

# Angles, UC, Trig Graphs/Equations – Angles and Angle Measure

General Angle in Standard Position	Various Types of Common Angles		
- angle → rotation of a ray about a fixed pt.	Positive Angles	Negative Angles	Quadrant Angles
<p>vertex (0,0)</p> <p>Initial side (ray) stationary</p> <p>terminal side (ray) rotate</p> <p>angle <math>\theta</math></p>	<p>rotation is <u>CCW</u></p> <p>arrow is <u>out</u></p>	<p>rotation is <u>CW</u></p> <p>arrow is <u>underneath</u></p>	<p>Terminal side falls on</p> <p>a.) x-axis like <math>0^\circ, \pm 180^\circ, \pm 360^\circ</math></p> <p>b.) y-axis like <math>\pm 90^\circ, \pm 270^\circ</math></p>

Angle Measurement # 1 – Degrees (with $^\circ$ )	Angle Measurement # 2 – Radians (with $\pi$ )
<p>To convert from degrees (<math>^\circ</math>) to radians (<math>\pi</math>) →</p> <p><math>\text{deg}^\circ \times \frac{\pi}{180} = \pi \text{ radians}</math></p> <p>Ex: Convert given degree measure to radians:</p> <p>a.) <math>45^\circ \rightarrow 45 \times \frac{\pi}{180} = \frac{45}{180} \pi = \boxed{\frac{\pi}{4}}</math></p> <p>b.) <math>300^\circ \rightarrow 300 \times \frac{\pi}{180} = \frac{300}{180} \pi = \boxed{\frac{5\pi}{3}}</math></p>	<p>To convert from radians (<math>\pi</math>) to degrees (<math>^\circ</math>) →</p> <p><math>\text{rads } \pi \times \frac{180}{\pi} = \text{degrees}</math></p> <p>Ex: Convert given radian measure to degrees:</p> <p>a.) <math>\frac{\pi}{3} \rightarrow \frac{\pi}{3} \times \frac{180}{\pi} = \left(\frac{1}{3}\right) \times 180 = \boxed{60^\circ}</math></p> <p>b.) <math>\frac{5\pi}{6} \rightarrow \frac{5\pi}{6} \times \frac{180}{\pi} = \left(\frac{5}{6}\right) \times 180 = \boxed{150^\circ}</math></p>

**Example 1:** Draw each angle in standard position. Draw the arrow of angle's direction.

a.) $\theta = 48^\circ$	b.) $\theta = -212^\circ$	c.) $\theta = 270^\circ$	d.) $\theta = \frac{4\pi}{3}$	e.) $\theta = -\frac{\pi}{6}$	f.) $\theta = -\pi$

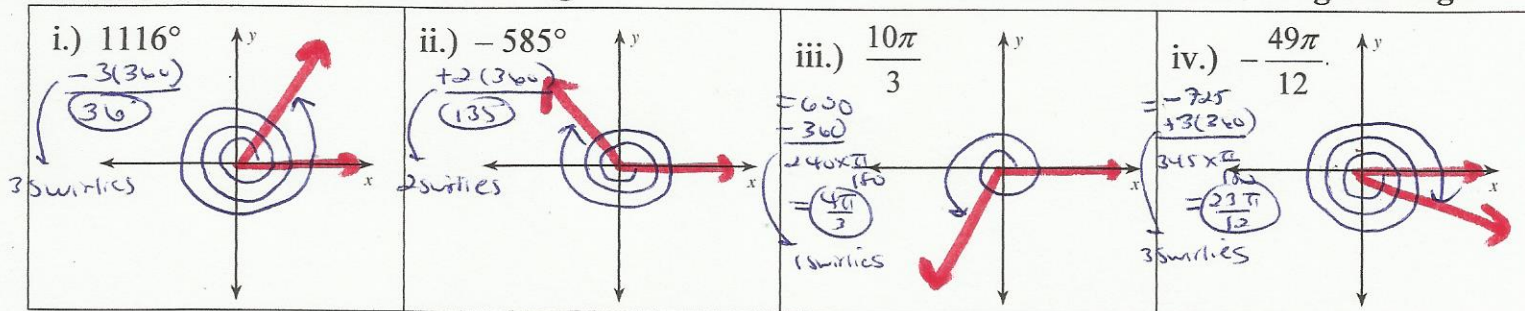
- **coterminal angles** → angles that Share a terminal side (end in the same place)
- To find a POSITIVE coterminal → add 360 (if in deg) or add 2 ( $\pi$ ) (if in rads)
  - To find a NEGATIVE coterminal → subtract 360 (if in deg) or subtract 2 ( $\pi$ ) (if in rads)
  - Coterminal angles can contain multiple rotations (I call these "swirlies")

