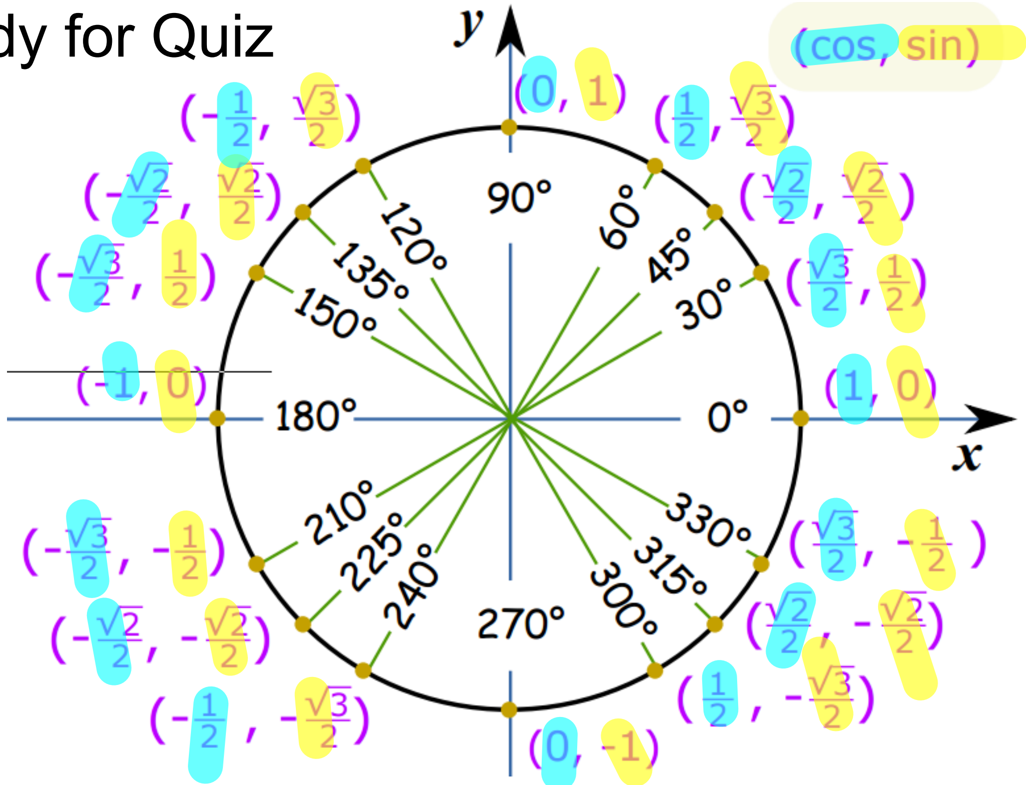
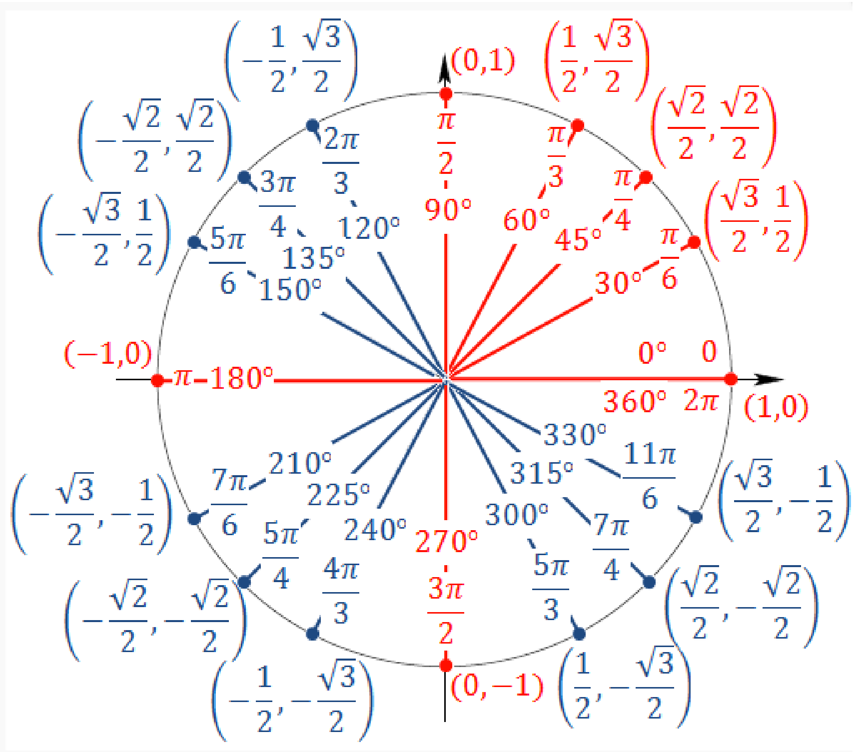
