Name ____ Date __________

5.2 Angles and Radian Measure
For use with Exploration 5.2

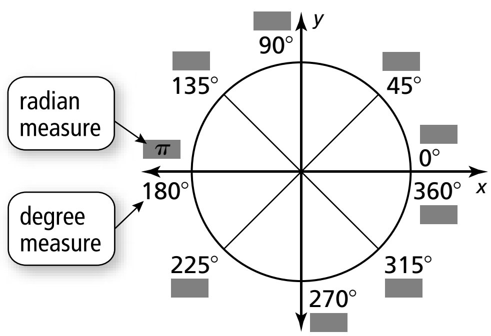
Essential Question
How can you find the measure of an angle in radians?

Let the vertex of an angle be at the origin, with one side of the angle on the positive x-axis. The *radian measure* of the angle is a measure of the intercepted arc length on a circle of radius 1. To convert between degree and radian measure, use the fact that $\frac{\pi \text{ radians}}{180^\circ} = 1$.

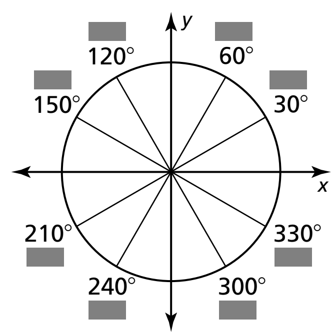
1 EXPLORATION: Writing Radian Measures of Angles

Work with a partner. Write the radian measure of each angle with the given degree measure. Explain your reasoning.

a.

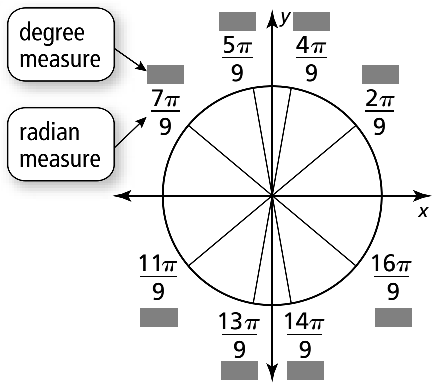


b.



2 EXPLORATION: Writing Degree Measures of Angles

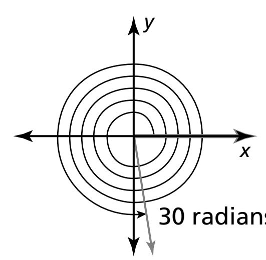
Work with a partner. Write the degree measure of each angle with the given radian measure. Explain your reasoning.



Communicate Your Answer

3. How can you find the measure of an angle in radians?

4. The figure shows an angle whose measure is 30 radians. What is the measure of the angle in degrees? How many times greater is 30 radians than 30 degrees? Justify your answers.



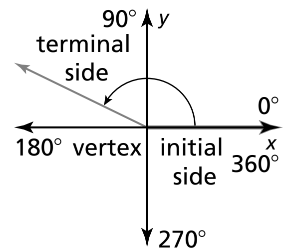
Name ______________________________ Date __________

5.2 Practice
For use after Lesson 5.2

Core Concepts

Angles in Standard Position

In a coordinate plane, an angle can be formed by fixing one ray, called the **initial side**, and rotating the other ray, called the **terminal side**, about the vertex.



An angle is in **standard position** when its vertex is at the origin and its initial side lies on the positive x-axis.

Notes:

Converting Between Degrees and Radians

Degrees to radians

Multiply degree measure by

$$\frac{\pi \text{ radians}}{180^\circ}.$$

Radians to degrees

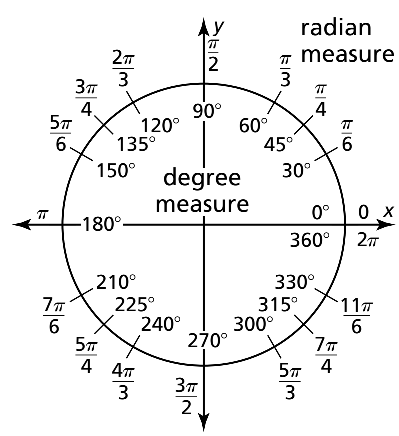
Multiply radian measure by

$$\frac{180^\circ}{\pi \text{ radians}}.$$

Degree and Radian Measures of Special Angles

The diagram shows equivalent degree and radian measures for special angles from 0° to 360° (0 radians to 2π radians).

