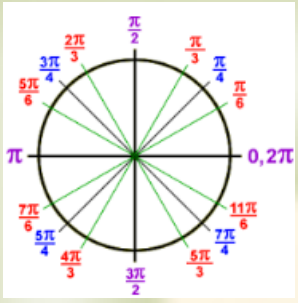
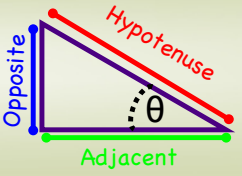
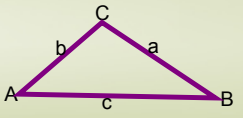
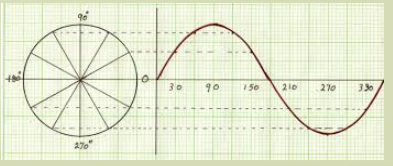








Math 1060 ~ Trigonometry

$\sin^2 u + \cos^2 u = 1$

$\sin 2u = 2\sin u \cos u$

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

$c^2 = a^2 + b^2 - 2ab\cos C$

1 Degree and Radian Measures of Angles

Learning Objectives

In this section you will:

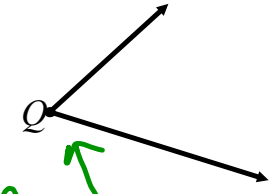
- **Convert between degree and radian measures.**
- **Graph angles in standard position.**
- **Determine coterminal angle measures in degrees and radians.**
- **Determine supplementary and complementary angles.**

Vocabulary for angles

ray : half of a line

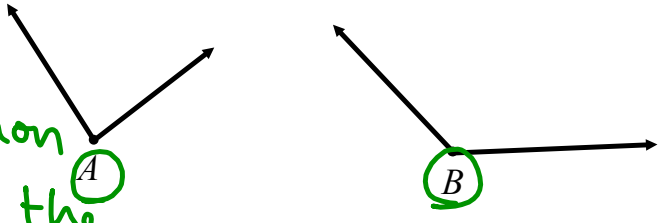
has one endpt and all pts on line lying to one side of that pt

angle : two rays sharing a common endpt



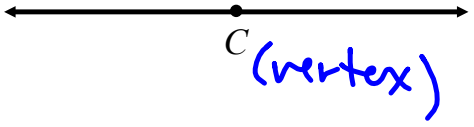
vertex

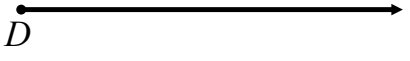
vertex : the common endpt of the 2 rays making up the angle



straight angle : an angle that forms a line (i.e. rays are directly opposite each other)

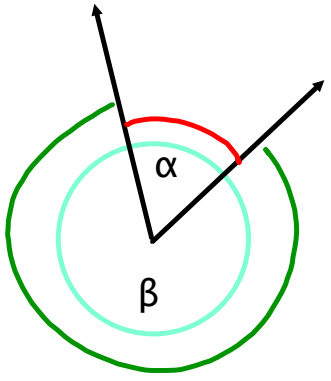
180° angle





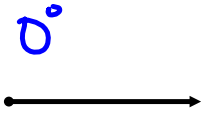
0° angle

Degree Measure of Angles and Types of Angles

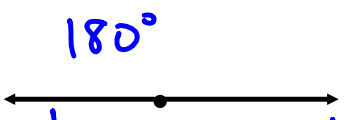


$\alpha + \beta = 360°$

Ex 1: State the measure of each of these angles in degrees and describe the type of each.