**Example 2a:** Find a positive and negative coterminal angle for the given angle  $\theta$ .

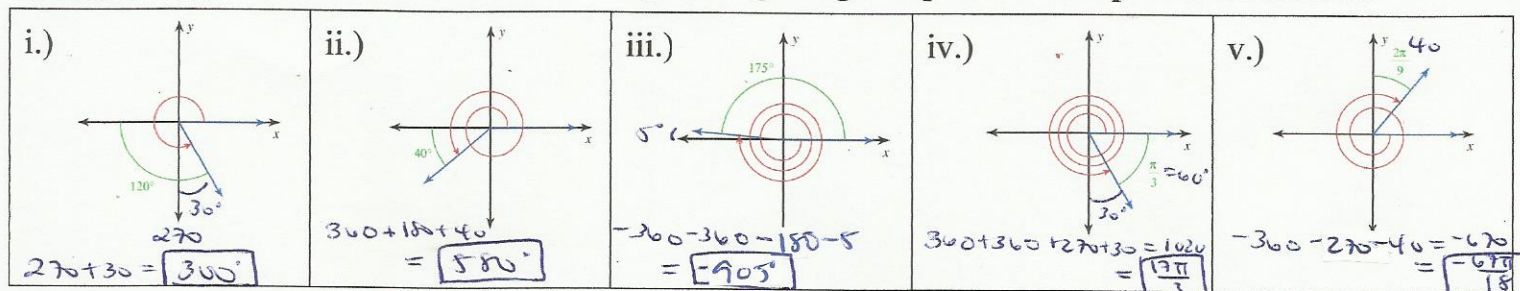
<p>i.) <math>\theta = 60^\circ \rightarrow</math></p> <p>positive coterminal angle = <math>60 + 360 = \boxed{420}</math></p> <p>negative coterminal angle = <math>60 - 360 = \boxed{-300}</math></p>	<p>ii.) <math>\theta = \frac{7\pi}{6} \rightarrow</math></p> <p>positive coterminal angle = <math>\frac{7\pi}{6}(\pi) + 2(\pi) = \boxed{\frac{19\pi}{6}}</math></p> <p>negative coterminal angle = <math>\frac{7\pi}{6}(\pi) - 2(\pi) = \boxed{-\frac{5\pi}{6}}</math></p>
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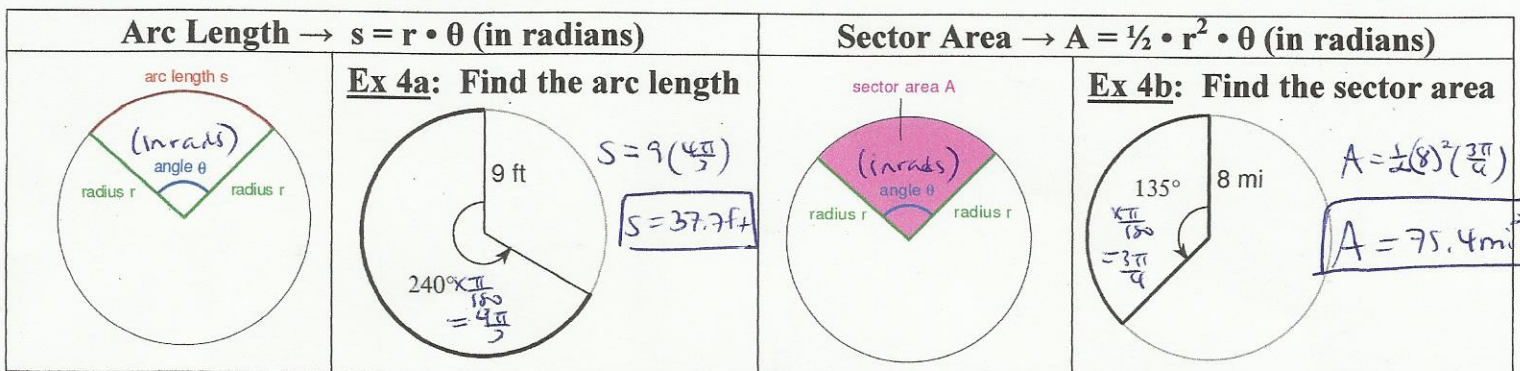
**Example 2b:** Find and draw an angle between  $0^\circ$  and  $360^\circ$  that is coterminal with the given angle.



**Example 2c:** Find the measure of each angle using the given picture. Keep units consistent.



### Application Problems Involving Angle Measure



**Example 3:** Using the appropriate formula(s), find what is asked. Round to tenth place.

