

Name: \_\_\_\_\_

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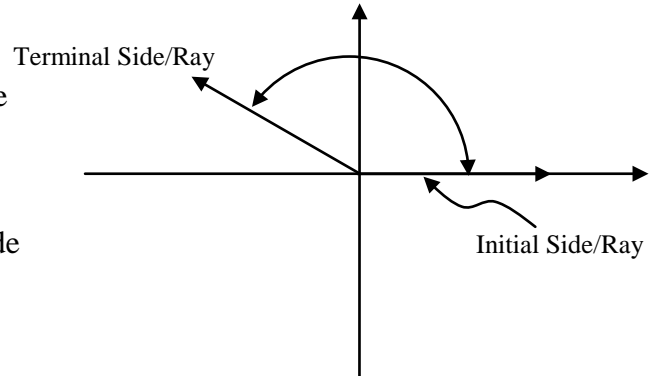
## COTERMINAL AND REFERENCE ANGLES ALGEBRA 2 HONORS

Standard Position: Any angle drawn on a coordinate grid whose vertex is at the origin and whose initial side extends along the positive  $x$ -axis.

Positive Angles – Counterclockwise turns of the terminal side of the angle.

Negative Angles – Clockwise turns of the terminal side of the angle.

Coterminal Angles – Angles whose terminal sides/rays coincide when placed in the standard position.



**Exercise #1:** Name the quadrant that the terminal ray of each angle is contained in if the angle is drawn in standard position:

(a)  $\theta = 100^\circ$

(b)  $\theta = 300^\circ$

(c)  $\theta = 80^\circ$

(d)  $\theta = \frac{2\pi}{3}$

(e)  $\theta = -\frac{\pi}{4}$

(f)  $\theta = \frac{4\pi}{3}$

**Exercise #2:** Name the quadrant that the terminal ray of each angle is contained in if the angle is drawn in standard position:

(a)  $\alpha = 400^\circ$

(b)  $\alpha = \frac{10\pi}{3}$

**Exercise #3:** List a negative angle that is coterminal with each of the following positive angles:

(a)  $\theta = 120^\circ$

(b)  $\theta = 245^\circ$

(c)  $\theta = 90^\circ$

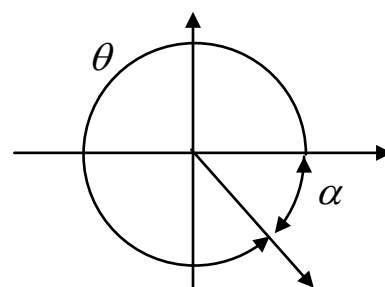
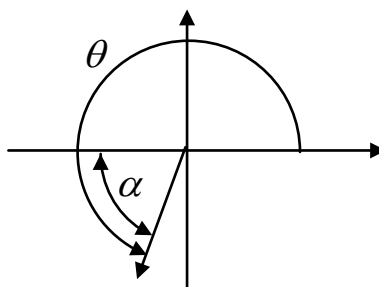
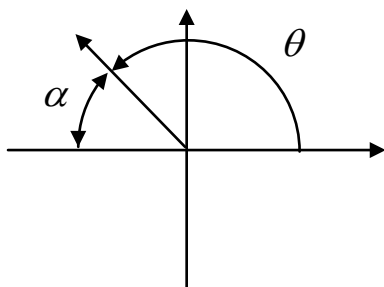
(d)  $\theta = \frac{2\pi}{3}$

(e)  $\theta = \frac{5\pi}{4}$

(f)  $\theta = \frac{3\pi}{2}$

Given an angle,  $\theta$ , drawn in standard position, the **reference angle** of  $\theta$  is the acute, positive angle formed by the terminal side of  $\theta$  and the positive or negative portion of the  $x$ -axis.

In the following pictures,  $\alpha$  is the reference angle for  $\theta$ .



**\*\* Note:** Any positive, acute angles are their own reference angles.

**Exercise #4:** For each of the following angles, sketch the angle along with its reference angle and determine the measure of its reference angle.

(a)  $\theta = 150^\circ$

(b)  $\theta = 260^\circ$

(c)  $\theta = 300^\circ$

(d)  $\theta = -160^\circ$

(e)  $\theta = \frac{3\pi}{4}$

(f)  $\theta = \frac{5\pi}{3}$

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**COTERMINAL AND REFERENCE ANGLES**  
**ALGEBRA 2 HONORS**

1. Name the quadrant that the terminal ray of each of the following angles, drawn in standard position, would fall in.

(a)  $290^\circ$

(b)  $165^\circ$

(c)  $520^\circ$

(d)  $\frac{7\pi}{4}$

(e)  $\frac{7\pi}{6}$

(f)  $\frac{11\pi}{4}$

2. Give four angles for each of the following that are coterminal. Make sure to include at least one negative angle in your answers. Remember that coterminal angles are always separated by an integer multiple of  $360^\circ$  or  $2\pi$  radians.

(a)  $110^\circ$

(b)  $250^\circ$

(c)  $310^\circ$

(d)  $\frac{\pi}{4}$

(e)  $\frac{5\pi}{3}$

(f)  $\frac{5\pi}{6}$

3. For each of the following angles, measured in degrees, determine its reference angle.

(a)  $290^\circ$

(b)  $140^\circ$

(c)  $-60^\circ$

(d)  $95^\circ$

(e)  $245^\circ$

(f)  $-200^\circ$

4. For each of the following angles, measured in radians, determine its reference angle.

(a)  $\frac{3\pi}{4}$

(b)  $\frac{7\pi}{3}$

(c)  $\frac{11\pi}{6}$

(d)  $-\frac{4\pi}{3}$

(e)  $\frac{7\pi}{4}$

(f)  $-\frac{2\pi}{3}$

5. **Memorization Refresher** - Without using your calculator or your previous notes, give the equivalent degree measure for each of the following radian measures.

(a)  $\frac{\pi}{6}$

(b)  $\frac{\pi}{4}$

(c)  $\frac{\pi}{3}$

(d)  $\frac{\pi}{2}$

(e)  $\pi$

(f)  $\frac{3\pi}{2}$

(g)  $2\pi$

6. Given what you saw in problem #4 and what you reviewed in problem #5, quickly convert the following radian measures to degree measures. Try to do as many of these as possible *without* your calculator.

(a)  $\frac{3\pi}{4}$

(b)  $\frac{5\pi}{4}$

(c)  $\frac{2\pi}{3}$

(d)  $\frac{5\pi}{6}$

(e)  $\frac{7\pi}{6}$

(f)  $\frac{5\pi}{3}$

(g)  $\frac{7\pi}{4}$

(h)  $\frac{11\pi}{6}$