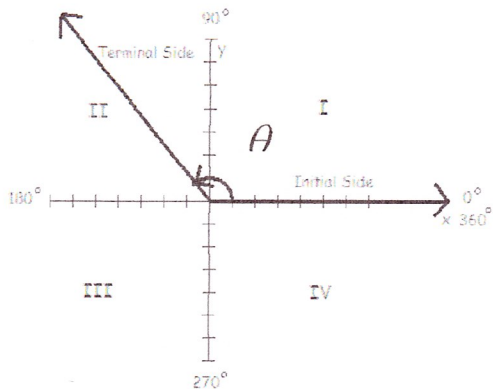


Section **4.2** - Radian and Degree Measure

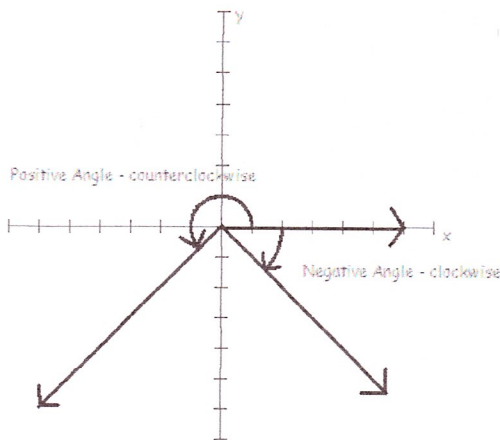
PART ONE: Radians and Degrees

Angle in Standard Position:



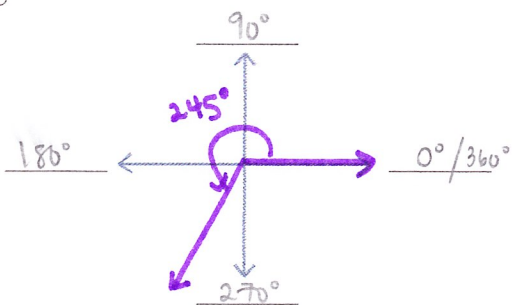
There are 360 degrees in ONE revolution.

Types of Angles:

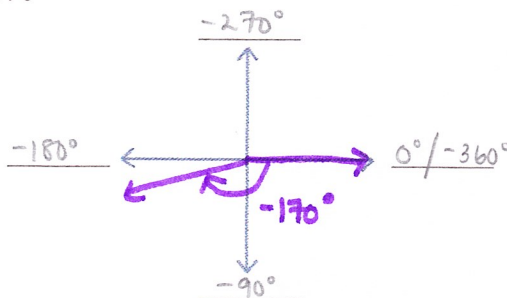


Example 1: Sketch the following angles in standard position.

a.  $245^\circ$



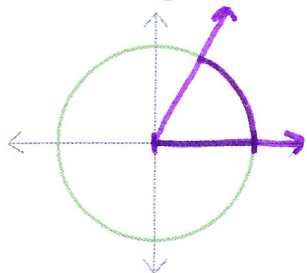
b.  $-170^\circ$



Radian Measure:

One radian is the measure of a central angle that intercepts an arc equal to the radius of the circle.

Draw in an angle with measure of "about" one radian.

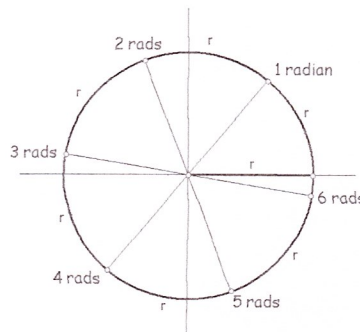


Approximately how many radians are in a circle?  $\approx$  6-ish radians

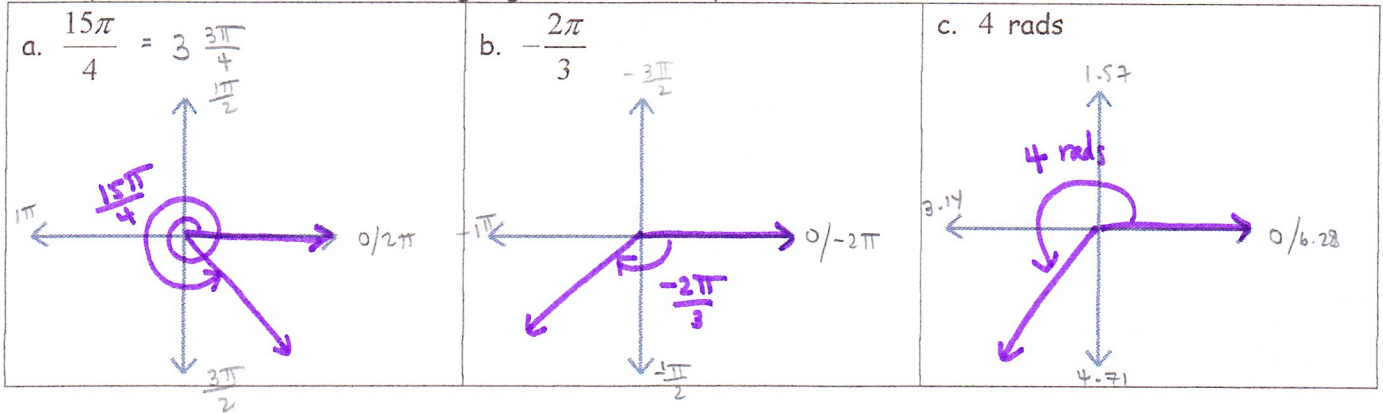
EXACTLY how many radians are in a circle? =  $2\pi$  radians

What is circumference of a circle?  $C =$   $2\pi r$

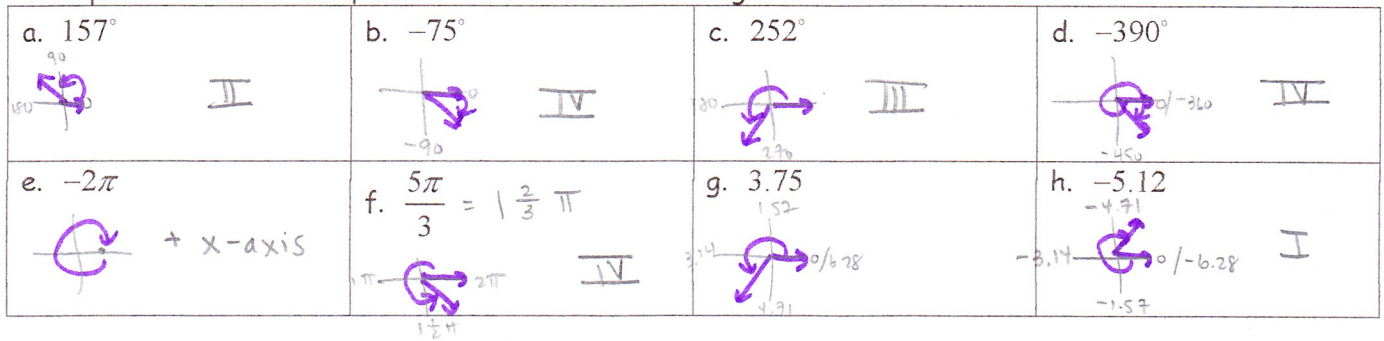
This means that one revolution is equal to  $2\pi$  radians.



Example 2: Sketch the following angles in standard position.

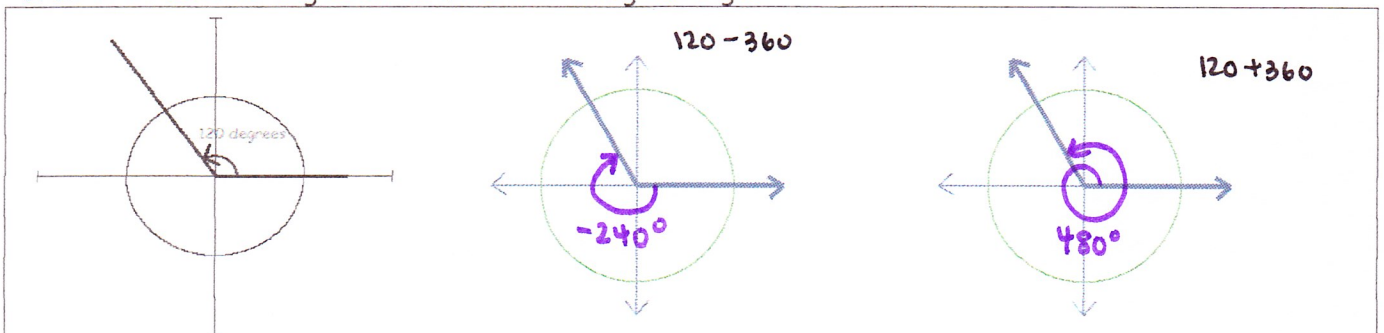


Example 3: State the quadrant or axis where each angle terminates.



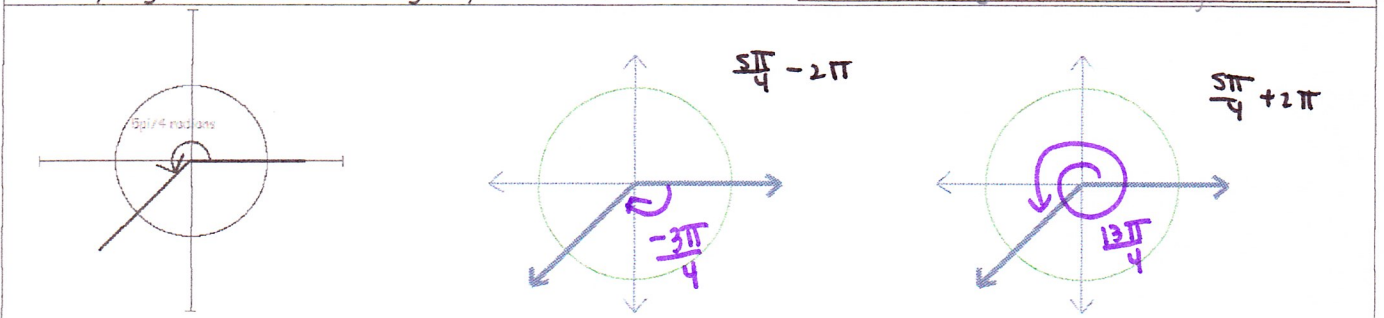
Co-terminal Angles are angles that have the same initial and terminal sides.

Draw in three other angles co-terminal with the given angle.



How many angles are co-terminal with  $120^\circ$ ? infinite

Could you get the calculator to give you a list of ALL of them? Sort of:  $y = 120 + 360x$ , then look @ table



How many angles are co-terminal with  $\frac{5\pi}{4}$  radians? infinite

Could you get the calculator to give you a list of ALL of them? Sort of In  $\pi$  form? \_\_\_\_\_

Yes, if \_\_\_\_\_

Example 4: State two coterminal angles for each given angle... **one positive and one negative.**

<p>a. <math>40^\circ</math></p> $40 + 360 = \boxed{400^\circ}$ $40 - 360 = \boxed{-320^\circ}$	<p>b. <math>-800^\circ</math></p> $-800 + 360 = \boxed{-440^\circ}$ $-800 + 3(360) = \boxed{280^\circ}$	<p>c. <math>\frac{5\pi}{4}</math></p> $\frac{5\pi}{4} - 2\pi = \boxed{\frac{-3\pi}{4}}$ $\frac{5\pi}{4} + 2\pi = \boxed{\frac{13\pi}{4}}$
<p>d. <math>9\pi</math></p> $9\pi - 2\pi = \boxed{7\pi}$ $9\pi - 2(5\pi) = \boxed{-\pi}$	<p>e. 5</p> $5 - 2\pi \approx \boxed{-1.28}$ $5 + 2\pi \approx \boxed{11.28}$	<p>f. <math>-47^\circ</math></p> $-47 + 360 = \boxed{313^\circ}$ $-47 - 360 = \boxed{-407^\circ}$

