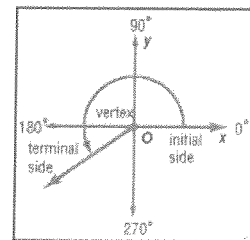


# 13-2 Angles & Angle Measure

Master E

- Standard position of an angle - the vertex is at the Center
- Initial side - the ray on the positive X-axis
- Terminal side - the ray that rotates about the center.
- Positive angle - results by rotating the terminal side ↺ counterclockwise
- Negative angle - results by rotating the terminal side ↻ clockwise



- Coterminal angles - two angles in standard positions that share the same terminal side.
- You can find a coterminal angle by either adding or subtracting multiples of 360 or 2π radians

Sketch the given angle. Then find one positive and one negative coterminal angle.

1.  $120^\circ$

+CT:  $480^\circ$   
-CT:  $-240^\circ$

2.  $325^\circ$

+CT:  $685^\circ$   
-CT:  $-35^\circ$

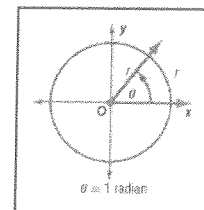
3.  $-20^\circ$

+CT:  $340^\circ$   
-CT:  $-380^\circ$

4.  $370^\circ$

+CT:  $10^\circ$   
-CT:  $-350^\circ$

- Radian - the measure of an angle  $\theta$  in standard position with a terminal side that intercepts an arc with the same length as the radius of the circle.
- Circumference - The circumference of a circle is  $2\pi r$ .



- Since  $\theta = 1$  radian, then one complete revolution around a circle equals  $2\pi$  radians.
- Since  $2\pi$  radians =  $360^\circ$ , degree measure and radian measure are related by the following equations:

$$2\pi \text{ radians} = 360^\circ$$

$$\pi \text{ radians} = 180^\circ$$

Converting from degrees to radians:  
multiply the number of degrees by  $\frac{\pi}{180}$

Converting from radians to degrees:  
multiply the number of radians by  $\frac{180}{\pi}$

Change each degree measure to radians and each radian measure to degrees.

5.  $18^\circ \cdot \frac{\pi}{180}$

$$\frac{\pi}{10}$$

6.  $-820^\circ \cdot \frac{\pi}{180}$

$$\frac{41\pi}{9}$$

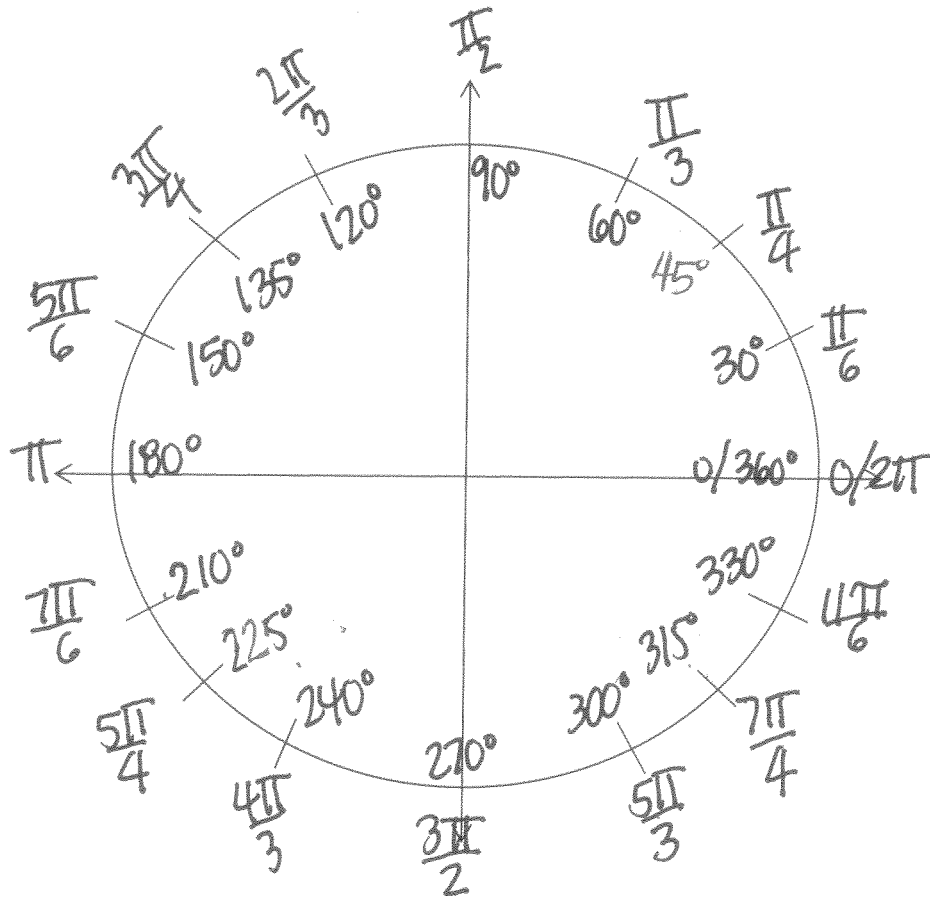
7.  $\frac{2\pi}{5} \cdot \frac{180}{\pi}$

$$72^\circ$$

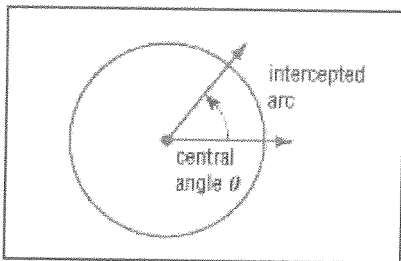
8.  $\frac{\pi}{30} \cdot \frac{180}{\pi}$

$$6^\circ$$

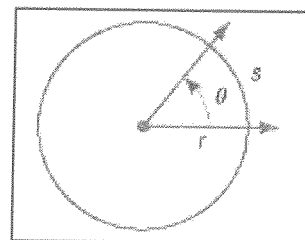
Fill in the radians and degrees on the Unit Circle (We will go into this more later):



▼ **Central Angle:** an angle with a vertex at the center of the circle



▼ **Arc Length:** For a circle with radius  $r$  and a central angle  $\theta$  (in radians), arc length is  $s = r\theta$   
 $\theta$  is found by multiplying the fraction by  $2\pi$

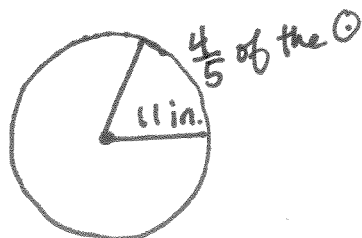


$$\begin{aligned} \text{Arc length} &= \frac{m}{360} \cdot 2\pi r \\ &= \frac{m}{2\pi} \cdot 2\pi r \end{aligned}$$

$$s = m \cdot r \text{ or } \theta r$$

**Real-World Example:**

9. The steering wheel on a monster truck has a radius of 11 inches. How far does a point on the steering wheel travel if the wheel makes four fifths of a rotation?



$$s = \theta r \quad \frac{4}{5} \cdot 22\pi = 55.29 \text{ in.}$$

$$\theta = \frac{s}{r} = \frac{55.29}{11} = 5.03 \text{ radians}$$