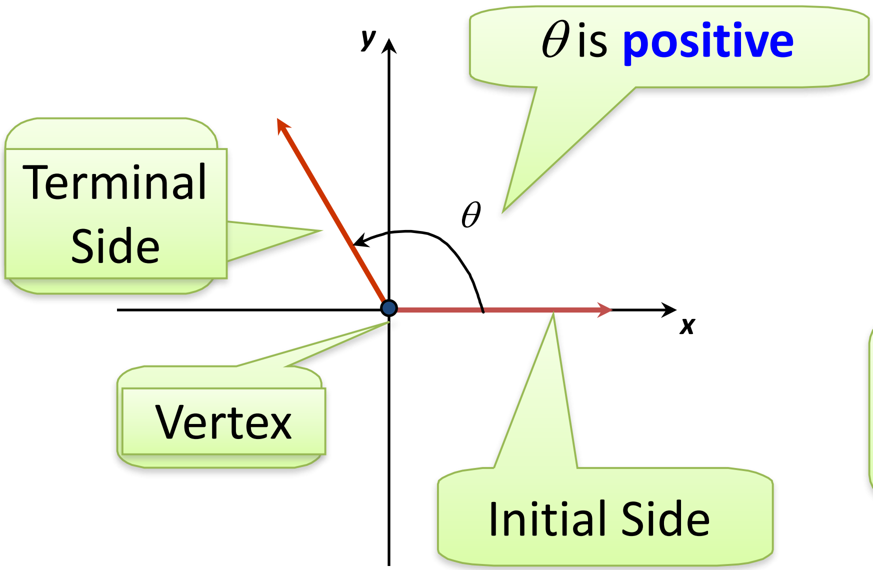
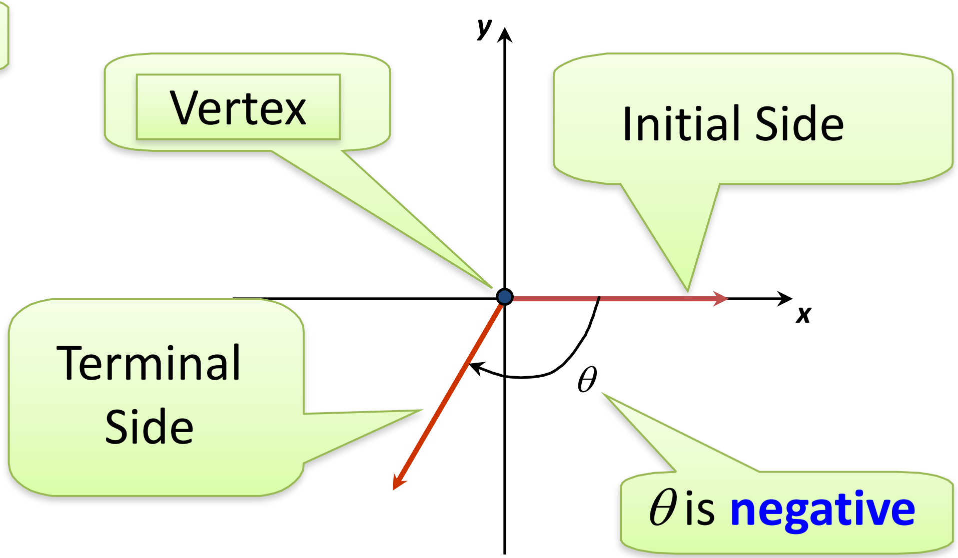
Pre-Calculus
Sec.4.1
Radian and Degree Measure

Angles are usually shown in Standard Position:

with the initial (fixed) side on the positive x-axis.



Positive angles rotate *counterclockwise*.

