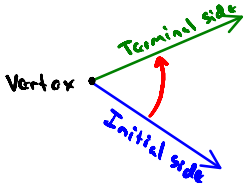
4.1 Radian and Degree Measure

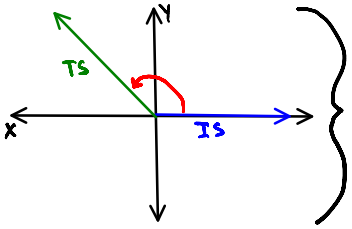
Monday, March 09, 2015
9:41 AM

Trigonometry is the Greek word that means "measurement of triangles".

An **Angle** is determined by rotating a RAY about its end points; it has 2 sides:

Initial Side is the starting point of the ray.
Terminal Side is the position after rotation.
Vertex is the end point of the ray.





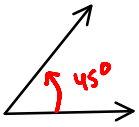
An angle that is in **Standard Position** has its vertex at the origin and the initial side coincides with the positive X-axis.

Angles are labeled with **Greek Letters** and **UPPERCASE LETTERS**:

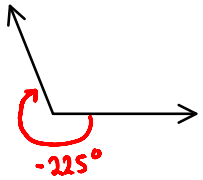
α	β	γ	θ
Alpha	Beta	Gamma	Theta

Angles are identified by showing the **direction** and the amount of **Rotation** from the initial side.

Positive Angles
Are formed by a counter clockwise rotation.

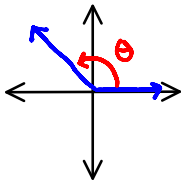


Negative Angles
Are formed by a clockwise rotation.

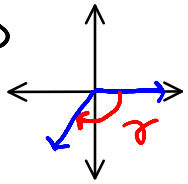


When $\angle\theta$ is in Standard Position, the terminal side will be in any of the 4 quadrants of a coordinate plane.

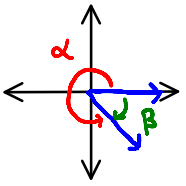
Ex.1 Identify the quadrant of the angle and whether its measure is positive or negative.

a) 

Quad. II, Positive ∠

b) 

Quad III, negative ∠

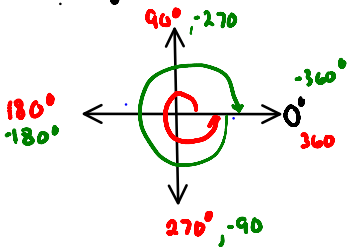
c) 

α Quad. IV, positive ∠

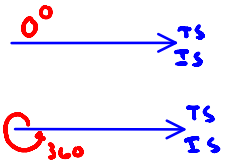
β Quad. IV, negative ∠

Angles α and β have the same I.S. and T.S., these angles are called Coterminal Angles.

Angles are measured in Degrees and Radians.



If the I.S. and T.S. are the same ray, then the degree measure is either:

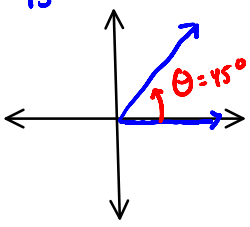


One revolution of a ray is 360°

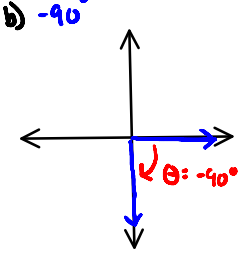
1° is 1/360 revolution
90° is 90/360 is 1/4 revolution
180° is 180/360 is 1/2 revolution
270° is 270/360 is 3/4 revolution
360° is 360/360 is 1 revolution

