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# Angles and the Unit Circle

Unit 13 Lesson 2

# Angles and the Unit Circle

Students will be able to:

construct a unit circle and determine the exact trigonometric function values using the unit circle.

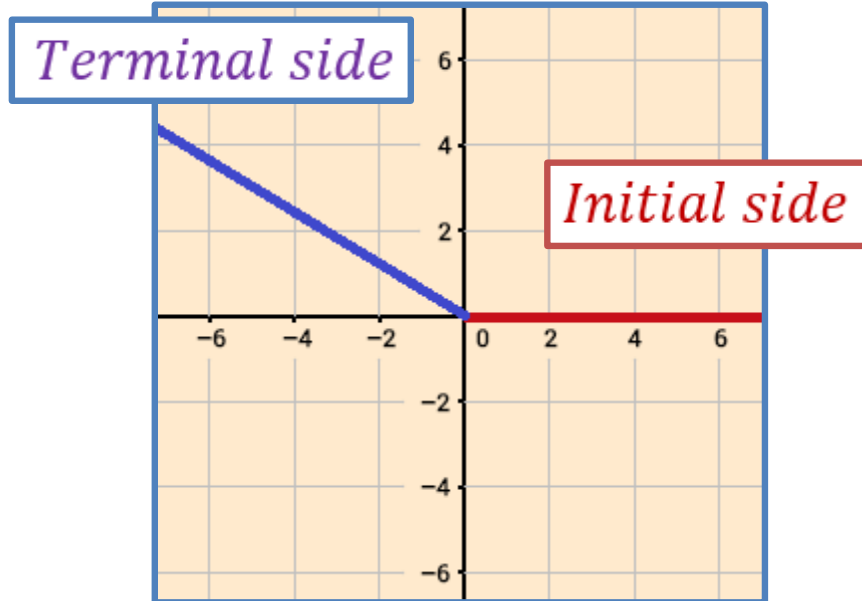
## Key Vocabulary

- **Initial side**
- **Terminal side**
- **Coterminal angles**
- **Unit circle**

# Angles and the Unit Circle

## Angle in standard position

An angle is in **standard position** when the vertex is at the origin and one ray is on the positive x axis.



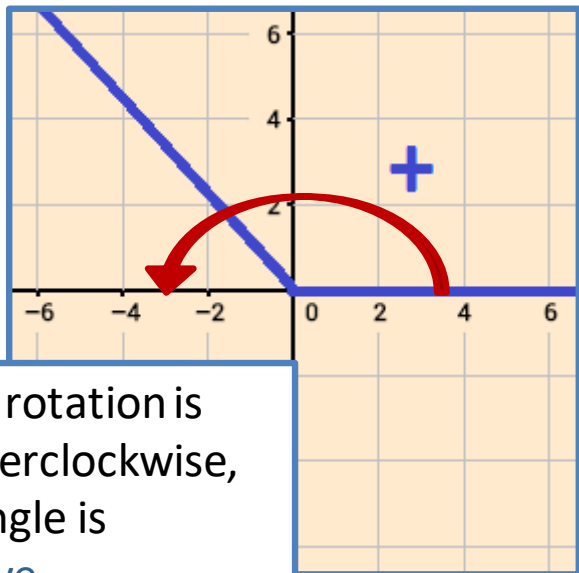
The ray on the x axis is the **initial side**.

The other ray is the **terminal side**.

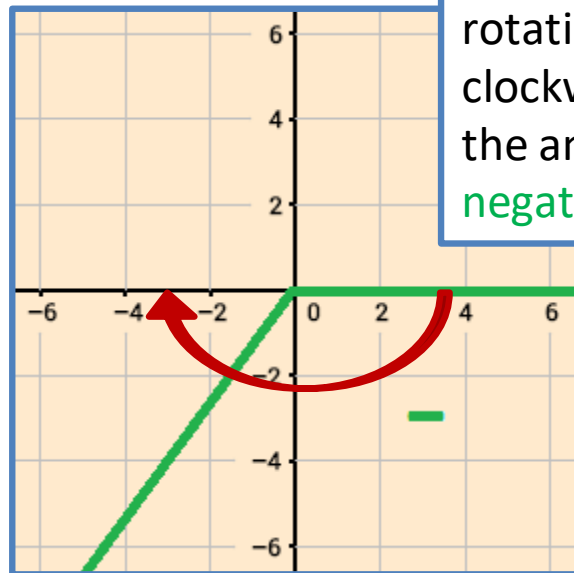
# Angles and the Unit Circle

## Measuring angles in standard position

The **measure** of an angle in standard position is the amount of rotation from the initial side to the terminal side.