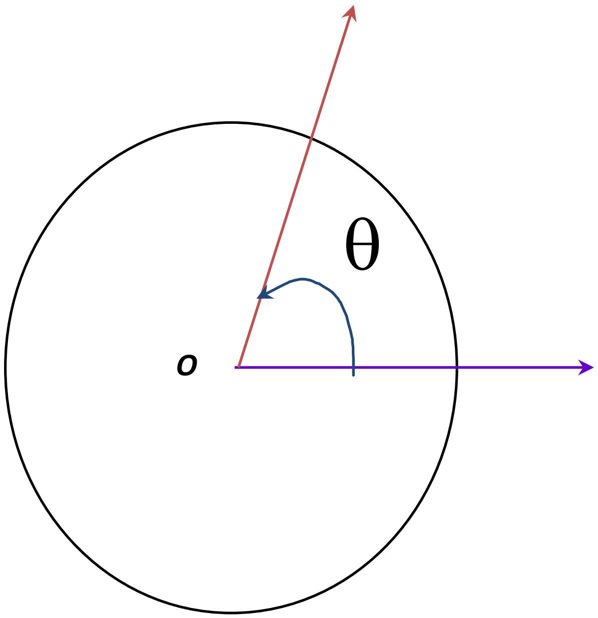


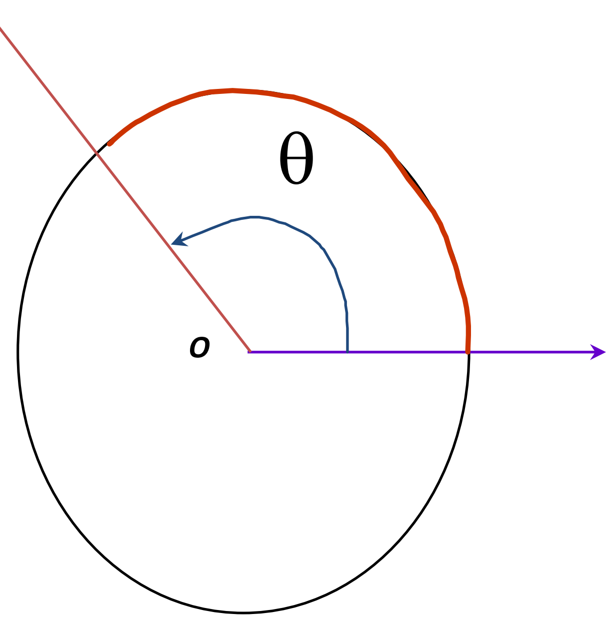
Negative angles rotate *clockwise*.

Angles are often measured in Degrees, but angles can also be measured in Radians.

Definition of a Radian:

1 radian is the radian measure of the central angle (θ) that is the # of radius units in its intercepted arc length (s).



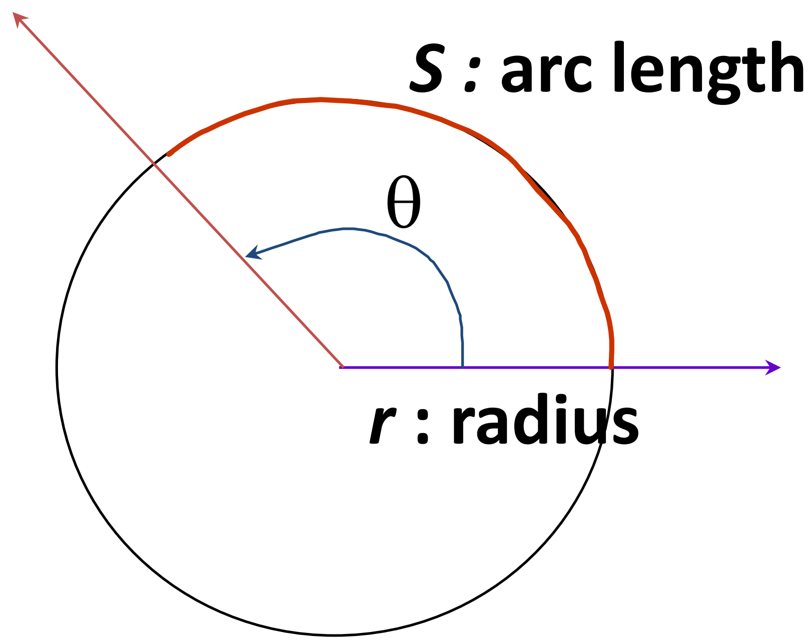


Radian Measure

Therefore, the radian measure can be computed by using:

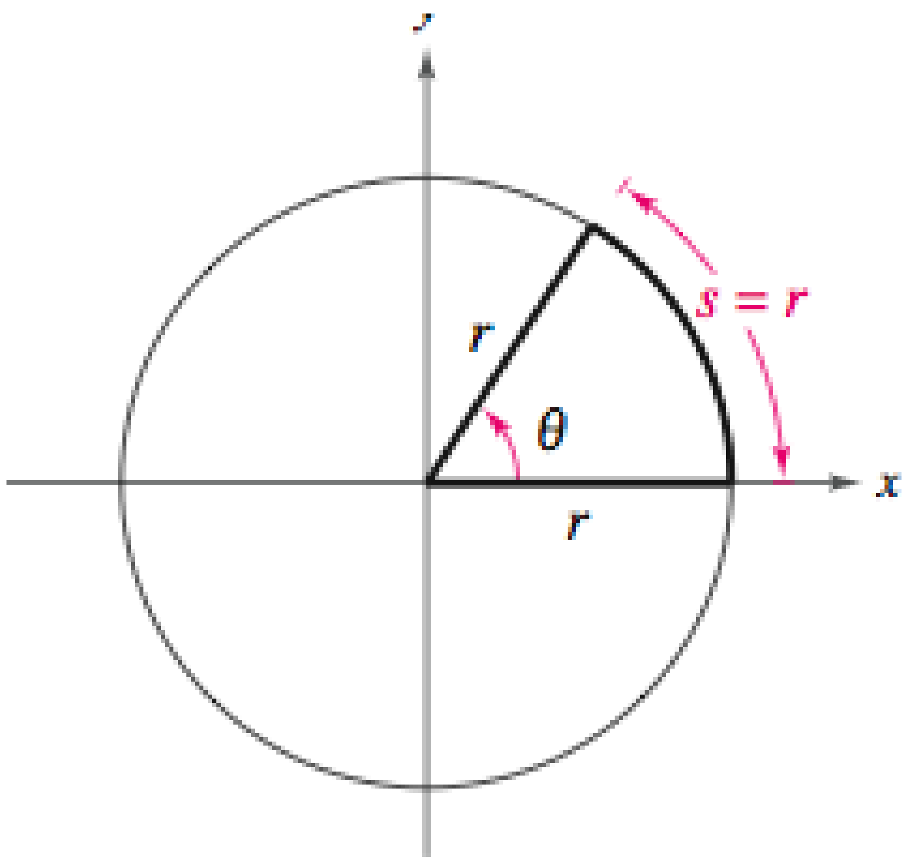
$$\theta = \frac{S}{r}$$

always in radians never in degrees; S and r must have the same units.



Because the circumference of a circle is $2\pi r$ units, it follows that a central angle of one full revolution (counterclockwise) corresponds to an arc length of

$$s = 2\pi r.$$



Measuring Angles Using Rotation

- One counter clockwise rotation (revolution):

  in degrees:

  in radians:

- One clockwise rotation (revolution):

  in degrees:

  in radians:

