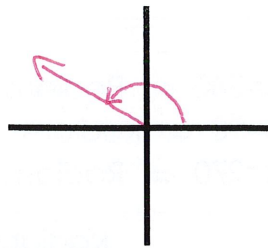
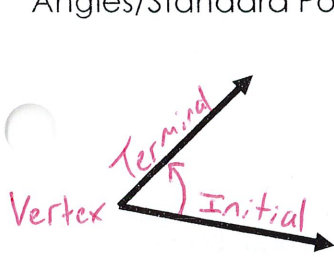
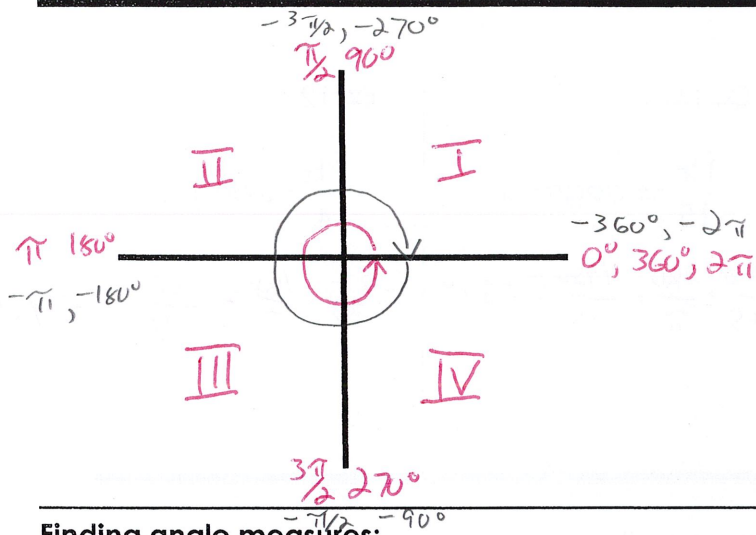


Angles/Standard Position



Standard position:

1. Vertex is at the origin
2. Initial side is the positive x-axis

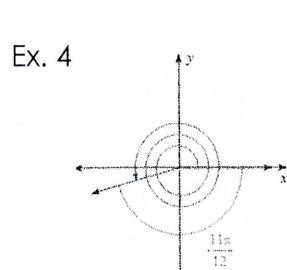
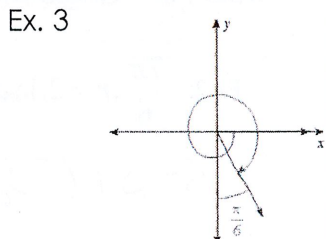
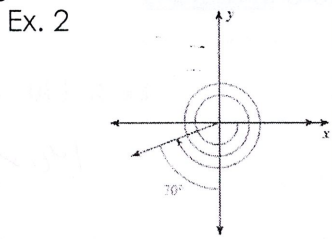
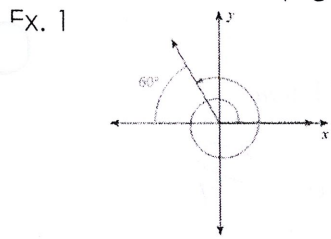


- Counterclockwise - your values are positive.
- Clockwise - your values are negative.

(go to conversions on back)

**Finding angle measures:**

- You can keep going around the unit circle more and more times.



