

**Objective :** Given an angle students will be able to identify the complement, supplement, coterminal and standard form of the angle in radians and degrees.

### Study Problems

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#### Important Vocabulary

Define each term or concept.

#### Trigonometry

- measurement of triangles

#### Central angle of a circle

- angle whose vertex is at the origin (center)

#### Complementary angles

- angles that sum to 90 degrees  $\frac{\pi}{2}$

#### Supplementary angles

- angles that sum to 180 degrees  $\pi$

#### Degree

- unit of measurement for angles

## I. Angles

An **angle** is determined by ... - rotating a ray (half line ) about its endpoint

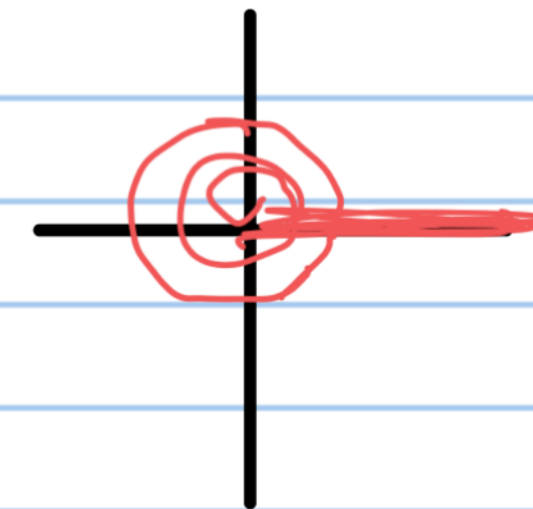
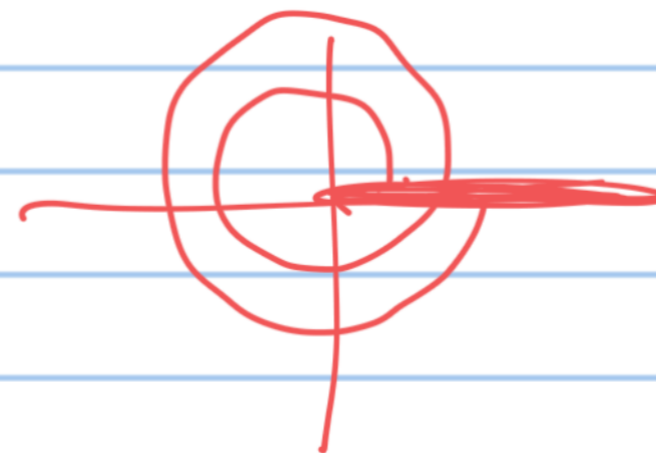
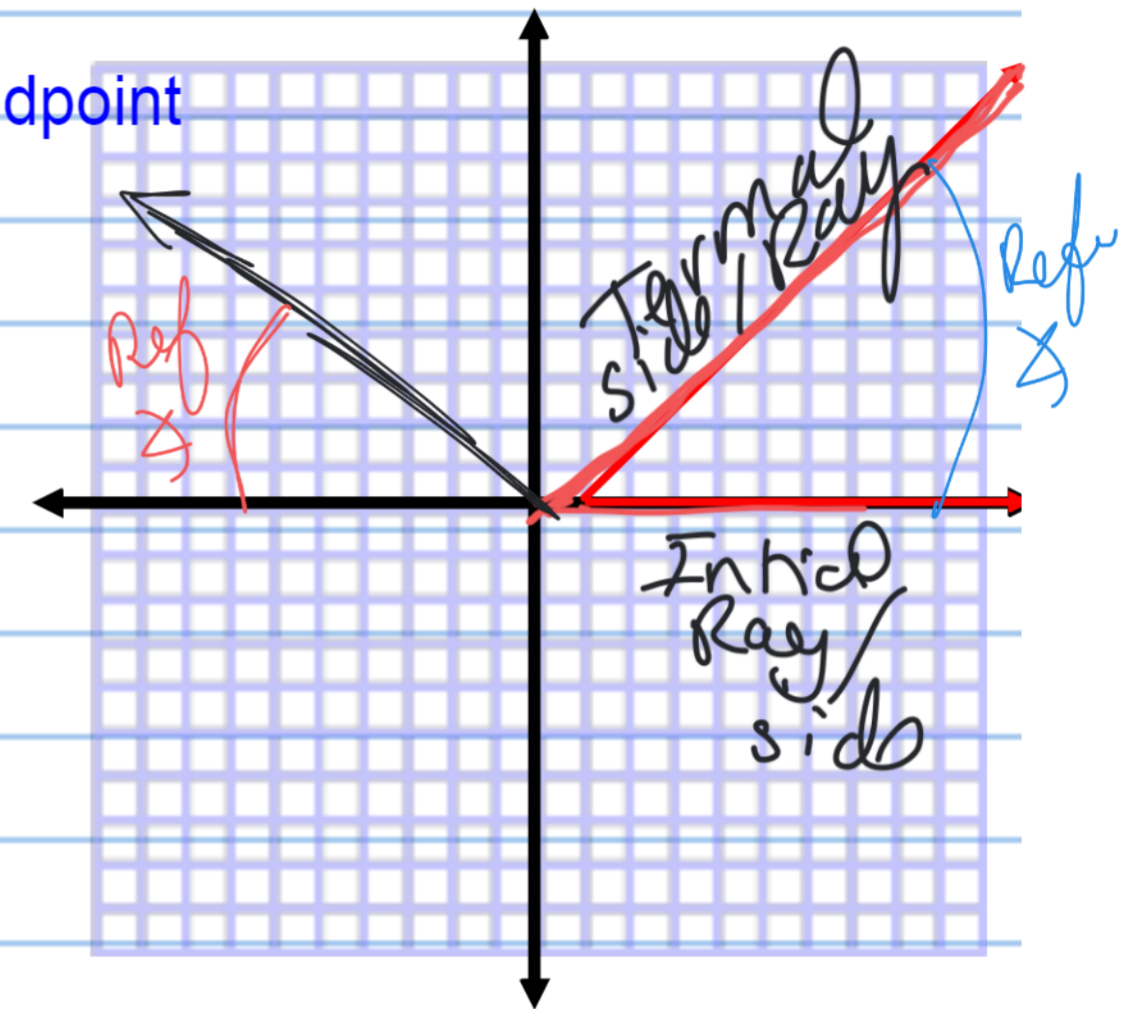
The **initial side** of an angle is ... - starting position of the ray