IF the rotation is counterclockwise, the angle is positive.



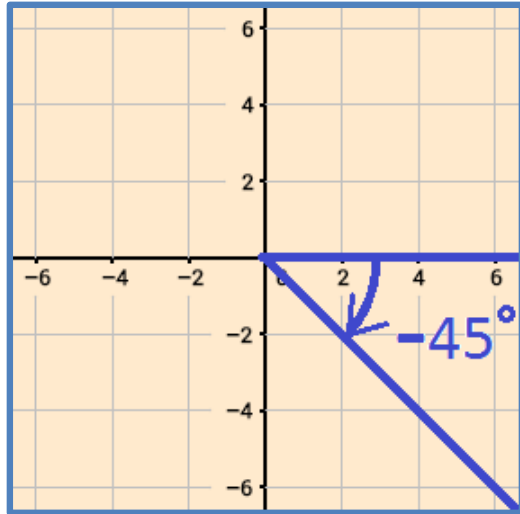
If the rotation is clockwise, the angle is negative.

# Angles and the Unit Circle

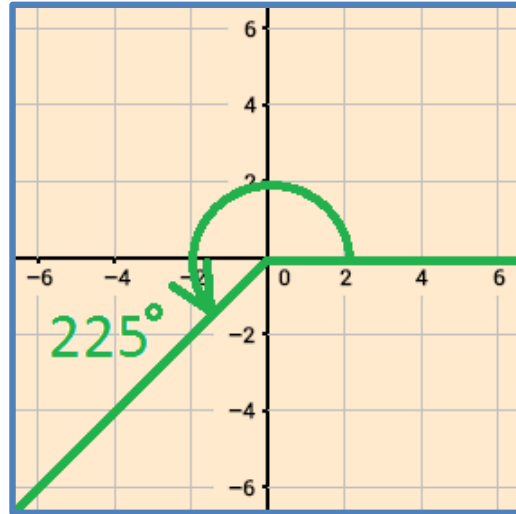
## Problem 1

Sketch angles in standard position:

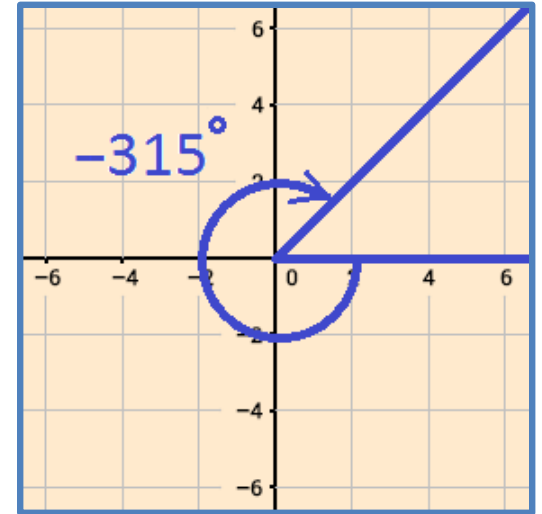
a)  $-45^\circ$



b)  $225^\circ$



c)  $-315^\circ$

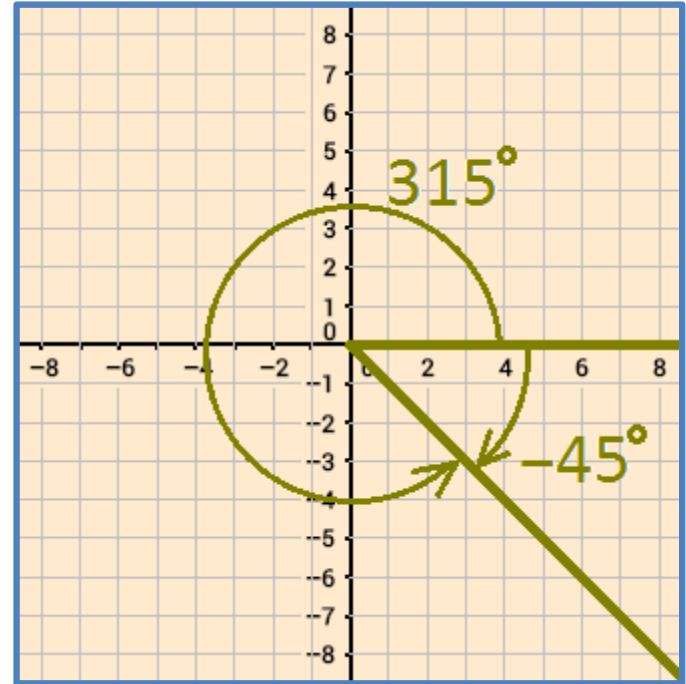


# Angles and the Unit Circle

## What are **Coterminal Angles**?

Two angles in standard position are **coterminal** angles if they have the same terminal side.

The difference between two coterminal angles is a multiple of  $360^\circ$

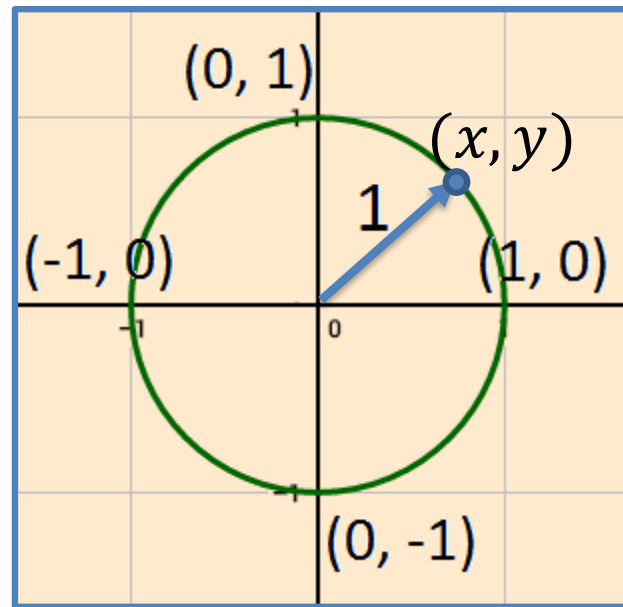


# Angles and the Unit Circle

## What is the Unit Circle?

**Unit Circle** is a circle of radius one unit and center at origin.

If  $(x, y)$  is a point on the unit circle's circumference, then  $|x|$  and  $|y|$  are the legs of a right triangle whose hypotenuse is 1.



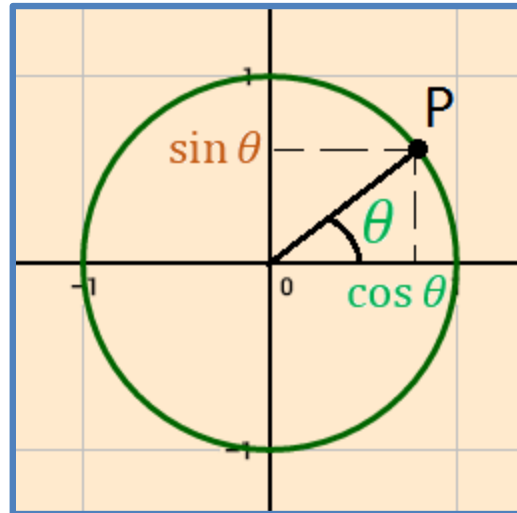
# Angles and the Unit Circle

## What is a **Cosine $\theta$** ?

The **cosine of  $\theta$**  ( $\cos \theta$ ) is the **x**-coordinate of the point at which the terminal side of the angle intersects the unit circle.

