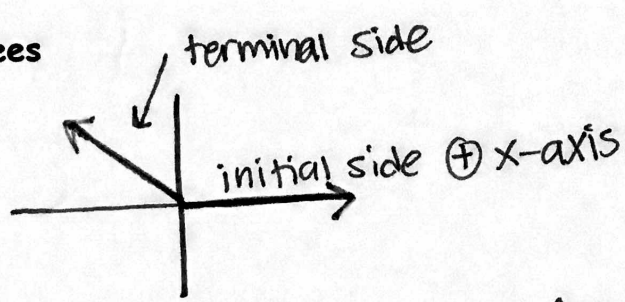


# Day 8 Notes: Angles, Radians to Degrees

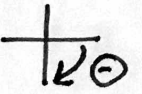
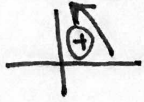
## I. Definitions:

Standard Position of an Angle:



Positive Angles: counter clockwise from positive x-axis

Negative Angles: Clockwise from the positive x-axis



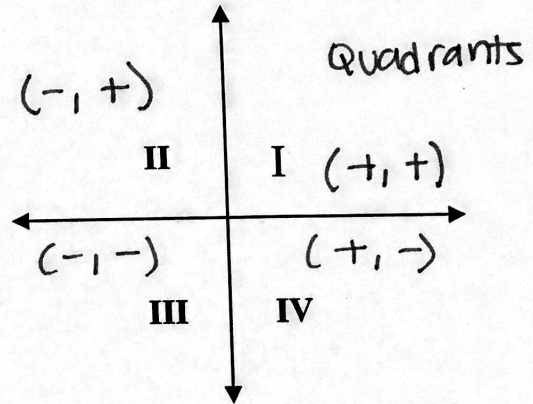
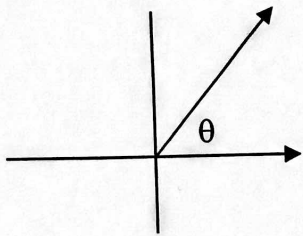
## II. Types of Angles

Acute: less than  $90^\circ$

Obtuse: greater than  $90^\circ$

Right: exactly  $90^\circ$

Straight:  $180^\circ$



Example: Draw each angle to determine in which quadrant it lies:

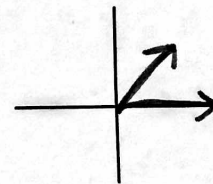
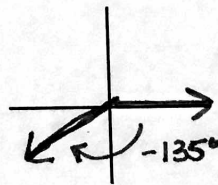
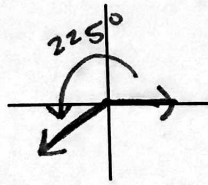
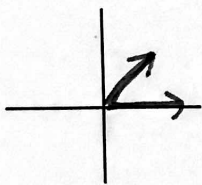
1.  $\theta = 45^\circ$

2.  $\theta = 225^\circ$

3.  $\theta = -135^\circ$

4.  $\theta = 405^\circ$

same as:  
 $405 - 360 = 45^\circ$   
reference angle

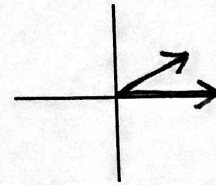
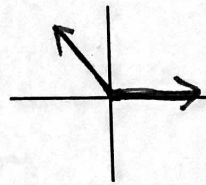
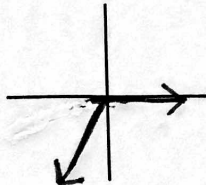
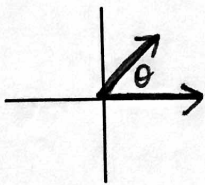


5.  $\theta = 30^\circ$

6.  $\theta = -120^\circ$

7.  $\theta = 480^\circ$   
 $480 - 360 = 120^\circ$

8.  $\theta = 390^\circ$   
 $390 - 360 = 30^\circ$



III. Coterminal Angles: Two angles with the same initial and terminal sides.

An angle of  $x^\circ$  is coterminal with angles of the form  $x^\circ + 360k$ , where  $k$  is an integer.

Example: Find a positive angle less than 360 that is coterminal with the following.

1.  $420^\circ \Rightarrow 420 - 360 = 60^\circ$

2.  $-120^\circ \rightarrow -120 + 360 = 240^\circ$

3.  $400^\circ \rightarrow 400 - 360 = 40^\circ$

4.  $-135^\circ \rightarrow -135 + 360 = 225^\circ$

IV. Complementary and Supplementary Angles

A. Complementary Angles: angles whose sum is  $90^\circ$ .

B. Supplementary Angles: angles whose sum is  $180^\circ$ .

V. Reference Angles: Angle formed by the terminal ray of the original angle and the x-axis.

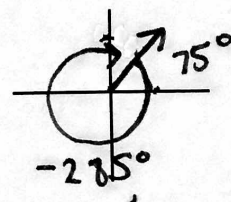
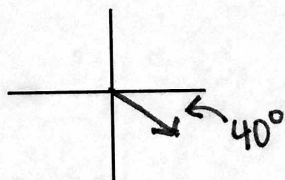
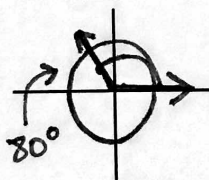
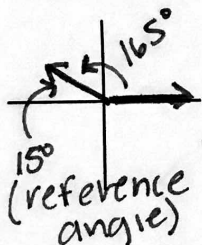
EX. Find the reference angle for each of the following.

1) 165

2) 460

3) -40

4) -285



VI. Radian - measure of the central angle of a circle that intercepts an arc equal in length to the radius of a circle.

$360^\circ$        $2\pi$  radians

$360^\circ = 2\pi$  radians  
 $180^\circ = \pi$  radians

Converting degrees to radians: multiply by the conversion factor  $\frac{\pi \text{ radians}}{180^\circ}$ .

EX. Convert the following degrees to radians.

1)  $30^\circ \left(\frac{\pi}{180}\right) = \frac{30\pi}{180} = \boxed{\frac{\pi}{6}}$     2)  $90^\circ \left(\frac{\pi}{180}\right) = \frac{90\pi}{180} = \boxed{\frac{\pi}{2}}$     3)  $-135^\circ \left(\frac{\pi}{180}\right) = \frac{-135\pi}{180} = \boxed{\frac{-3\pi}{4}}$

4)  $60^\circ$

5)  $260^\circ$

6)  $-300^\circ$

Converting radians to degrees: multiply by the conversion factor  $\frac{180^\circ}{\pi \text{ radians}}$ .

EX. Convert the following radians to degrees.

1)  $\frac{\pi}{3} \left( \frac{180}{\pi} \right) = \frac{180}{3} = \boxed{60^\circ}$     2)  $\frac{-5\pi}{3} \left( \frac{180}{\pi} \right) = \boxed{-300^\circ}$     3) 3

4)  $\frac{7\pi}{6}$

5)  $\frac{3\pi}{4}$

6) 6 radians