The **terminal side** of an angle is ... - is the position after rotation

The **vertex** of an angle is ... - the endpoint of the rays

An angle is in **standard position** when ... - the vertex is at the origin and the initial side coincides with the positive x-axis.

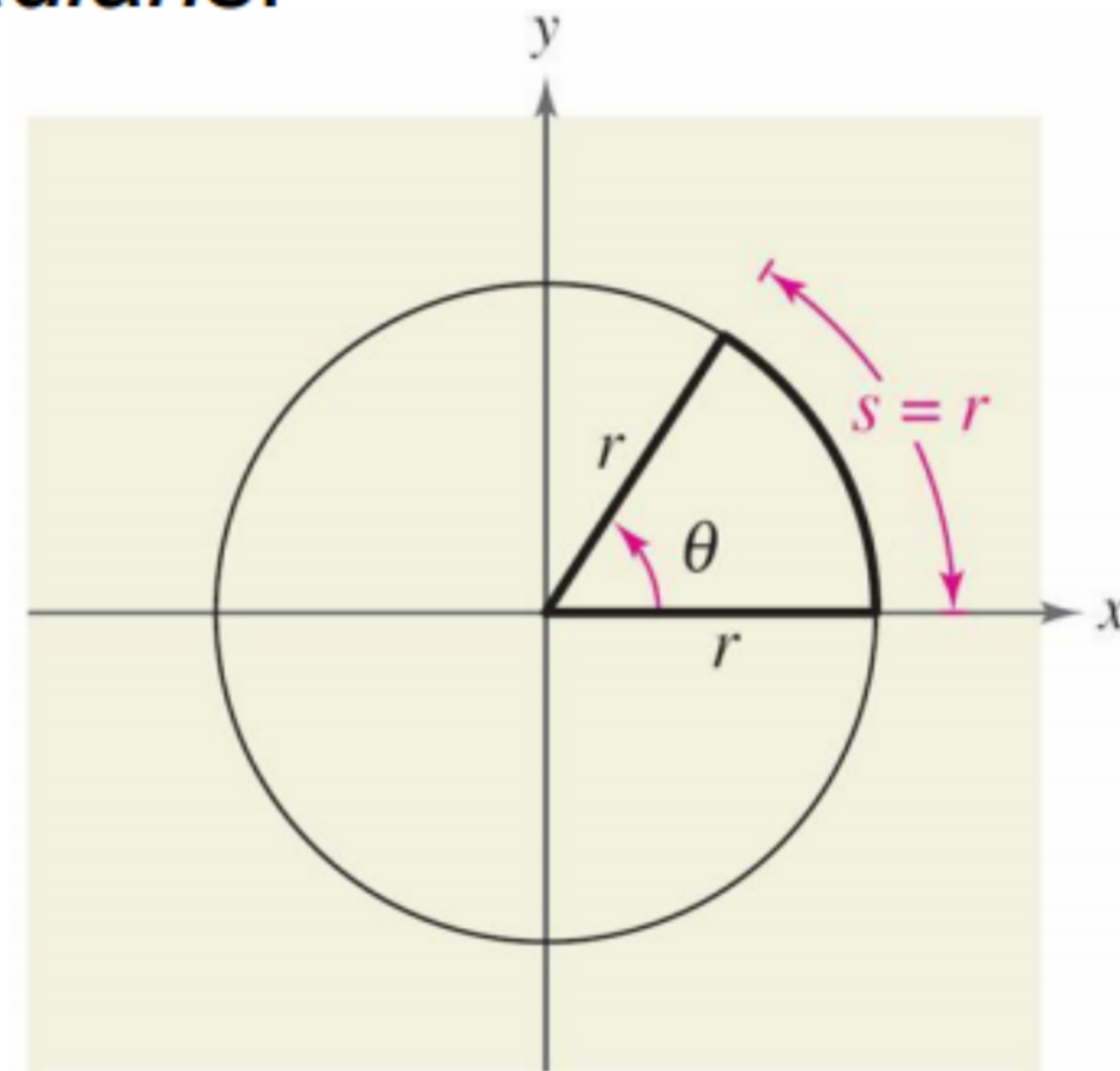
A **coterminal angle** is ... - angles that have the same initial and terminal side.



The **measure of an angle** is determined by the amount of rotation from the initial side to the terminal side.