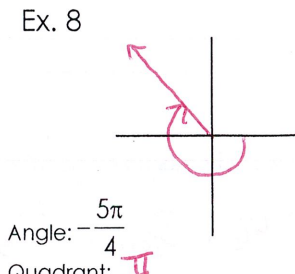
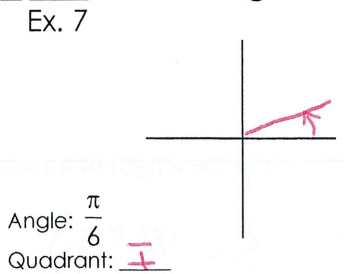
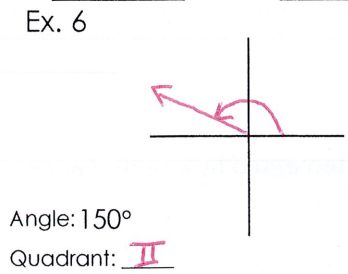
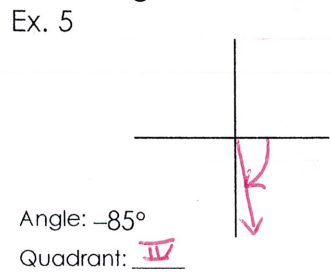
$360^\circ + 90^\circ + 30^\circ = 480^\circ$

$2(-360^\circ) + -90^\circ + -70^\circ = -880^\circ$

$-2\pi + \frac{\pi}{3} = -\frac{7\pi}{3}$

$2(2\pi) + \pi + \frac{\pi}{12} = \frac{61\pi}{12}$

**Sketching & Determining the Quadrant of the Terminal Side of each Angle:**



**Finding Coterminals:** Add and subtract  $360^\circ$  or  $2\pi$

$217^\circ = \underline{577^\circ}, \underline{937^\circ}, \underline{-143^\circ}$

$\frac{3}{4}\pi = \underline{\frac{11\pi}{4}}, \underline{\frac{19\pi}{4}}, \underline{-\frac{5\pi}{4}}$

**Converting Between Radians  $\leftrightarrow$  Degrees**

Degrees=180  $\leftrightarrow$  Radians= $\pi$

Degrees=360  $\leftrightarrow$  Radians= $2\pi$

Degrees=90  $\leftrightarrow$  Radians= $\frac{\pi}{2}$

Degrees=270  $\leftrightarrow$  Radians= $\frac{3\pi}{2}$

Degrees  $\rightarrow$  Radians (mult. by  $\frac{\pi}{180}$ )

Radians  $\rightarrow$  Degrees (mult. by  $\frac{180}{\pi}$ )

**Convert Each:**

Ex. 9

900°  $\Rightarrow$  radians

$$900 \times \frac{\pi}{180} = \frac{900\pi}{180} = 5\pi$$

Ex. 10

-32°  $\Rightarrow$  radians

$$-32 \times \frac{\pi}{180} = \frac{-32\pi}{180} = \frac{-8\pi}{45}$$

Ex. 11

$\frac{11\pi}{15} \Rightarrow$  degrees

$$\frac{11\pi}{15} \cdot \frac{180}{\pi} = \frac{1980}{15} = 132^\circ$$

Ex. 12

$-\frac{21\pi}{4} \Rightarrow$  degrees

$$-\frac{21\pi}{4} \cdot \frac{180}{\pi} = \frac{-3780}{4} = -945^\circ$$

**Arc Length:** To find the measure of the length of an arc:  $s = r\theta$ S = arc length; r = radius;  $\theta$  = angle measure in radians

Ex 1:  $\frac{\pi}{4}; r = 3m$

$$s = 3\left(\frac{\pi}{4}\right)$$

$$s = \frac{3\pi}{4} \approx 2.36m$$

Ex 2:  $\frac{7\pi}{6}; r = 2.1yds$

$$s = 2.1\left(\frac{7\pi}{6}\right)$$

$$s = \frac{14.7\pi}{6} \approx 7.70yds$$

Ex. 3: 140°; r = 11.1cm

$$s = 140 \times \frac{\pi}{180} = \frac{7\pi}{9}$$

$$s = 11.1\left(\frac{7\pi}{9}\right)$$

$$s = \frac{77.7\pi}{9} \approx 27.12cm$$

Ex 4: A circle has a radius of 4 inches. Find the length of an arc intercepted by a central angle of 240°

$$240 \times \frac{\pi}{180} = \frac{4\pi}{3}$$

$$s = 4\left(\frac{4\pi}{3}\right)$$

$$s = \frac{16\pi}{3} \approx 16.76in$$