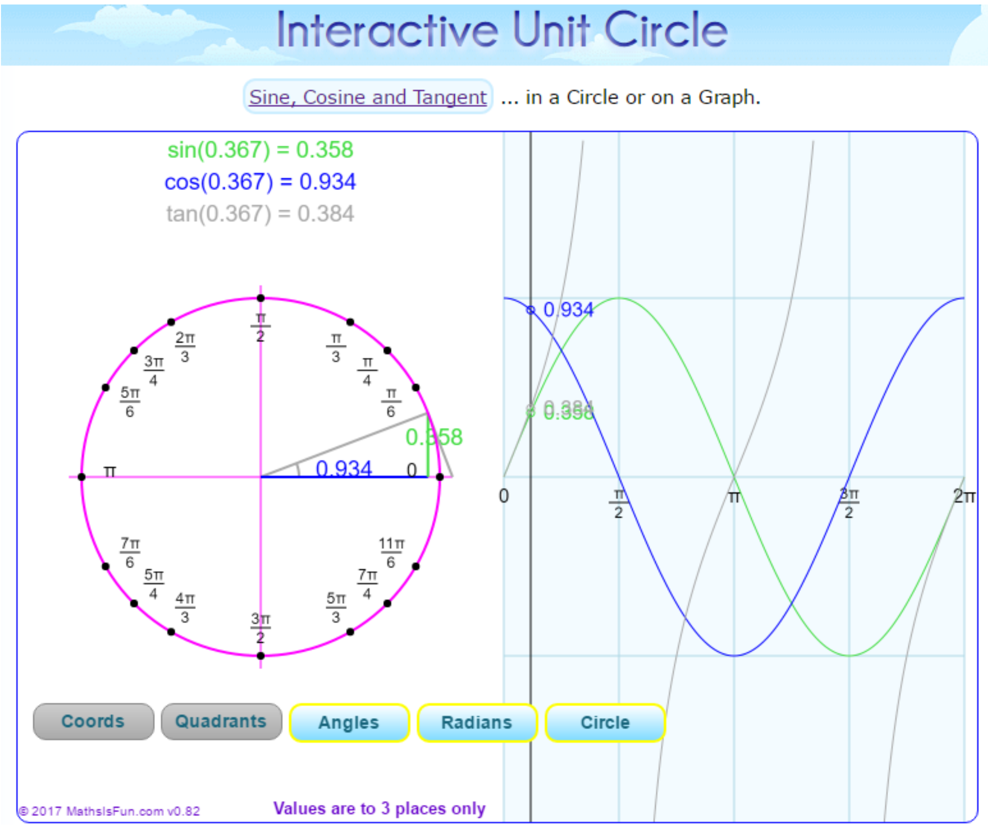
Study for Quiz