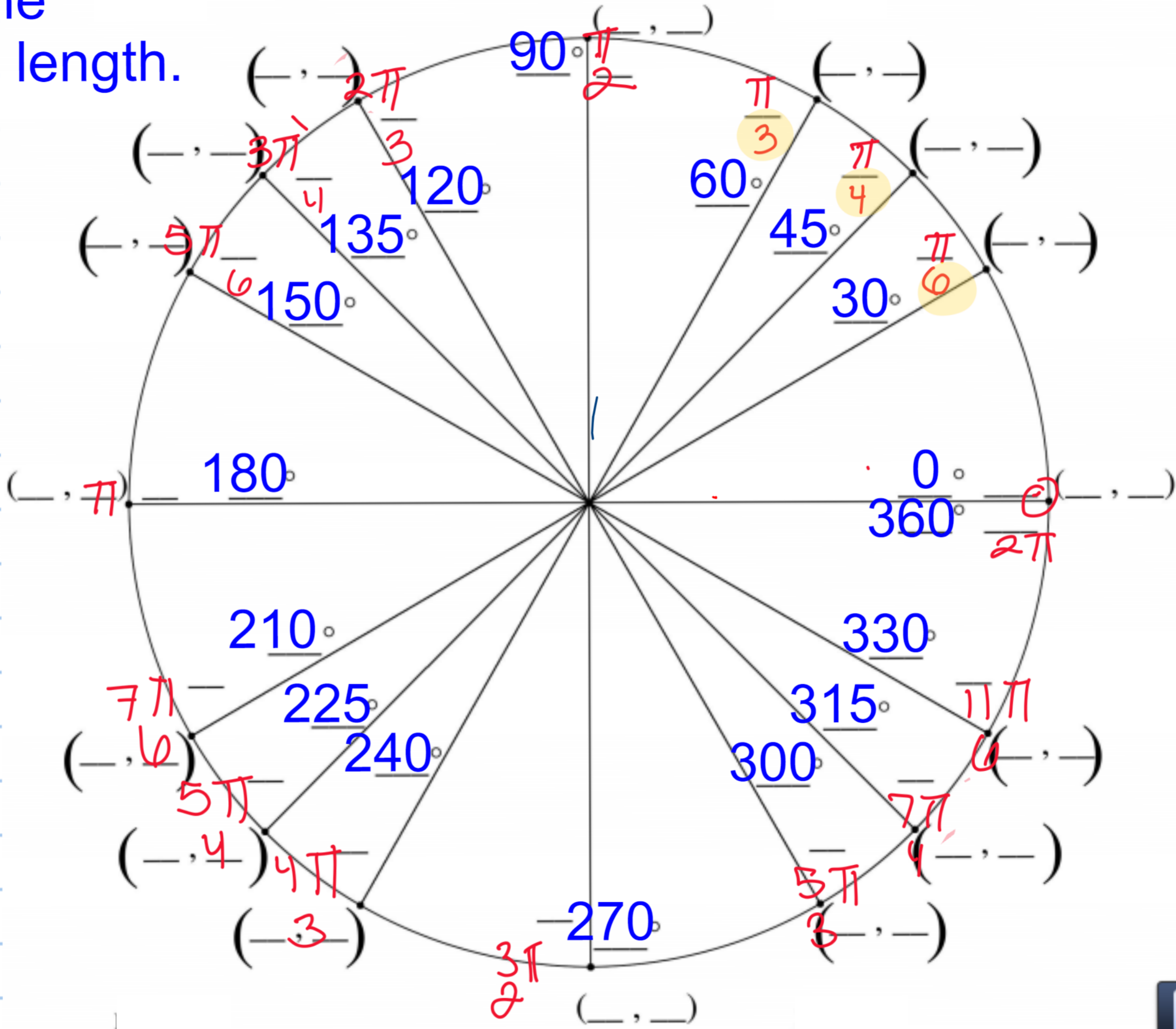
One way to measure angles is in *radians*.

To define a radian, you can use a **central angle** of a circle, one whose vertex is the center of the circle.



Arc length = radius when  $\theta = 1$  radian

Fill in the arc length according to the circumference length.