### PART TWO: Conversions Between Degrees and Radians

<p>1 revolution is <math>2\pi</math> radians</p> $\frac{2\pi \text{ rad}}{2\pi} = \frac{360^\circ}{2\pi}$ <p><math>2\pi</math> radians = <math>360^\circ</math></p> <p>SO 1 radian = <math>\frac{180}{\pi}^\circ</math></p> <p>then 7 radians = <math>7\left(\frac{180}{\pi}\right)^\circ</math></p> <p><b>To convert</b> rads <math>\Rightarrow</math> deg, multiply rads by <math>\frac{180}{\pi}</math> degrees.</p>	<p>1 revolution is <math>2\pi</math> radians</p> $\frac{360^\circ}{360} = \frac{2\pi \text{ rad}}{2\pi}$ <p><math>360^\circ = 2\pi</math> radians</p> <p>SO <math>1^\circ = \frac{\pi}{180}</math> radians</p> <p>then <math>7^\circ = 7\left(\frac{\pi}{180}\right)</math> radians</p> <p><b>To convert</b> deg <math>\Rightarrow</math> rads, multiply degrees by <math>\frac{\pi}{180}</math> rads.</p>
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Example 1: Convert from degrees to radians.

<p>a. <math>135^\circ</math></p> $\frac{135^\circ}{1} \cdot \frac{\pi}{180^\circ} = \boxed{\frac{3\pi}{4} \text{ rad}}$	<p>b. <math>540^\circ</math></p> $\frac{540^\circ}{1} \cdot \frac{\pi}{180^\circ} = \boxed{3\pi \text{ rad}}$	<p>c. <math>-270^\circ</math></p> $\frac{-270^\circ}{1} \cdot \frac{\pi}{180^\circ} = \boxed{\frac{-3\pi}{2} \text{ rad}}$
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Example 2: Convert from radians to degrees.

<p>a. <math>-\frac{\pi}{2}</math></p> $\frac{-\pi \text{ rad}}{2} \cdot \frac{180}{\pi \text{ rad}} = \boxed{-90^\circ}$	<p>b. <math>\frac{9\pi}{2}</math></p> $\frac{9\pi \text{ rad}}{2} \cdot \frac{180}{\pi \text{ rad}} = \boxed{810^\circ}$	<p>c. 2</p> $\frac{2 \text{ rad}}{1} \cdot \frac{180^\circ}{\pi \text{ rad}} = \boxed{\frac{360^\circ}{\pi}}$
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Can we divide an angle up into units smaller than a degree? yes

Why would we want to do so? better accuracy

# Deg° Min' Sec" OR D° M' S"

1 degree can be divided into 60 minutes (NOT TIME), so  $1' = \frac{1}{60}$  deg.

1 minute can be divided into 60 seconds (NOT TIME), so  $1'' = \frac{1}{60}$  min.

So, there are 3600 seconds in 1 degree, resulting in  $1'' = \frac{1}{3600}$  deg.

Example 3: Change each angle measure to decimal degree form. SHOW YOUR WORK.

a.  $42^{\circ}33'40''$

$$42^{\circ} + \frac{33'}{1} \cdot \frac{1^{\circ}}{60'} + \frac{40''}{1} \cdot \frac{1^{\circ}}{3600''}$$

$$\approx 42.56^{\circ}$$

b.  $-300^{\circ}52'30''$

$$-(300^{\circ} + \frac{52'}{1} \cdot \frac{1^{\circ}}{60'} + \frac{30''}{1} \cdot \frac{1^{\circ}}{3600''})$$

$$= -300.875^{\circ}$$

Example 4: Change each angle measure to D° M' S" form. SHOW YOUR WORK.

a.  $2.54^{\circ}$

$$2^{\circ} + .54^{\circ}$$

$$2^{\circ} + \frac{.54^{\circ}}{1} \cdot \frac{60'}{1^{\circ}}$$

$$2^{\circ} + 32.4'$$

$$2^{\circ} + 32' + .4'$$

$$2^{\circ} + 32' + \frac{.4'}{1} \cdot \frac{60''}{1'}$$

$$2^{\circ} 32' 24''$$

b.  $-36.126^{\circ}$

$$-36^{\circ} + \frac{.126^{\circ}}{1} \cdot \frac{60'}{1^{\circ}}$$

$$-36^{\circ} + 7.56'$$

$$-36^{\circ} + 7' + \frac{.56'}{1} \cdot \frac{60''}{1'}$$

$$-36^{\circ} 7' 33.6''$$

Will the calculator do the computations above for us? yes

How? look under angle menu →  $\boxed{2^{\text{nd}}}$   $\boxed{\text{APPS}}$   
and " is  $\boxed{\text{ALPHA}}$   $\boxed{+}$