## What is a **Sine $\theta$** ?

The **sine of  $\theta$**  ( $\sin \theta$ ) is the **y**-coordinate of the point at which the terminal side of the angle intersects the unit circle.



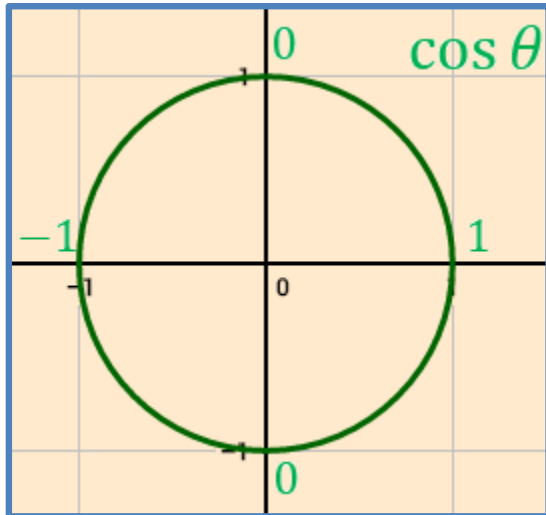


# Angles and the Unit Circle

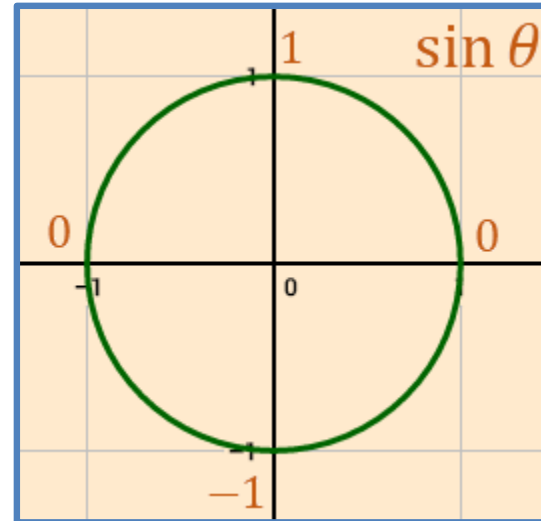
## Problem 2

An angle in standard position with terminal side lying on x-axis or y-axis is called as **Quadrantal Angle**.

Use the unit circle to determine Sine and Cosine of Quadrantal Angles.



$$\begin{aligned}\cos 0^\circ &= 1 \\ \cos 90^\circ &= 0 \\ \cos 180^\circ &= -1 \\ \cos 270^\circ &= 0\end{aligned}$$

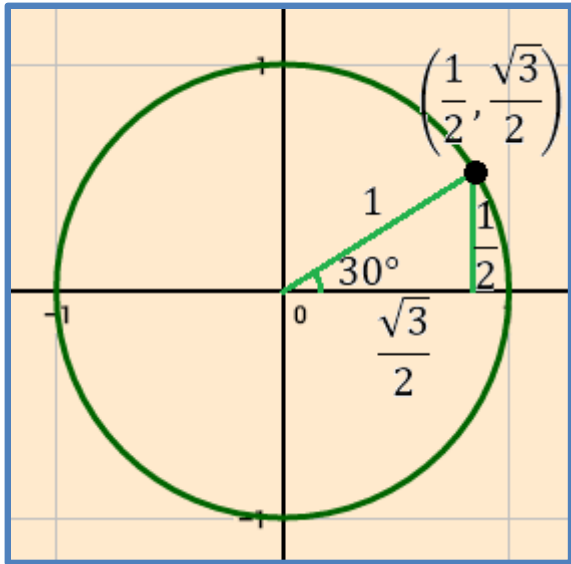


$$\begin{aligned}\sin 0^\circ &= 0 \\ \sin 90^\circ &= 1 \\ \sin 180^\circ &= 0 \\ \sin 270^\circ &= -1\end{aligned}$$

# Angles and the Unit Circle

## Problem 3

Use the unit circle to determine exact values for the  $\sin 30^\circ$  and  $\cos 30^\circ$ .



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

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