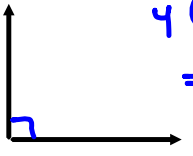


0°



180°

straight angle

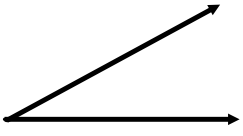


$\frac{1}{4}(360°)$

$= 90°$

right angle

1/4 of the circle

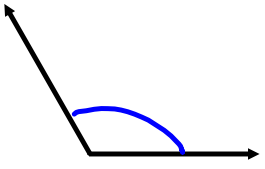


1/12 of the circle

$\frac{1}{12}(360°)$

$= 30°$

acute angle

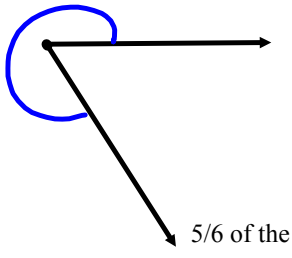


1/3 of the circle

$\frac{1}{3}(360°)$

$= 120°$

obtuse angle



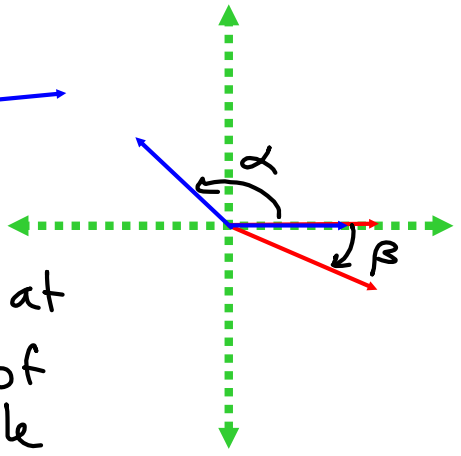
5/6 of the circle

$\frac{5}{6}(360°)$

$= 300°$

reflex angle

Angles in Standard Position



standard position: initial side on positive x-axis w/ vertex at origin

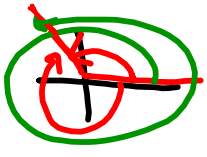
initial side: starting ray of angle

terminal side: ending ray of angle

positive angle: counter-clockwise (ex α)

negative angle: clockwise (ex β)

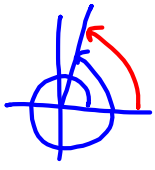
coterminal angles: have same terminal side



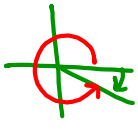
(there are infinitely many coterminal angles for any angle)

Ex 2: State a coterminal angle between 0° and 360° for each of these.

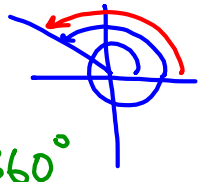
a) $\alpha = 432°$ b) $\beta = -25°$ c) $\gamma = 500°$ d) $\theta = -630°$



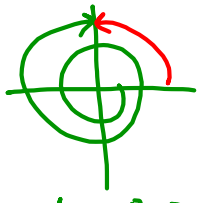
$432° - 360° = 72°$



$-25° + 360° = 335°$



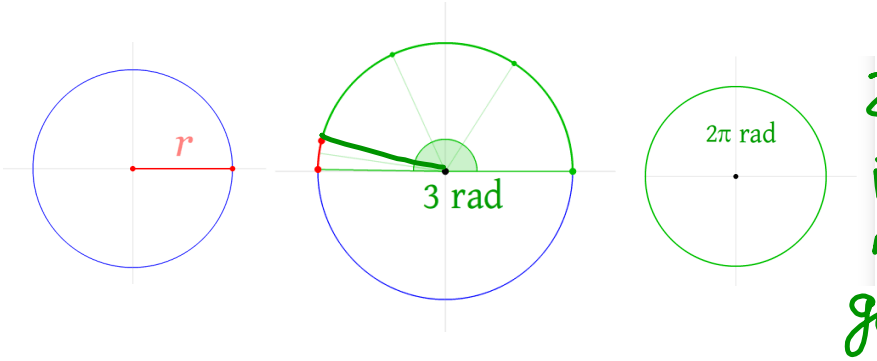
$500° - 360° = 140°$



$-630° + 360° = -270°$

$-270° + 360° = 90°$

https://en.wikipedia.org/wiki/File:Circle_radians.gif



2π radians is angle measure to go one revolution around circle

Radian Measure of an Angle

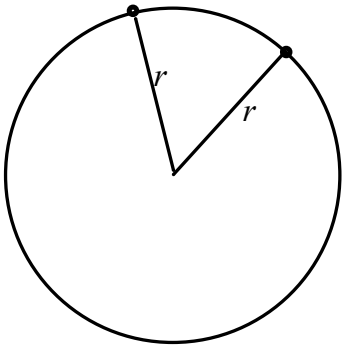
What is the number π ?

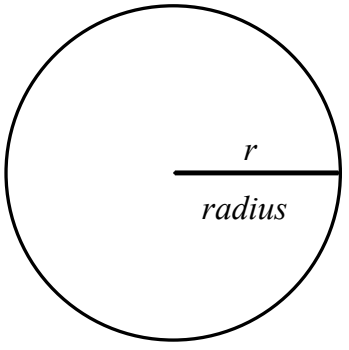
A radian is that portion of the circle equal in length to one radius of that circle.

r =

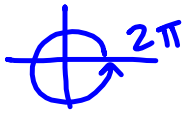
s =

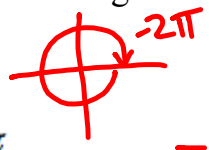
θ =



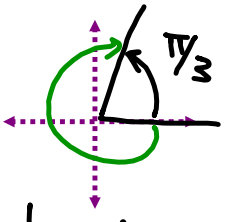


Ex 3: Graph each of these angles in standard position and classify them according to where their terminal side lies. State another coterminal angle between -2π and 2π for each angle.





