

8.1 (Part I) – Angles and Angle Measure

General Angle in Standard Position	Various Types of Common Angles		
<p>– <u>angle</u> → <u>rotation of a ray about a fixed point</u></p>	<p>Positive Angles</p> <p>▪ rotation is <u>CCW</u></p> <p>▪ arrow is <u>on top</u></p>	<p>Negative Angles</p> <p>▪ rotation is <u>CW</u></p> <p>▪ arrow is <u>underneath</u></p>	<p>Quadrant Angles</p> <p>▪ Terminal side falls on</p> <p>a.) x-axis like $0^\circ, \pm 180^\circ, \pm 360^\circ$</p> <p>b.) y-axis like $\pm 90^\circ, \pm 270^\circ$</p>

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

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

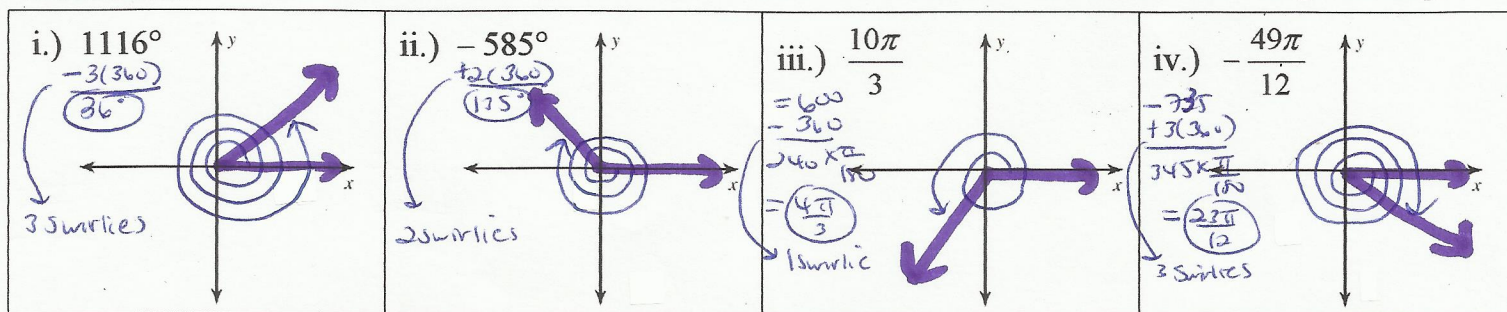
a.) $\theta = 48^\circ$	b.) $\theta = -212^\circ$	c.) $\theta = 270^\circ$	d.) $\theta = \frac{4\pi}{3} = 240^\circ$	e.) $\theta = -\frac{\pi}{6} = -30^\circ$	f.) $\theta = -\pi = -180^\circ$

- **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”)

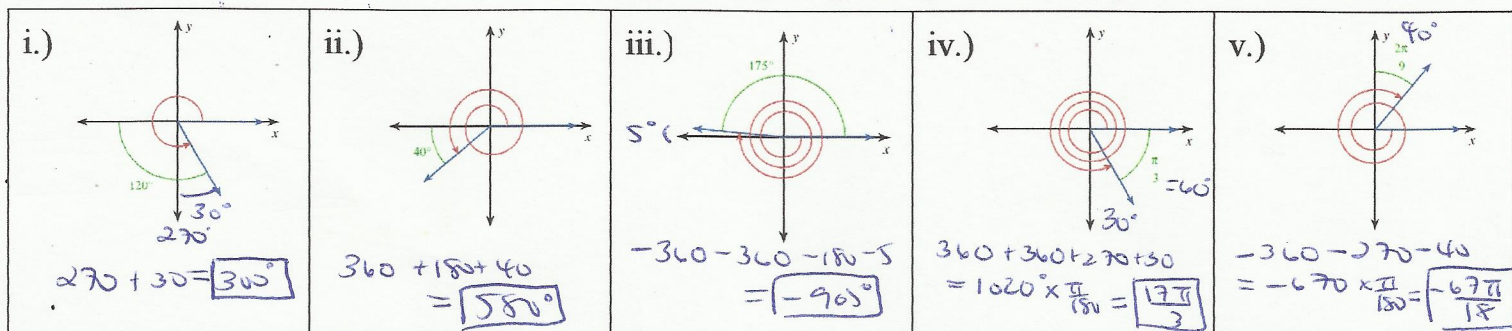
Example 2a: Find a positive and negative coterminal angle for the given angle θ .

<p>i.) $\theta = 60^\circ \rightarrow$</p> <p>positive coterminal angle = $60 + 360 = \boxed{420^\circ}$</p> <p>negative coterminal angle = $60 - 360 = \boxed{-300^\circ}$</p>	<p>ii.) $\theta = \frac{7\pi}{6} \rightarrow$</p> <p>positive coterminal angle = $\frac{7}{6}(\pi) + 2(\pi) = \boxed{\frac{19\pi}{6}}$</p> <p>negative coterminal angle = $\frac{7}{6}(\pi) - 2(\pi) = \boxed{-\frac{5\pi}{6}}$</p>
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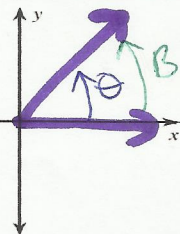

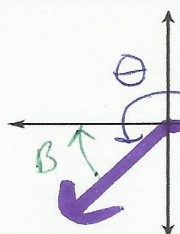
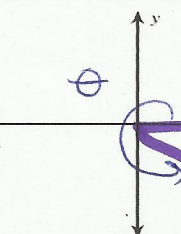
Example 2b: Find and draw an angle between 0° and 360° that is coterminal with the given angle.



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



– **reference angle** → an angle B associated with angle θ where B is an acute angle formed by the terminal side of angle θ and the x-axis (less than 90°)

Angle θ Falls in QI	Angle θ Falls in QII	Angle θ Falls in QIII	Angle θ Falls in QIV
			
Formula: $B = \theta$	Formula: $B = 180^\circ - \theta$	Formula: $B = \theta - 180^\circ$	Formula: $B = 360^\circ - \theta$

Example 3: Find the reference angle B given angle θ . Make sure angle θ is between 0° and 360°

angle θ	Quadrant θ Lies	Work to find angle B	reference angle B
a.) 120°	II (2)	$B = 180 - 120$	$B = 60^\circ$
b.) 53°	I (1)	X	$B = 53^\circ$
c.) 948° (228°)	III (3)	$B = 228 - 180$	$B = 48^\circ$
d.) -765° (315°)	IV (4)	$B = 360 - 315$	$B = 45^\circ$