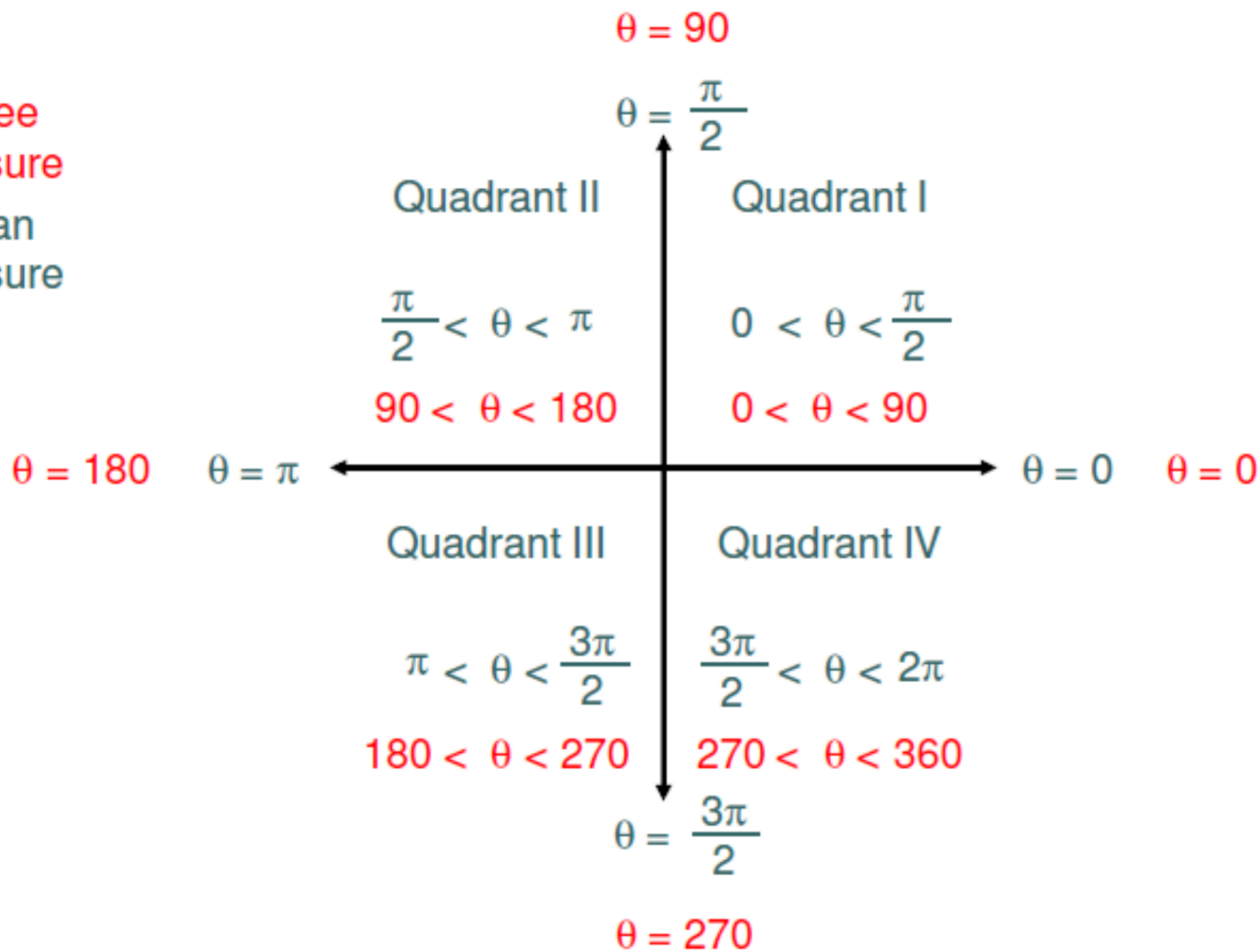
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# Angles in Standard Position