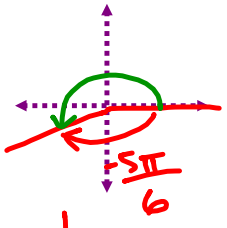
a) $\alpha = \frac{\pi}{3}$ b) $\beta = -\frac{5\pi}{6}$ c) $\lambda = \frac{\pi}{2}$ d) $\theta = \frac{9\pi}{4}$ $= 2\pi + \frac{\pi}{4}$



terminal side in Q1

$\frac{\pi}{3} - 2\pi = \frac{\pi}{3} - \frac{6\pi}{3}$

$= \frac{-5\pi}{3}$

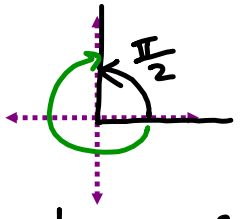


terminal side in Q3

$-\frac{5\pi}{6} + 2\pi$

$= -\frac{5\pi}{6} + \frac{12\pi}{6}$

$= \frac{7\pi}{6}$

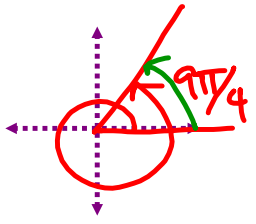


terminal side is on vertical axis

$\frac{\pi}{2} - 2\pi$

$= \frac{\pi}{2} - \frac{4\pi}{2}$

$= \frac{-3\pi}{2}$



terminal side in Q1

$\frac{9\pi}{4} - 2\pi = \frac{\pi}{4}$

Converting Between Degrees and Radians

The conversion factor between degrees and radians is

2π *radians* = 360º.

use conversion factor

$\pi = 180°$

Ex 4: Convert the following measures.

a) 225º to radians

$225° \left(\frac{\pi}{180°}\right) = \frac{225\pi}{180} = \frac{5\pi}{4}$

a form of one

b) $-\frac{5\pi}{6}$ radians to degrees

$\frac{-5\pi}{6}\left(\frac{180°}{\pi}\right) = -150°$

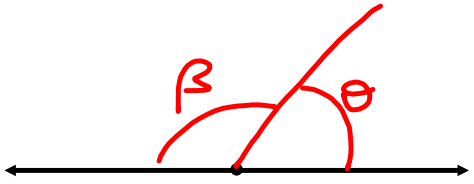
c) 2 radians to degrees

$2\left(\frac{180°}{\pi}\right) = \frac{360°}{\pi} \approx 114.59°$

d) 1080º to radians

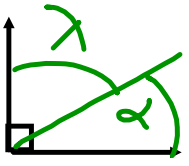
$1080° \left(\frac{\pi}{180°}\right) = 6\pi$

Supplementary and Complementary Angles in Degrees



$\beta + \theta = 180^\circ$

β, θ are supplementary angles



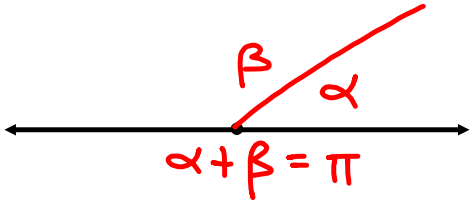
$\gamma + \alpha = 90^\circ$

γ, α are complementary angles

Ex 5: Determine the complement and supplement (if they exist) for each of these angles.

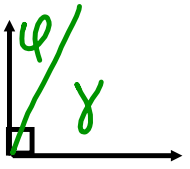
angle	complement	supplement
a) $\alpha = 24^\circ$	$90^\circ - 24^\circ = 66^\circ$	$180^\circ - 24^\circ = 156^\circ$
b) $\beta = 90^\circ$	0° (or DNE)	$180^\circ - 90^\circ = 90^\circ$
c) $\gamma = 130^\circ$	DNE (no pos. # adds to 130° to give 90°)	$180^\circ - 130^\circ = 50^\circ$
d) $\varphi = 180^\circ$	DNE	0° (or DNE)

Supplementary and Complementary Angles in Radians



$\alpha + \beta = \pi$

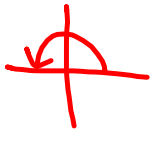
α and β add to make a straight angle



$\gamma + \varphi = \frac{\pi}{2}$

γ and φ add to make a rt. angle

Ex 6: Determine the complement and supplement (if they exist) for each of these angles.

angle	complement	supplement
a) $\alpha = \frac{\pi}{3}$	$\frac{\pi}{2} - \frac{\pi}{3} = \frac{\pi}{6}$	$\pi - \frac{\pi}{3} = \frac{2\pi}{3}$
b) $\beta = \frac{5\pi}{6}$	 DNE	$\pi - \frac{5\pi}{6} = \frac{\pi}{6}$
c) $\gamma = \frac{\pi}{4}$	 $\frac{\pi}{2} - \frac{\pi}{4} = \frac{\pi}{4}$	$\pi - \frac{\pi}{4} = \frac{3\pi}{4}$
d) $\varphi = \pi$ $\pi > \frac{\pi}{2}$	 DNE	$0 = \pi - \pi$ (or DNE)