Unit Circle Quiz

STUDY


Interactive Unit Circle
Sine, Cosine and Tangent ... in a Circle or on a Graph.
sin(0.367) = 0.358
cos(0.367) = 0.934
tan(0.367) = 0.384
0.358
0.934
0.934
Coords
Quadrants
Angles
Radians
Circle
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Values are to 3 places only

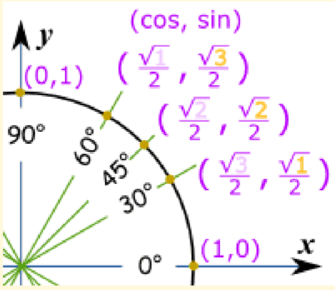
How To Remember?

To help you remember, think **"1,2,3"** :

$$\sin(30°) = \frac{\sqrt{1}}{2} = \frac{1}{2} \quad \text{(because } \sqrt{1} = 1\text{)}$$

$$\sin(45°) = \frac{\sqrt{2}}{2}$$

$$\sin(60°) = \frac{\sqrt{3}}{2}$$



And cos goes **"3,2,1"**

$$\cos(30°) = \frac{\sqrt{3}}{2}$$

$$\cos(45°) = \frac{\sqrt{2}}{2}$$

$$\cos(60°) = \frac{\sqrt{1}}{2} = \frac{1}{2} \quad \text{(because } \sqrt{1} = 1\text{)}$$

Unit Circle Practice Quiz

1. complete the table

Degree	Radians
30	
45	
60	
225	
330	

π

2. Write the ratio for:

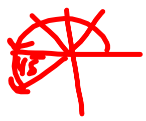
a. $\cos(330^{\circ}) =$

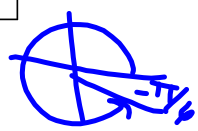
b. $\sin\left(\frac{7\pi}{6}\right) =$

Unit Circle Practice Quiz KEY

1. complete the table

Degree	Radians (π)
30	$\pi/6$
45	$\pi/4$
60	$\pi/3$
$225 - 180 = 45$	$5\pi/4$
$360 - 330 = 30$	$11\pi/6$





2. Write the ratio for:

a. $\cos(330^\circ) = \frac{\sqrt{3}}{2}$

b. $\sin\left(\frac{7\pi}{6}\right) = -\frac{1}{2}$

Unit Circle Quiz

7

1. complete the table

Degree	Radians (π)
30	$\pi/6$
45	$\pi/4$
60	$\pi/3$
120	$2\pi/3$ ~ $\frac{4\pi}{6}$
210	$7\pi/6$

2. Write the ratio for:

a. $\text{Cos}(60^{\circ}) = \frac{1}{2}$

b. $\text{Sin}\left(\frac{5\pi}{6}\right) = \frac{1}{2}$

6.3 More "Sine" Language

A Solidify Understanding Task

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Clarita is helping Carlos calculate his height at different locations around a Ferris wheel. They have noticed that when they use their formula $h(t) = 30 + 25\sin(\theta)$ their calculator gives them correct answers for the height even when the angle of rotation is greater than 90°. They don't understand why since right triangle trigonometry only defines the sine for acute angles.

Carlos and Clarita are making notes of what they have observed about this new way of defining the sine that seems to be programmed into the calculator.

Carlos: "For some angles the calculator gives me positive values for the sine of the angle, and for some angles it gives me negative values."

1. Without using your calculator, list at least five angles of rotation for which the value of the sine produced by the calculator should be positive.

   30, 45, 60, 110, 125

   0 ⟷ 180

2. Without using your calculator, list at least five angles of rotation for which the value of the sine produced by the calculator should be negative.

   210, 225, 181, 190, 300

   180 ⟷ 360°

Clarita: "Yeah, and sometimes we can't even draw a triangle at certain positions on the Ferris wheel, but the calculator still gives us values for the sine at those angles of rotation."

3. List possible angles of rotation that Clarita is talking about—positions for which you can't draw a reference triangle. Then, without using your calculator, give the value of the sine that the calculator should provide at those positions.

   90°

   180 0, 360°

   270°

Carlos: "And, because of the symmetry of the circle, some angles of rotation should have the same values for the sine."