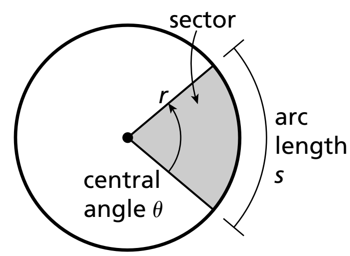
You may find it helpful to memorize the equivalent degree and radian measures of special angles in the first quadrant and for $90^\circ = \dfrac{\pi}{2}$ radians. All other special angles shown are multiples of theses angles.



Name____ Date__________

Arc Length and Area of a Sector

The arc length s and area A of a sector with radius r and central angle θ (measured in radians) are as follows.



Arc length: $s = r\theta$

Area: $A = \frac{1}{2}r^2\theta$

Notes:

Worked-Out Examples

Example #1

Convert the degree measure to radians.

$$-260° = (-260\ \cancel{\text{degrees}})\left(\frac{\pi \text{ radians}}{180\ \cancel{\text{degrees}}}\right)$$
$$= -\frac{13\pi}{9}$$

Example #2

Convert the radian measure to degrees.

$$\frac{\pi}{9} = \left(\frac{\pi}{9}\ \cancel{\text{radians}}\right)\left(\frac{180°}{\pi\ \cancel{\text{radians}}}\right)$$
$$= 20°$$

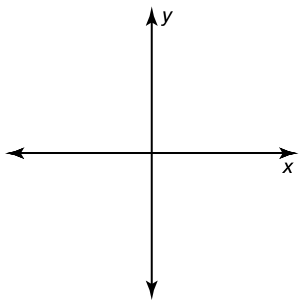
Name ____ Date __________

5.2 **Practice (continued)**

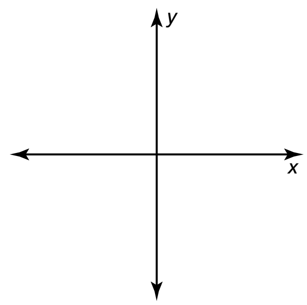
Practice A

In Exercises 1 and 2, draw an angle with the given measure in standard position.

1. $260°$



2. $-750°$



In Exercises 3–6, find one positive angle and one negative angle that are coterminal with the given angle.

3. $55°$

4. $-300°$

5. $460°$

6. $-220°$

In Exercises 7–10, convert the degree measure to radians or the radian measure to degrees.

7. $54°$

8. $-310°$

9. $\dfrac{16\pi}{15}$

10. $-\dfrac{2\pi}{5}$

Name ____ Date __________

Practice B

In Exercises 1–6, draw an angle with the given measure in standard position.

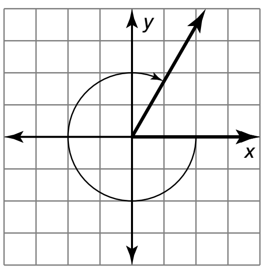
1. 260° **2.** 400° **3.** -200°

4. $\dfrac{5\pi}{2}$ **5.** $\dfrac{7\pi}{6}$ **6.** -4π

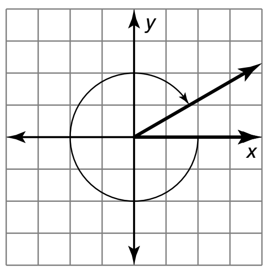
In Exercises 7–9, match the angle measure with the angle.

7. -300° **8.** $\dfrac{5\pi}{3}$ **9.** $-\dfrac{11\pi}{6}$

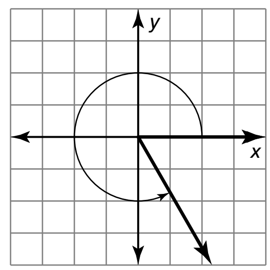
A.



B.



C.



In Exercises 10–12, find one positive angle and one negative angle that are coterminal with the given angle.

10. $\dfrac{5\pi}{4}$ **11.** -420° **12.** $-\dfrac{11\pi}{2}$

In Exercises 13–18, convert the degree measure to radians or the radian measure to degrees.

13. 200° **14.** 1° **15.** -475°

16. $\dfrac{3\pi}{10}$ **17.** $-\dfrac{5\pi}{12}$ **18.** 6

19. There are 60 minutes in 1 degree of arc, and 60 seconds in 1 minute of arc. The notation 50°30’10” represents an angle with a measure of 50°, 30 minutes, and 10 seconds.

a. Write the angle measure 160.44° using the notation above.

b. Write the angle measure $98^\circ 15' 45''$ to the nearest hundredth of a degree.