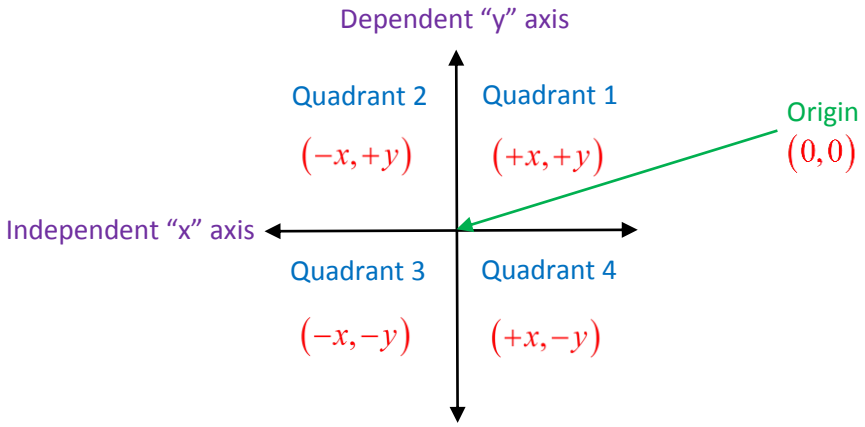
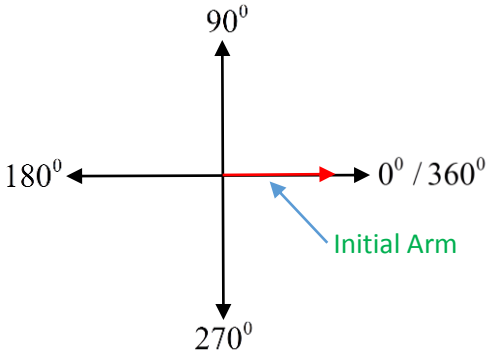
Precalculus 11 **Sec 2.1 – Angles in Standard Position**

Let's do a quick review of the coordinate plane and some key terms.

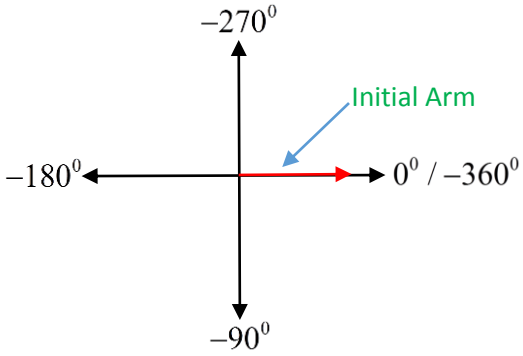


The "unit circle" and rotations.

- A unit circle is any circle that has its center at the origin (0, 0) and a radius of 1 unit
- When you begin the rotation of any unit circle, always begin on the (+)ve 'x'-axis
- The line in which the rotation begins is known as the "initial arm"
- The line that is rotating around the circle is the "terminal arm"
- If the rotation is counter-clockwise, the terminal arm will always move in a (+)ve direction
- If the rotation is clockwise, the terminal arm will always move in a (-)ve direction



The terminal arm is rotating counter-clockwise, so the angle will always be (+)ve



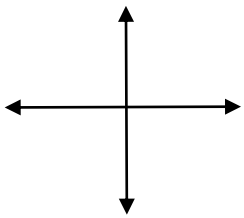
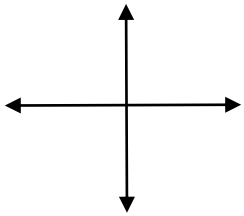
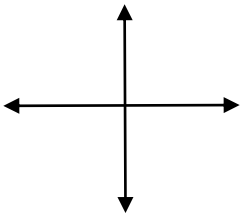
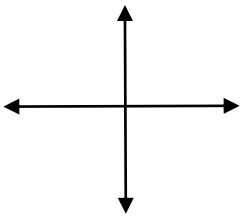
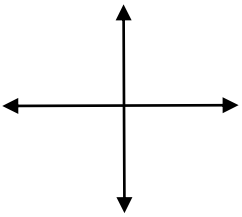
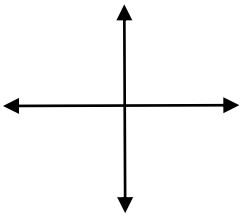
The terminal arm is rotating clockwise, so the angle will always be (-)ve

All angles in "standard position" must begin from the initial arm, (+)ve x-axis

Any angle can be created be rotating the terminal arm around the circle

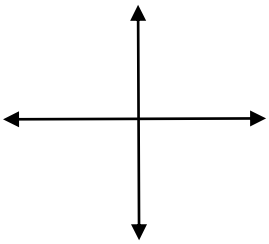
- Remember: counter-clockwise = (+)ve angle and clockwise = (-)ve angle

Example 1: Draw the following angles in standard position.