Conversion between Degrees and Radians

- Using the basic relationship π (rad.) = 180°

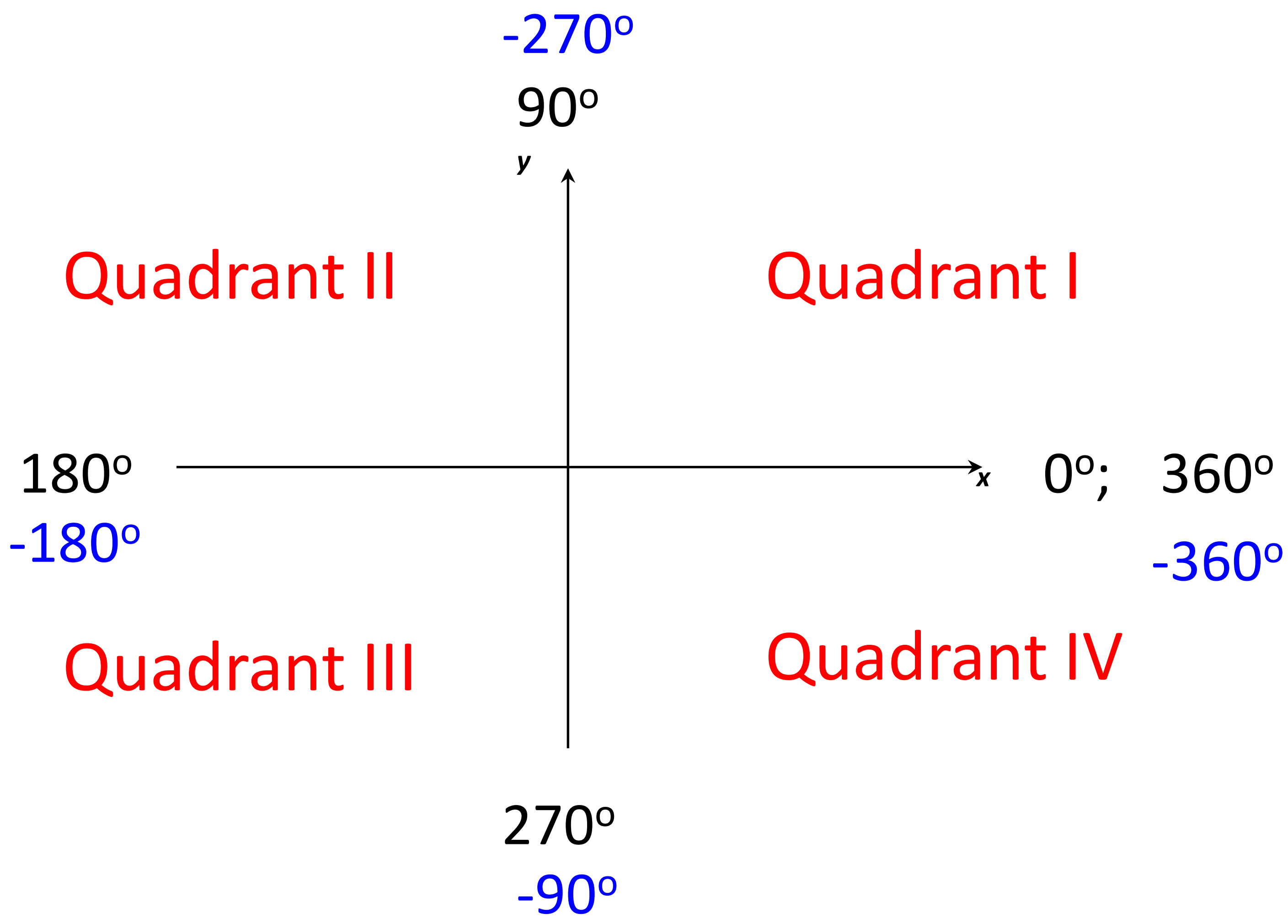
- To convert degrees to radians:

  multiply by $\dfrac{\pi}{180}$

- To convert radians to degrees:

  multiply by $\dfrac{180}{\pi}$

Quadrants in Which the Angle Lies



Quadrantal Angles: if the terminal side lies on an axis.

Ex. 1: Determine the quadrant in which theta lies, then convert to radians: a) 55^o b) 260^o

(NO Calc.)