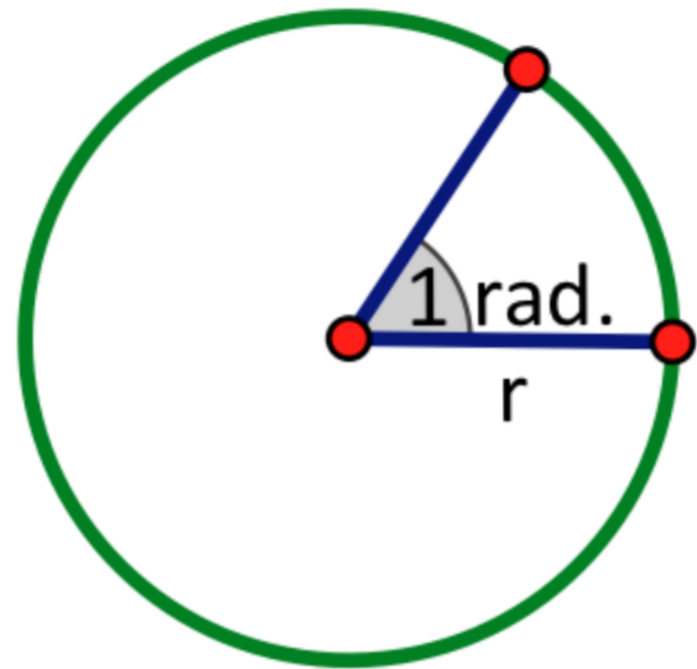
Degree  
Measure  
Radian  
Measure



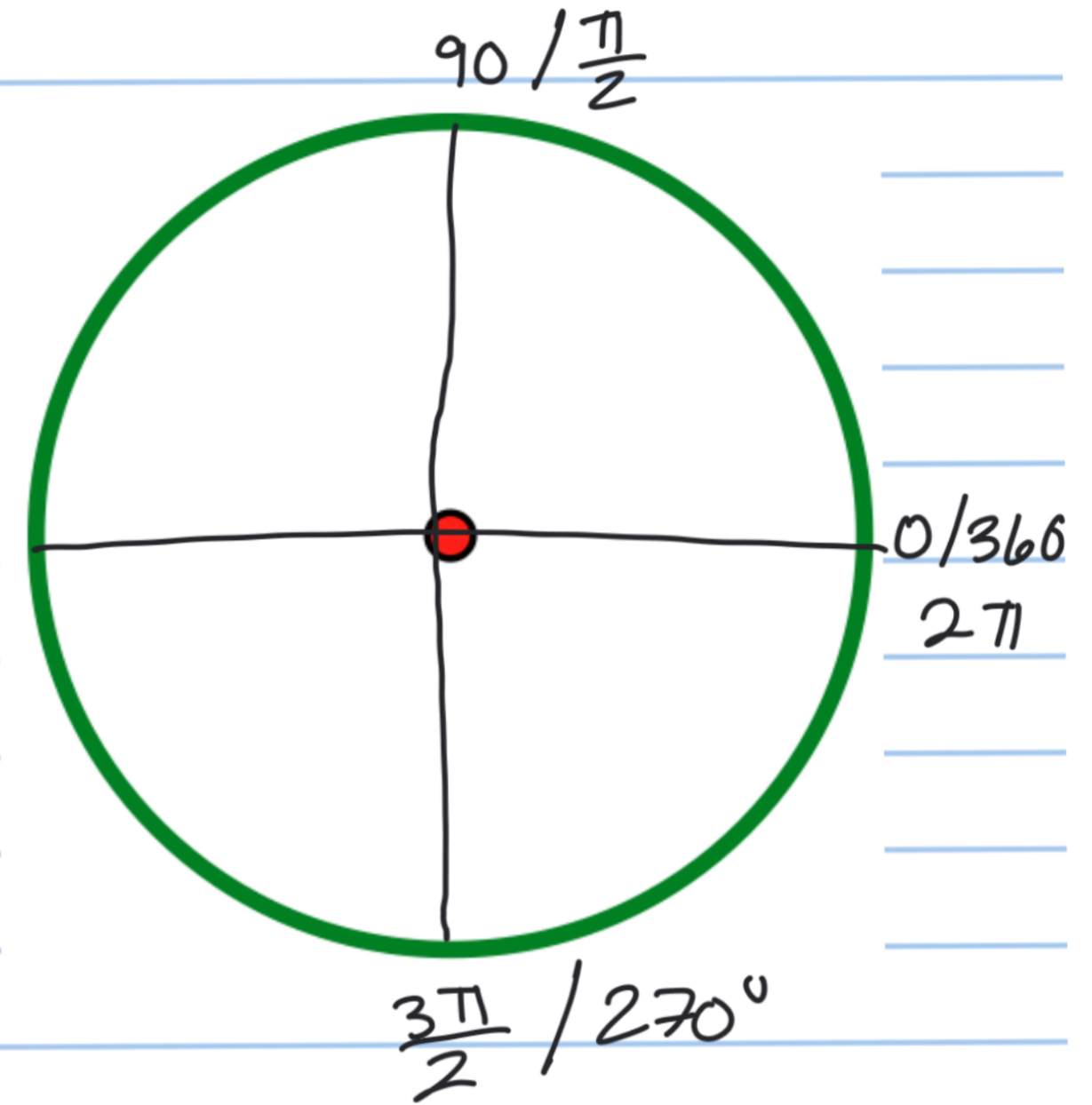
To be able to convert between two different measurements we need two values where they have the same value – one complete circular revolution. In that case the degree measure is  $360^\circ$  and the radian measure is  $2\pi$  radians.