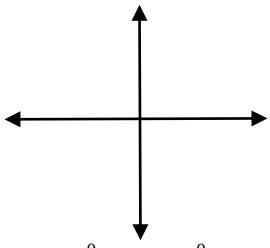
a) 135^0 	b) -120^0 	c) 215^0 
d) -150^0 	e) 300^0 	f) -330^0 

Co-terminal angles are angles that have the terminal arm ending in exactly the same position, regardless of the number of rotations.

- All co-terminal angles are multiples of 360^0 or a difference of 360^0

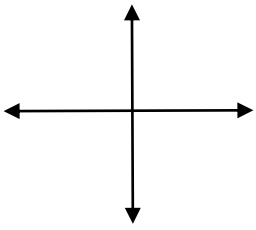
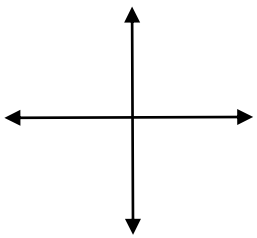
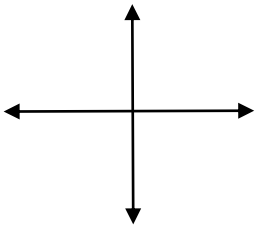
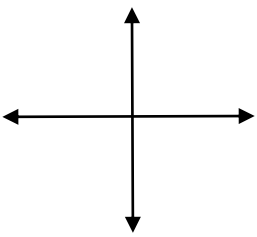


$30^0,\ 390^0,\ 750^0,\ 1110^0$



$45^0,\ -315^0,\ -675^0,\ -1035^0$

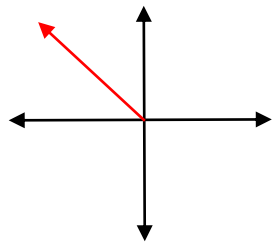
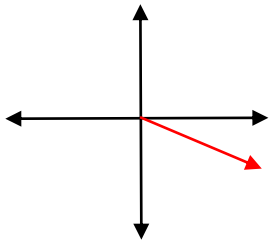
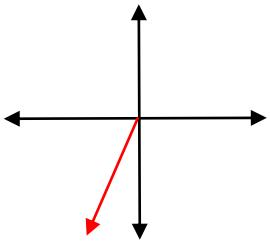
Example 2: Provide 2 co-terminal angles and draw the location of the terminal arm

a) 25^0 	b) -50^0 	c) 130^0 	d) -125^0 

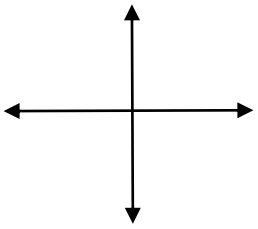
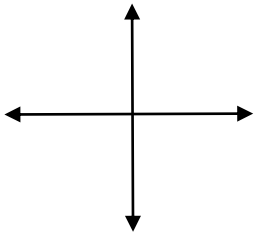
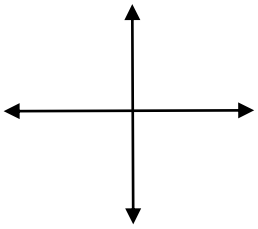
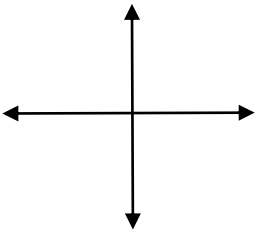
A "reference angle" is any angle created by the terminal arm and the 'x'-axis

- They must be in the same quadrant as the terminal arm
- All reference angles are absolute, ie, they are always positive

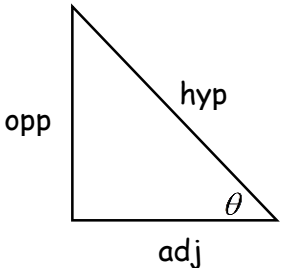
Example 3: Given the position of the terminal arm, indicate the reference angle.

a)	b)	c)
		

Example 4: Given an angle in standard position, determine the reference angle.

e) 156^0	f) -320^0	g) 647^0	h) -831^0
			

If you recall, from Precalculus 10, these are the trigonometric ratios that are used to calculate the sides and angles of any right triangle.



$$\sin\theta = \frac{opp}{hyp} \qquad \cos\theta = \frac{adj}{hyp} \qquad \tan\theta = \frac{opp}{adj}$$

Use Pythagoras Theorem to calculate the unknown side of any right triangle as long as 2 other sides are known $hyp = \sqrt{opp^2 + adj^2}$

Example 5: Point P(4, 7), is on the terminal arm of an angle θ in standard position.

a) Calculate the distance 'r' from the origin to P.	b) Give the trigonometric ratios for θ.	c) Determine the measure of angle θ.

Example 6: The pendulum arm of a grandfather clock is 1.3m long and swings left and right from a start position of 80^0 to 100^0. What is the total horizontal distance the pendulum moves in one complete swing?

Homework: