Pre-Calculus Notes

Name: _key_

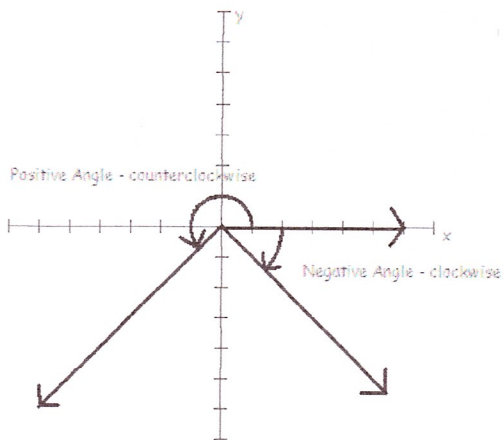# Section 4.1 – Radian and Degree Measure

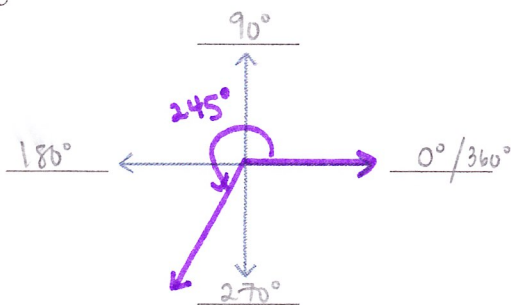**PART ONE:** Radians and Degrees

Angle in Standard Position:	Types of Angles:
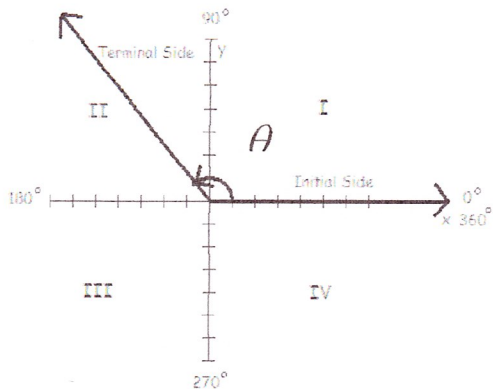
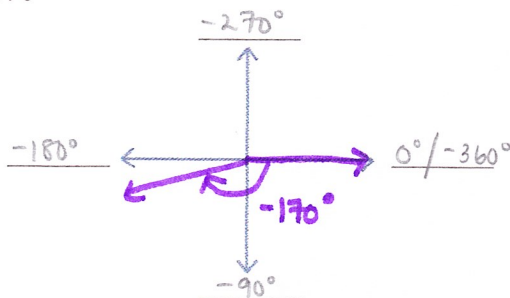There are 360 degrees in ONE revolution.

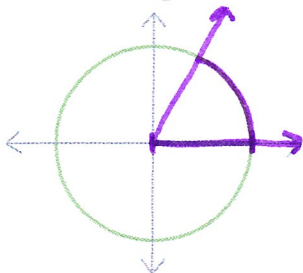**Example 1:** Sketch the following angles in standard position.

a. 245°

b. −170°

Radian Measure: One radian is the measure of a central angle that intercepts an **_arc equal to the radius of the circle_**.

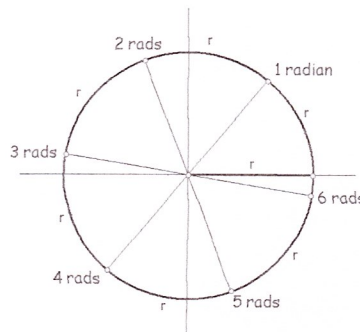Draw in an angle with measure of "about" one radian.

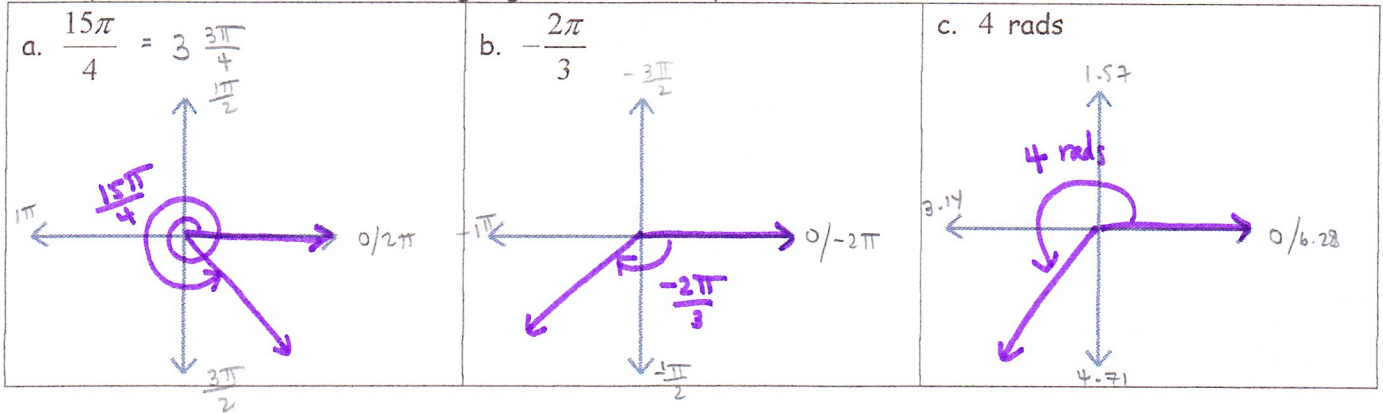Approximately how many radians are in a circle? ≈ _____6 ish_____ radians

EXACTLY how many radians are in a circle? = _____2π_____ radians

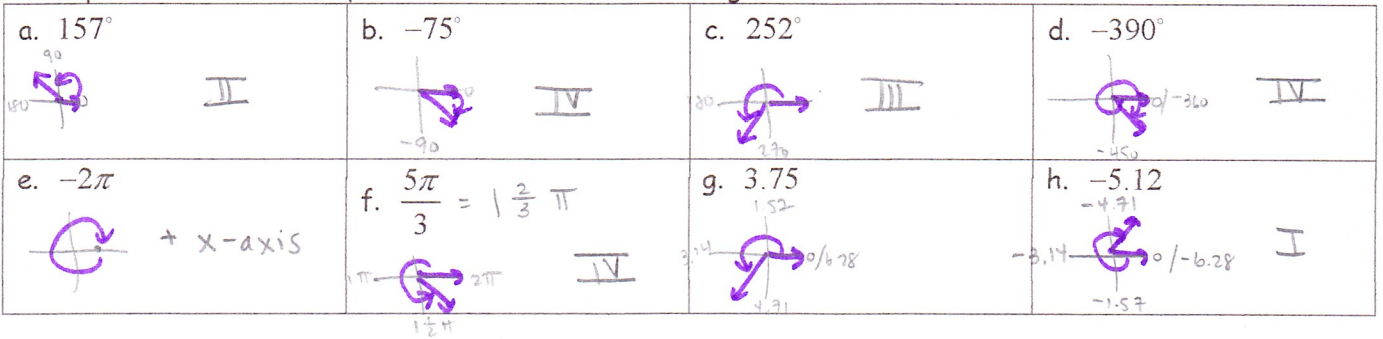What is circumference of a circle? $C = $ _____$2\pi r$_____

This means that one revolution is equal to _____2π_____ radians.

**Example2:** Sketch the following angles in standard position.

a. $\dfrac{15\pi}{4} = 3\dfrac{3\pi}{4}$ $\dfrac{15\pi}{2}$

b. $-\dfrac{2\pi}{3}$

c. 4 rads

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

a. 157°   II

b. −75°   IV

c. 252°   III

d. −390°   IV

e. −2π   + x-axis

f. $\dfrac{5\pi}{3} = 1\dfrac{2}{3}\pi$ IV

g. 3.75

h. −5.12   I

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

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

120 − 360

−240°

120 + 360

480°
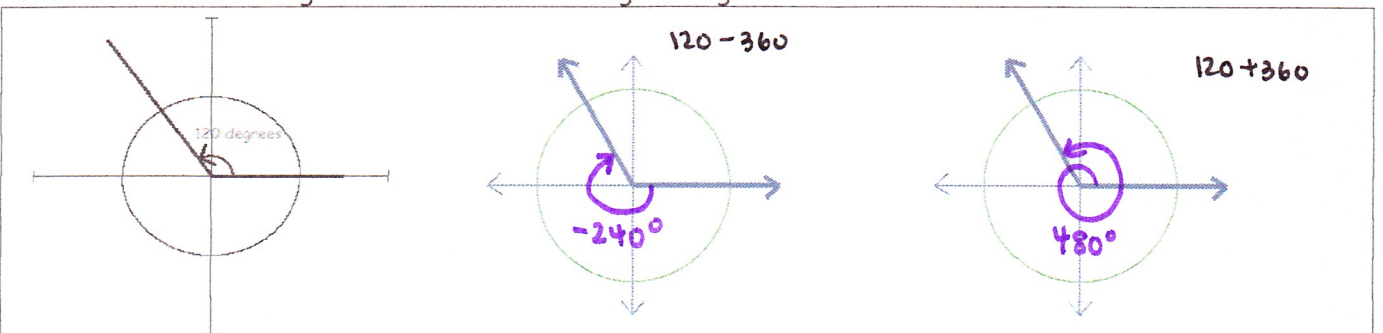
How many angles are co-terminal with 120°? __infinite__

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

$\dfrac{5\pi}{4} - 2\pi$

$-\dfrac{3\pi}{4}$

$\dfrac{5\pi}{4} + 2\pi$

$\dfrac{13\pi}{4}$
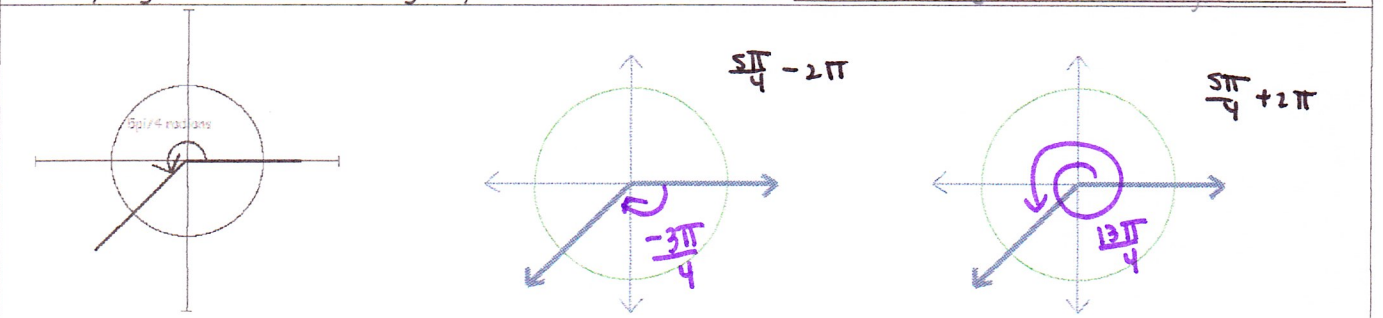
How many angles are co-terminal with $\dfrac{5\pi}{4}$ radians? __infinite__ $y = \dfrac{5\pi}{4} + 2\pi x$

Could you get the calculator to give you a list of ALL of them? _Sort of_   In π form? _____

Yes, if _____.

