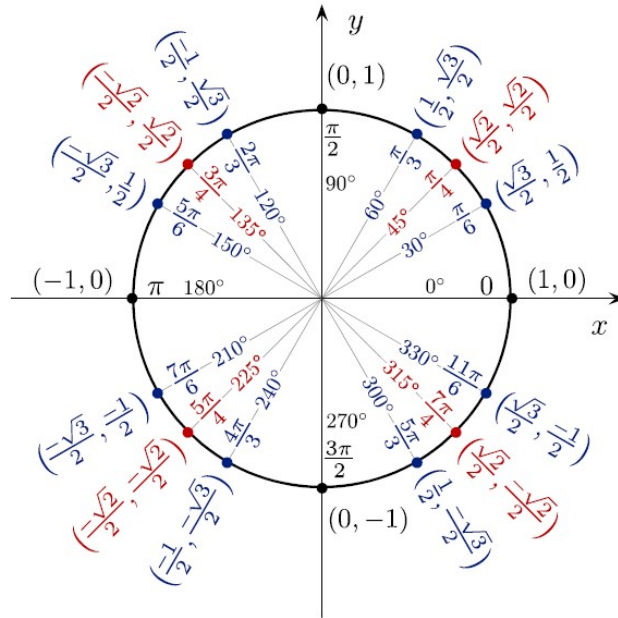


LAST ONE:

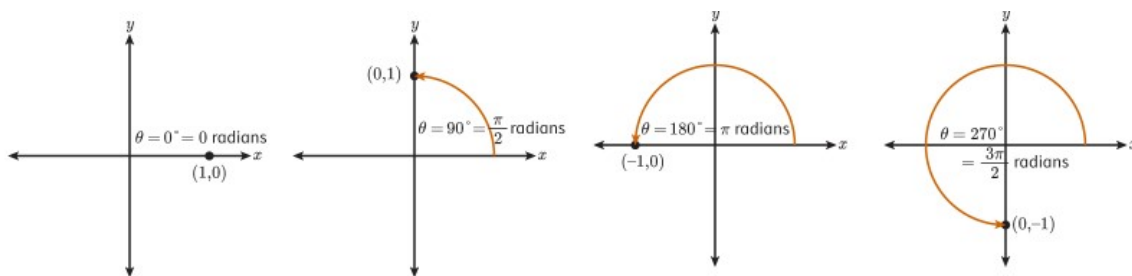
SOH-CAH-TOA

What is $\cos 3\pi$?

Use the coterminal angle ...



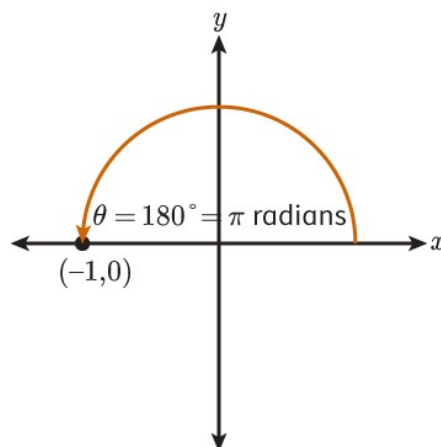
QUADRANTAL ANGLES



The angles at the Quadrant boundaries.

LAST ONE:**SOH-CAH-TOA****What is $\cos 3\pi$?**Use the coterminal angle of 1π .

It is a "flat triangle"
 The adjacent is the same as the hypotenuse for this angle spot,
 And the opposite is 0.



$$\cos 3\pi = \cos \pi = -1$$

Your Tools & Clues:

- SOH-CAH-TOA
- The Unit Circle
- Reference Angles
- Coterminal Angles
- Quadrantal Angles
- And check the signs!

Some test questions will require you to use multiples tools and clues! So take your time. 😊

Review last weeks Tools & Clues, too!

Questions??

Review the **Key Terms and Key Concepts** documents for this unit.



Look up the topic at [khanacademy.org](https://www.khanacademy.org) and [virtualnerd.com](https://www.virtualnerd.com)

Check our class website at nca-patterson.weebly.com

*Reserve a time for a call with me at jpattersonmath.youcanbook.me

We can use the LiveLesson whiteboard to go over problems together!