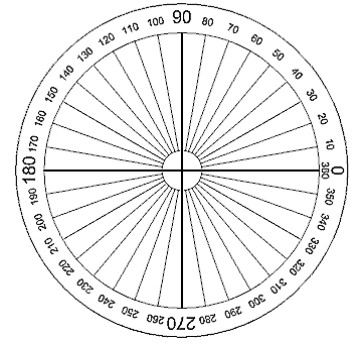
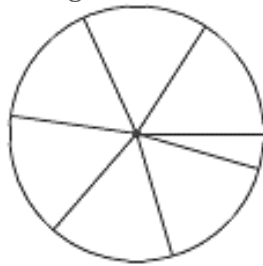


Units for Measuring Angles



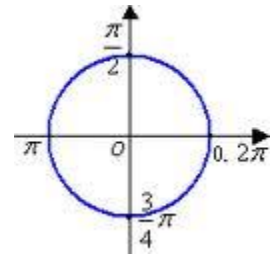
- **Degrees:** A circle is divided into 360 equal degrees, so that a right angle is 90°

- **Radians:** One **radian** is the angle made at the center of a circle by an arc whose length is equal to the radius of the circle.



-The circumference of a circle with radius 1 is _____ so a complete revolution has made _____ radians (or approximately 6.28 radians as seen in the above figure).

-A straight angle (or _____ of a circle) has measure _____ radians.



Converting Radians and Degrees:

$$\text{Radians} = \left(\frac{\pi}{180^\circ} \right) \times \text{degrees}$$

$$\text{Degrees} = \left(\frac{180^\circ}{\pi} \right) \times \text{radians}$$

Examples:

1. Express 60° in radians

2. Express $\frac{\pi}{6}$ rad in degrees

On Your Own:

#1-8, change the given angle to radians.

1) 315°

2) -60°

3) 212°

4) -168°

5) 12.5°

6) -310°

7) 600°

8) -720°

#9-16, change the given angle to degrees.

9) $\frac{3\pi}{4}$

10) $-\frac{9\pi}{5}$

11) $\frac{15\pi}{8}$

12) $-\frac{\pi}{10}$

13) $\frac{7\pi}{10}$

14) $-\frac{16\pi}{15}$

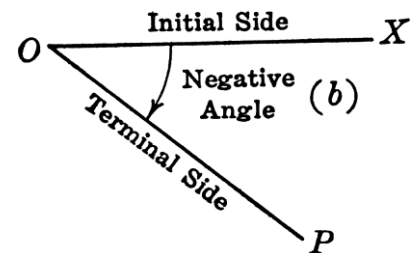
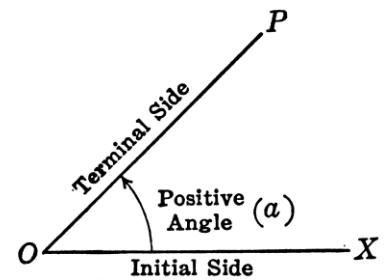
15) $\frac{88\pi}{9}$

16) $-\frac{29\pi}{12}$

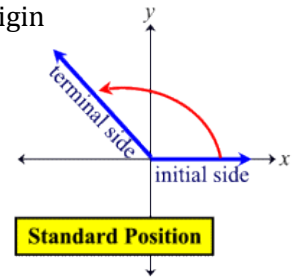
Angles in Standard Position

Angle: generated by the rotation of 2 rays that share a fixed endpoint

- **Initial Side:** fixed ray
- **Terminal Side:** ray that rotates away from initial side
- **Positive Angle:** counterclockwise rotation
- **Negative Angle:** clockwise rotation

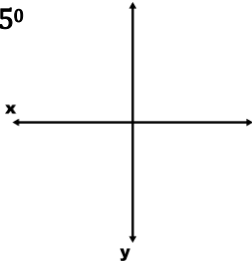


An angle is in **standard position** if it is drawn in the xy -plane with its vertex at the origin and its initial side on the positive x -axis.

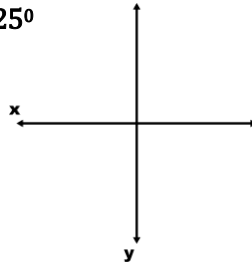


Example: Draw the given angle in standard position. State the quadrant in which the terminal side lies.

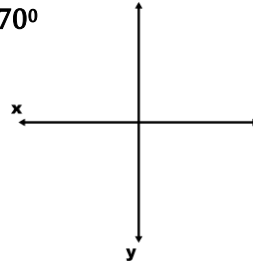
1. 45°



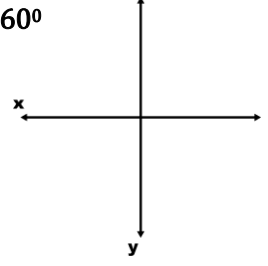
2. 225°



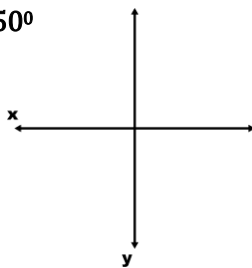
3. 270°



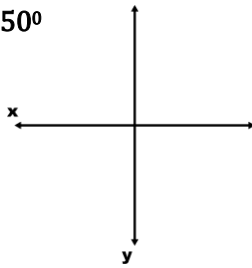
4. -60°



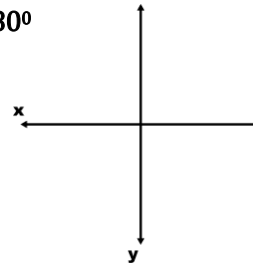
5. 750°



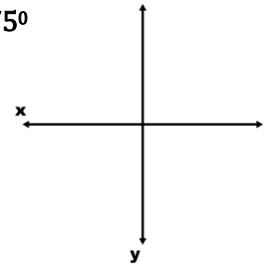
6. -150°



7. 180°

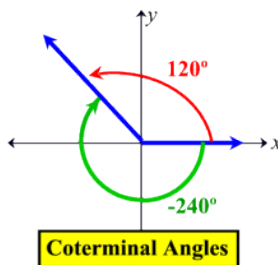


8. -75°



Coterminal Angles

Two angles in standard position are **coterminal angles** if their terminal sides coincide. Every angle has infinitely many coterminal angles.



To find angles that are coterminal, add or subtract any multiple of _____ for degrees or _____ for radians.

Examples:

- Find three angles that are coterminal with the angle $\theta = 30^\circ$ in standard position
- Find three angles that are coterminal with the angle $\theta = \frac{\pi}{3}$ in standard position
- Find an angle with a measure between 0° and 360° that is coterminal with the angle of measure 1290° in standard position.