4. Without using your calculator, list at least five pairs of angles that should have the same sine value.

   150° 30°

   91 89

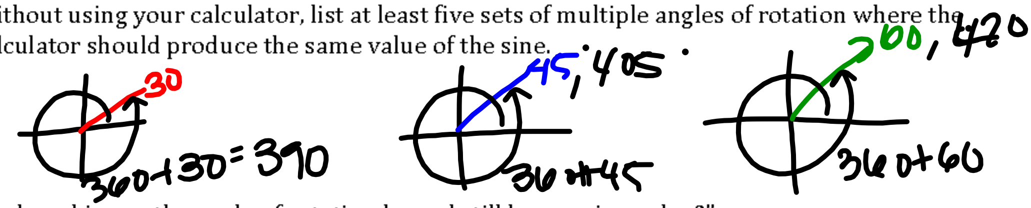
   30° 30°

   210 330

   120 60

Clarita: "Right! And if we go around the circle more than once, the calculator still gives us values for the sine of the angle of rotation, and multiple angles have the same value of the sine."

5. Without using your calculator, list at least five sets of multiple angles of rotation where the calculator should produce the same value of the sine.



Carlos: "So how big can the angle of rotation be and still have a sine value?"
Clarita: "Or how small?"

6. How would you answer Carlos and Clarita's questions?

It could be infinitely big, because you can keep rotating
also infinitely small, because it can go negative

Carlos: "And while we are asking questions, I'm wondering how big or how small the value of the sine can be as the angles of rotation get larger and larger?"

7. Without using a calculator, what would your answer be to Carlos' question?

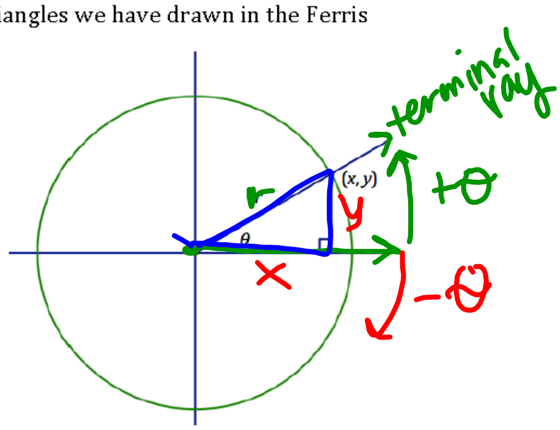
Clarita: "Well, whatever the calculator is doing, at least it's consistent with our right triangle definition of sine as the ratio of the length of the side opposite to the length of the hypotenuse for angles of rotation between 0 and 90°."

<u>**Part 2**</u>

Carlos and Clarita decide to ask their math teacher how mathematicians have defined sine for angles of rotation, since the ratio definition no longer holds when the angle isn't part of a right triangle. Here is a summary of that discussion.

We begin with a circle of radius r whose center is located at the origin on a rectangular coordinate grid. We represent **an angle of rotation in standard position** by placing its vertex at the origin, the *initial ray* oriented along the positive x-axis, and its *terminal ray* rotated θ degrees counterclockwise around the origin when θ is positive and clockwise when θ is negative. Let the ordered pair (x, y) represent the point when the terminal ray intersects the circle. (See the diagram below, which Clarita diligently copied into her notebook.)

In this diagram, angle θ is between 0 and 90°; therefore, the terminal ray is in quadrant I. A right triangle has been drawn in quadrant I similar to the right triangles we have drawn in the Ferris wheel tasks.



8. Based on this diagram and the right triangle definition of the sine ratio, find an expression for $sin\ \theta$ in terms of the variables x, y and r.

$sin\ \theta = \frac{O}{H}\ \ \frac{y}{r}$

We will use this definition for <u>any</u> angle of rotation. Let's try it out for a specific point on a particular circle.