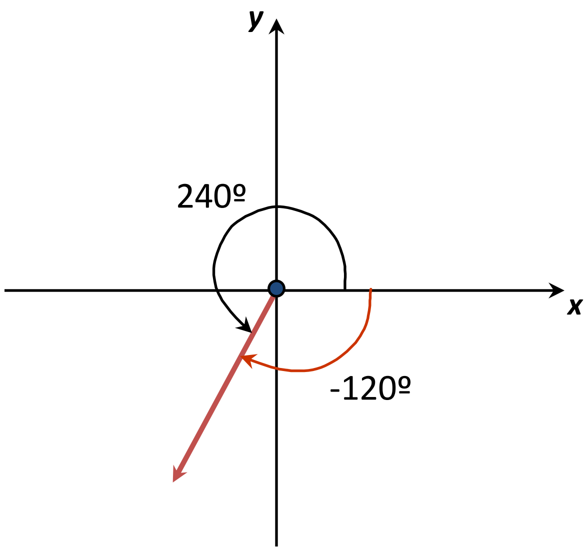
Ex. 2: Determine the quadrant in which theta lies, then

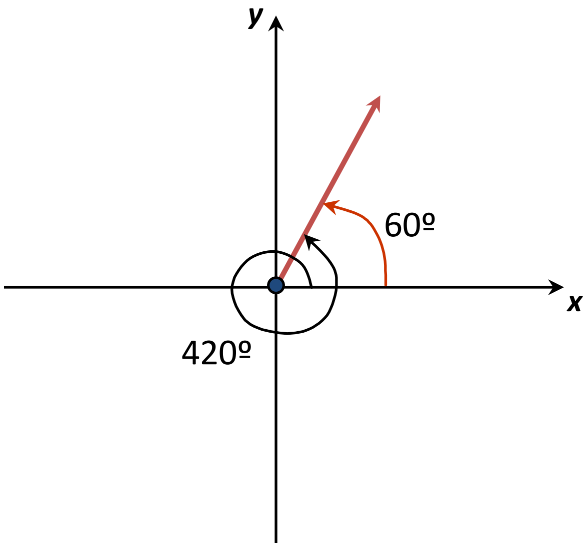
convert to degrees: a) $\frac{\pi}{5}$ b) 3 c) $-\frac{7\pi}{9}$

(NO Calc.)

Coterminal Angles

(Two angles with the same initial & terminal sides.)





To find coterminal angles just keep adding or subtracting 360^o (or 2π) to the given angle. There are an infinite amount of coterminal angles that can be found for each given angle.

Ex. 3: Find a positive and negative coterminal angle (as close to zero as possible) to the following given angles. Give answers in the same form as the question. (NO Calc.)

a. 50°

b. -120°

c. $\frac{7\pi}{8}$

d. $\frac{23\pi}{15}$

Recall: $\theta = \dfrac{s}{r}$ always in radians, never in degrees

Ex.4: Find the radian measure of a central angle that intercepts an arc of 10 cm on a circle with a radius of 15 cm.

Ex. 5: Find the length of the arc on a circle of radius r intercepted by a central angle θ. Given $r = 9$ feet; $\theta = 60^\circ$

Linear Speed measures how fast a particle moves, and Angular Speed measures how fast the angle changes.

Angular speed = 　　　　　　　　　　　　Linear speed =

Ex. 6: The circular blade on a saw has a diameter of 9 inches and rotates at 3600 revolutions per minute.

A)Find the angular speed of the blade in radians per second. (in terms of π)

B)Find the linear speed of the saw teeth (in feet per second) as they contact the wood being cut. Give the answer in terms of π (exact form). Then use a calculator to give the answer rounded to 3 decimal places.

Ex. 7: A 15 inch diameter tire on a car makes 9.3 revolutions per second.

A)Find the angular speed in radians per second. (in terms of π)

B)Find the linear speed in feet per minute. Give the answer in terms of π (exact form). Then use a calculator to give the answer rounded to 3 decimal places.