Ex.2 Draw each angle

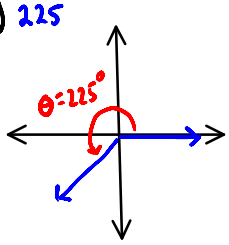
a) 45°



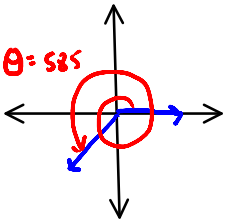
b) -90°



c) 225°

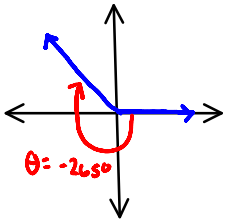


d) 585°

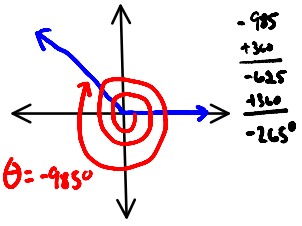


585
-360
225°

e) -265°



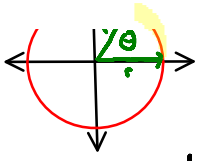
f) -985°



-985
+360
-625
+360
-265°

A second way to measure angles is in Radians. It is a unit of Angular measurement.

Measure of a central angle θ that



intercepts an arc equal in length to the radius of the circle.

When arc length equals radius, θ equals 1 radian.

$C = 2\pi r$ (circumference of a circle) when $r = 1$, then the circumference is 2π. So arc length of

arc length $\rightarrow S = 2\pi$.

2π radians corresponds to 360°

π radians corresponds to 180°

Radian is the measure of a central angle θ that intercepts an arc s equal in length to the radius r of the circle.

1 radian corresponds to 57.296° to an arc length of 1 corresponds to $\frac{180}{\pi}$

Use for conversion: $\frac{180}{\pi} : 1 \text{ rad}$ or $\frac{\pi}{180} = 1^\circ$

Ex.3 Convert from degrees to Radians

a) 60° $\quad 60 \cdot \frac{\pi}{180}$ $\quad \frac{60\pi}{180} \rightarrow \frac{\pi}{3}$ rads

b) 150° $\quad 150 \cdot \frac{\pi}{180}$ $\quad \frac{5\pi}{6}$ rads

c) -45° $\quad -45\left(\frac{\pi}{180}\right)$ $\quad -\frac{\pi}{4}$ rads

d) 120° $\quad 120\left(\frac{\pi}{180}\right)$ $\quad \frac{2\pi}{3}$ rads

Ex.4 Convert from Radians to degrees

a) $\frac{\pi}{5}$ $\quad \frac{\pi}{5} \cdot \frac{180}{\pi}$ $\quad \frac{180}{5} \rightarrow 36^\circ$

b) $\frac{7\pi}{4}$ $\quad \frac{7\pi}{4} \cdot \frac{180}{\pi}$ $\quad 315^\circ$

c) $-\frac{\pi}{3}$ $\quad -\frac{\pi}{3} \cdot \frac{180}{\pi}$ $\quad -60^\circ$

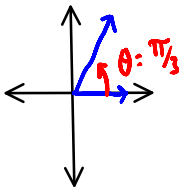
d) $-\frac{7\pi}{3}$ $\quad -\frac{7\pi}{3} \cdot \frac{180}{\pi}$ $\quad -420^\circ$

e) .682 radians $\quad .682 \cdot \frac{180}{\pi}$ $\quad \frac{122.76}{\pi}$ $\quad 39.08^\circ$

Ex.5 Draw the angles

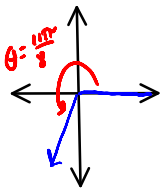
a) π $\quad$ b) $\frac{11\pi}{6}$ $\quad$ c) $\frac{5\pi}{4}$

a) $\frac{\pi}{3}$



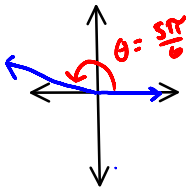
$\frac{\pi}{3} \cdot \frac{180}{\pi} = 60°$

b) $\frac{11\pi}{8}$



$\frac{11\pi}{8} \cdot \frac{180}{\pi} = 247.5°$

c) $\frac{5\pi}{6}$



$\frac{5\pi}{6} \cdot \frac{180}{\pi} = 150°$

Degrees	0°	30°	45°	60°	90°	180°	270°	360°
Radians	0	π/6	π/4	π/3	π/2	π	3π/2	2π

} memorize