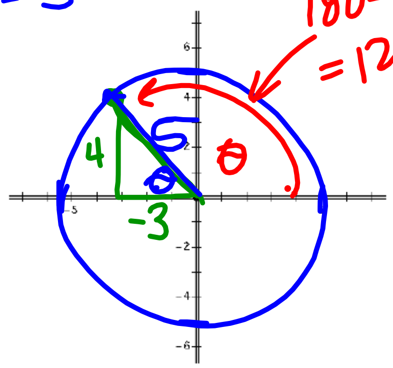
9. Consider the point (-3, 4) which is on the circle $x^2 + y^2 = 25$.

a. What is the radius of this circle?

$r = 5$

b. Draw the circle and the angle of rotation, showing the initial and terminal ray.

$180 - 53.13$
$= 126.87$



c. For the angle of rotation you just drew, what would the value of the sine be if we use the definition we wrote for sine in question 8?

$\sin\theta = \frac{4}{5} \quad \frac{y}{r}$

d. What is the measure of the angle of rotation? How did you determine the size of the angle of rotation?

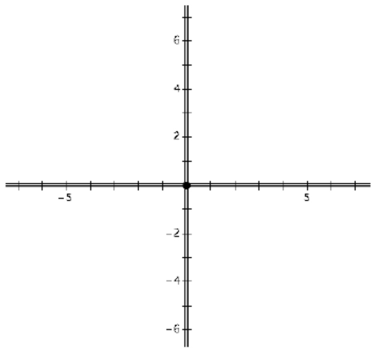
$\sin^{-1}\left(\frac{4}{5}\right) = 53.13$

e. Is the calculated value based on this definition the same as the value given by the calculator for this angle of rotation?

10. Consider the point (-1, -3), which is on the circle $x^2 + y^2 = 10$.

a. What is the radius of this circle?

b. Draw the circle and the angle of rotation, showing the initial and terminal ray.



c. For the angle of rotation you just drew, what would the value of the sine be if we use the definition we wrote for sine in question 8?

d. What is the measure of the angle of rotation? How did you determine the size of the angle of rotation?

e. Is the calculated value based on this definition the same as the value given by the calculator for this angle of rotation?

6.3 Ready, Set, Go!

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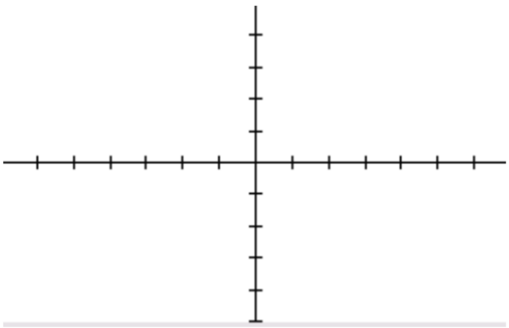
Ready

Topic: Graphing a curve

1. Graph the table of values. Connect your points with a smooth curve.

x	y
-6	0
-5	-3
-4	-4
-3	-3
-2	0
-1	3
0	4
1	3
2	0
3	-3
4	-4
5	-3
6	0



2. Identify the maximum and minimum values of the curve.

3. This curve repeats itself. (It's called a *periodic function*.) Find the length of the interval that would allow you to see **exactly** one full length of the curve.

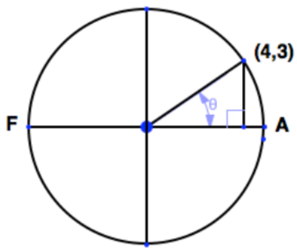
4. The curve is positive on the interval (-2, 2). Identify two more intervals where this curve will be positive.

Use the given point on the circle to find the value of sine. Recall that $r = \sqrt{x^2 + y^2}$ and $\sin\theta = \frac{y}{r}$.

Bonus ★

Find angle measure in 5-8

5.