Example 4: State two coterminal angles for each given angle... <mark>one positive and one negative.</mark>

a. $40°$	b. $-800°$	c. $\dfrac{5\pi}{4}$
$40 + 360 = \boxed{400°}$ $40 - 360 = \boxed{-320°}$	$-800 + 360 = \boxed{-440°}$ $-800 + 3(360) = \boxed{280°}$	$\dfrac{5\pi}{4} - 2\pi = \boxed{\dfrac{-3\pi}{4}}$ $\dfrac{5\pi}{4} + 2\pi = \boxed{\dfrac{13\pi}{4}}$
d. 9π	e. 5	f. $-47°$
$9\pi - 2\pi = \boxed{7\pi}$ $9\pi - 2(5\pi) = \boxed{-\pi}$	$5 - 2\pi \approx \boxed{-1.28}$ $5 + 2\pi \approx \boxed{11.28}$	$-47 + 360 = \boxed{313°}$ $-47 - 360 = \boxed{-407°}$

PART TWO: Conversions Between Degrees and Radians

1 revolution is 2π radians $\dfrac{2\pi \text{ rad}}{2\pi} = \dfrac{360°}{2\pi}$ 2π radians $= 360°$ SO 1 radian = $\underline{\dfrac{180}{\pi}}$ ° then 7 radians = $\underline{7\left(\dfrac{180}{\pi}\right)}$ ° **To convert** rads $\Rightarrow$ deg **, multiply rads by** $\dfrac{180}{\pi}$ **degrees**.	1 revolution is 2π radians $\dfrac{360°}{360} = \dfrac{2\pi \text{ rad}}{360}$ $360° = 2\pi$ radians SO $1° = \underline{\dfrac{\pi}{180}}$ radians then $7° = \underline{7\left(\dfrac{\pi}{180}\right)}$ radians **To convert** deg $\Rightarrow$ rads **, multiply degrees by** $\dfrac{\pi}{180}$ **rads**.

Example 1: Convert from degrees to radians.

a. $135°$	b. $540°$	c. $-270°$
$\dfrac{135°}{1} \cdot \dfrac{\pi}{180°} = \boxed{\dfrac{3\pi}{4} \text{ rad}}$	$\dfrac{540°}{1} \cdot \dfrac{\pi}{180°} = \boxed{3\pi \text{ rad}}$	$\dfrac{-270°}{1} \cdot \dfrac{\pi}{180°} = \boxed{\dfrac{-3\pi}{2} \text{ rad}}$

Example 2: Convert from radians to degrees.

a. $-\dfrac{\pi}{2}$	b. $\dfrac{9\pi}{2}$	c. 2
$\dfrac{-\pi \text{ rad}}{2} \cdot \dfrac{180}{\pi \text{ rad}} = \boxed{-90°}$	$\dfrac{9\pi \text{ rad}}{2} \cdot \dfrac{180}{\pi \text{ rad}} = \boxed{810°}$	$\dfrac{2 \text{ rad}}{1} \cdot \dfrac{180°}{\pi \text{ rad}} = \boxed{\dfrac{360°}{\pi}}$

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 $1' = \dfrac{1}{60}$ deg.

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

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

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

a. 42°33'40"

$42° + \dfrac{33'}{1} \cdot \dfrac{1°}{60'} + \dfrac{40''}{1} \cdot \dfrac{1°}{3600''}$

$\approx \boxed{42.56°}$

b. −300°52'30"

$-\left(300° + \dfrac{52'}{1} \cdot \dfrac{1°}{60'} + \dfrac{30''}{1} \cdot \dfrac{1°}{3600''}\right)$

$= \boxed{-300.875°}$

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

a. 2.54°

$2° + .54°$

$2° + .54° \cdot \dfrac{60'}{1°}$

$2° + 32.4'$

$2° + 32' + .4'$

$2° + 32' + \dfrac{.4'}{1} \cdot \dfrac{60''}{1'}$

$\boxed{2° \; 32' \; 24''}$

b. −36.126°

$-36° + \dfrac{.126°}{1} \cdot \dfrac{60'}{1°}$

$-36° + 7.56'$

$-36° + 7' + \dfrac{.56'}{1} \cdot \dfrac{60''}{1'}$

$\boxed{-36° \; 7' \; 33.6''}$

Will the calculator do the computations above for us? __yes__

How? look under angle menu → [2nd] [APPS]
and " is [ALPHA] [+]