

Warm Up

Sketch each angle in standard position. Then, find the measure of the reference angle for each angle.

1. 120°

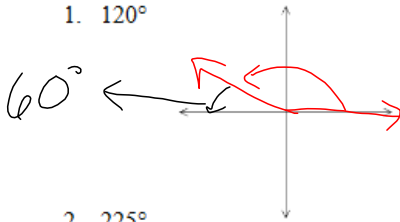
2. 225°

3. -150°

4. 315°

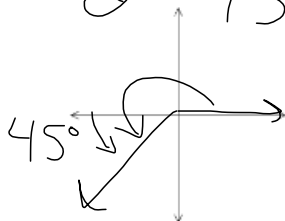
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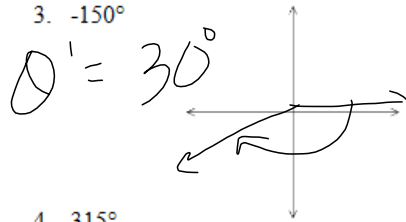


2. 225°

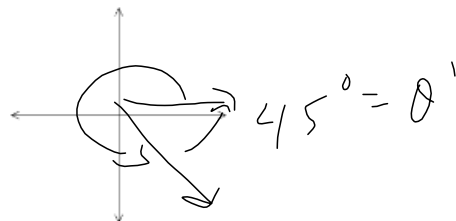
$\theta' = 45^\circ$



3. -150°



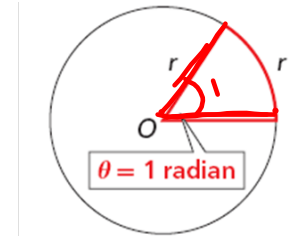
4. 315°



10.2 Extension

Radian Measure

So far, we have measured angles in degrees. You can also measure angles in *radians*.



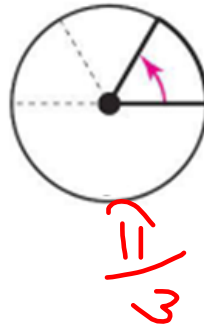
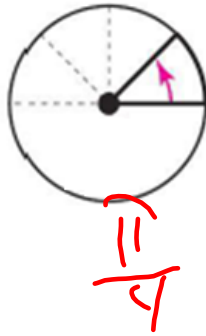
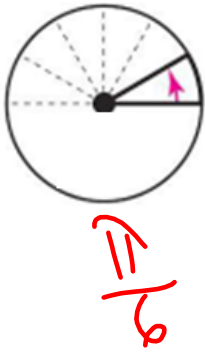
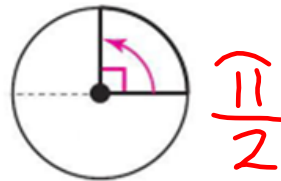
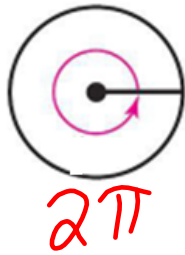
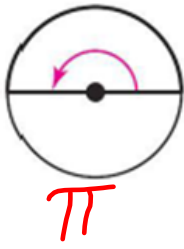
A **radian** is a unit of angle measure based on arc length. In a circle of radius r , if a central angle has a measure of 1 radian, then the length of the intercepted arc is r units.

$$C = 2\pi r$$

The circumference of a circle of radius r is $2\pi r$. Therefore, an angle representing one complete clockwise rotation measures 2π radians. Let's visualize some other commonly used radian measures.

Find the indicated angle measure in radians.

Answers should be exact in terms of π .



Determine the quadrant in which each angle lies.

1.) $\frac{5\pi}{3}$ IV

2.) $\frac{11\pi}{10}$ III

3.) $\frac{2\pi}{3}$ II

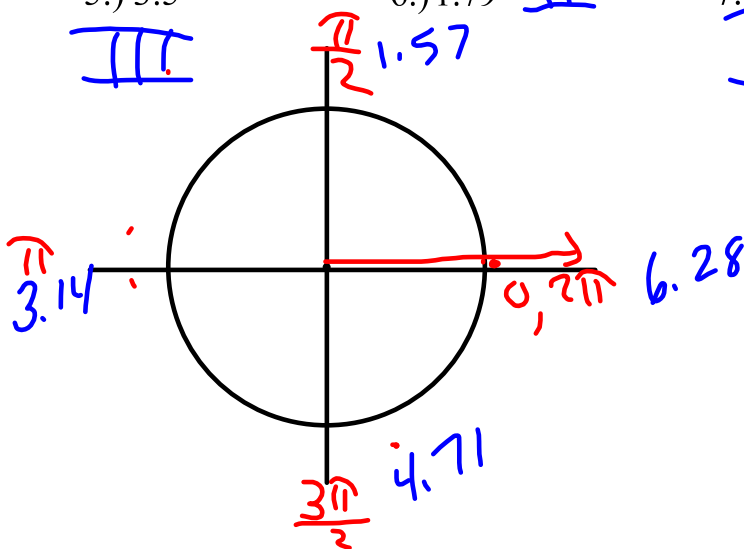
4.) $\frac{13\pi}{6}$ I

5.) 3.5 III

6.) 1.79 II
1.57

7.) 5.12 IV

8.) 7.36 I



Because 2π radians is equivalent to 360° , you can easily convert between radians and degrees.

Converting Angle Measures

DEGREES TO RADIANs	RADIANS TO DEGREES
Multiply the number of degrees by $\left(\frac{\pi \text{ radians}}{180^\circ}\right)$.	Multiply the number of radians by $\left(\frac{180^\circ}{\pi \text{ radians}}\right)$.

Reading Math

Angles measured in radians are often not labeled with the unit. If an angle measure does not have a degree symbol, you can usually assume that the angle is measured in radians.

Example 1: Converting Between Degrees and Radians

Convert each measure from degrees to radians or from radians to degrees.

$$\text{A. } -60^\circ \cdot \frac{\pi}{180^\circ} = -\frac{\pi}{3}$$

$$\text{B. } \frac{2\pi}{3} \cdot \frac{180^\circ}{\pi} = 120^\circ$$

Check It Out! Example 1

Convert each measure from degrees to radians or from radians to degrees.

a. 80° $\frac{4\pi}{9}$

b. $\frac{2\pi}{9}$ 40°

Check It Out! Example 1

Convert each measure from degrees to radians or from radians to degrees.

c. -36° $-\frac{\pi}{5}$

d. 4π 720°

Degrees - Minutes - Seconds

D°M'S"

$$\underline{60} \text{ minutes} = \underline{1} \text{ degree}$$

$$\underline{60} \text{ seconds} = \underline{1} \text{ minute}$$

$$\therefore \underline{3600} \text{ seconds} = \underline{1} \text{ degree}$$

Converting DMS to Decimal

94° 30' 30"

94.5083°

$$30' \cdot \frac{1}{60}' = 0.5^\circ$$

$$30'' \cdot \frac{1}{3600}'' = 0.0083^\circ$$

331°14'03"

Converting Decimal Degree to DMS

42.35°

$$\begin{aligned} & -231.89^\circ \\ & 0.89^\circ \cdot \frac{60'}{1^\circ} = 53.4' \\ & 0.4' \cdot \frac{60''}{1'} \end{aligned} \quad -231^\circ \underline{53'} \underline{24''}$$