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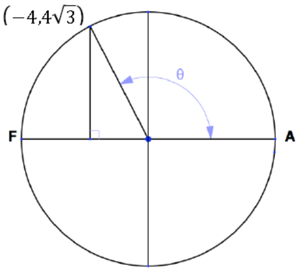
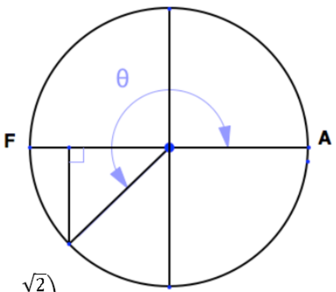
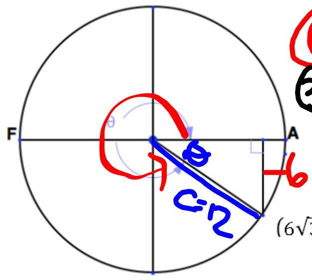


7.



$\left(-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}\right)$

8.



$(6\sqrt{3}, -6)$

$(6\sqrt{3})^2 + (-6)^2 = c^2$

$(36 \cdot 3) + 36$

$108 + 36$

$\sqrt{144} = \sqrt{c^2}$

$12 = c$

$\sin\theta = \frac{-6}{12} = -\frac{1}{2}$

9. In each graph, the angle of rotation is indicated by an arc and θ. Describe the angles of rotation that make the y-values of the points be positive and the angles of rotation that make the y-values be negative.

Name Trigonometric Functions | 6.3

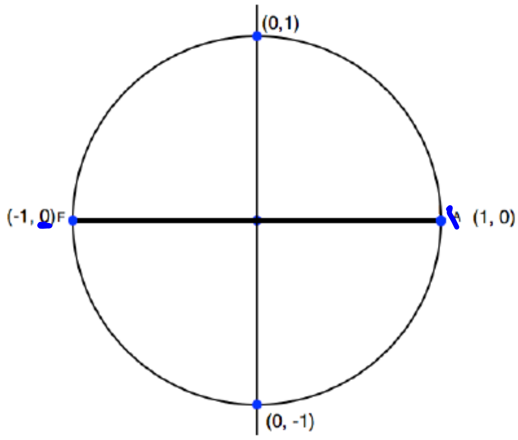
10. What do you notice about the y-values and the value of sine in the graphs?

11. In the graph at the right, the radius of the circle is 1. The intersections of the circle and the axes are labeled. Based on your observation in #6, what do you think the value of sine might be for

(height / y-value)

90°? 180°? 270°? 360°?

1 0 -1 0



Go Topic: Solving problems using right angle trigonometry

MUST DRAW AND LABEL PICTURES

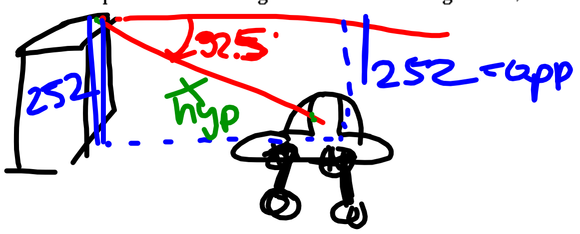
Make a sketch of the following problems, then solve.

19. A kite is aloft at the end of a string that is 1500 feet long. The string makes an angle of 43º with the ground. How far above the ground is the kite? (Round your answer to the nearest foot.)

20. A ladder leans against a building. The top of the ladder reaches a point on the building that is 12 feet above the ground. The foot of the ladder is 4 feet from the building. Find to the nearest degree the measure of the angle that the ladder makes with the level ground.
What is the angle the ladder makes with the building?

21. The shadow of a flagpole is 40.6 meters long when the angle of elevation of the sun is 34.6º. Find the height of the flagpole.

22. The angle of depression from the top of a building to a car parked in the parking lot is 32.5º. How far from the top of the building is the car on the ground, if the building is 252 meters high?



$\sin 32.5 = \frac{252}{x}$

$x = \frac{252}{\sin 32.5}$

$x = 469.01$ meters.