$$\text{So } \frac{2\pi}{2} = \frac{360^\circ}{2}$$

$$\pi = 180^\circ$$



$$\frac{180}{\pi}$$

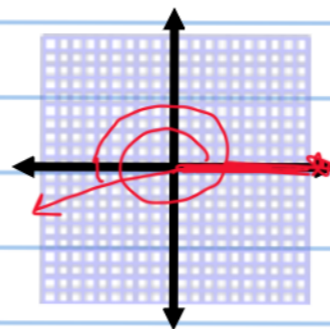


\* Convert to degree  $\rightarrow \left(\frac{180^\circ}{\pi}\right) = 1 \text{ rad}$

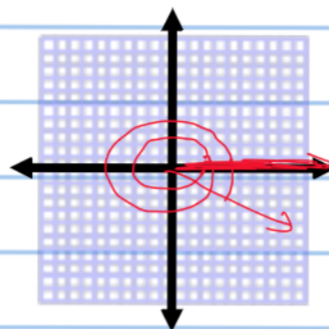
\* Convert to radian  $\rightarrow \left(\frac{\pi}{180}\right) = 1^\circ$

Sketch the angle in standard position.

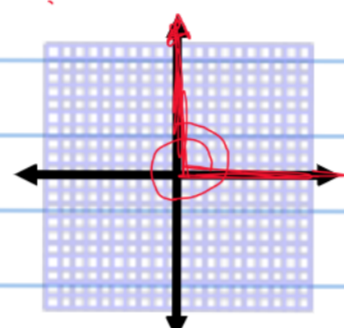
a.  $545^\circ$   
 $\frac{-360}{185}$



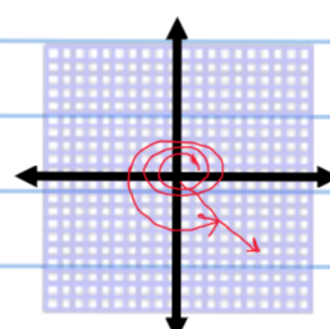
b.  $-750^\circ$   $\frac{360+360+30}{}$



c.  $15\pi/6 = 2\frac{3\pi}{6}$   
 $2\frac{\pi}{2}$



4.  $17\pi/3$   
 $5\frac{2\pi}{3}$



**2 Example** Given the degree measure, find its equivalent **radian measure**.  
Leave answer as exact value in most reduced form.

(A)  $450^\circ$

$450^\circ \left( \frac{\pi}{180} \right)$

$\frac{5\pi}{2}$

(B)  $-220^\circ$

$-220 \left( \frac{\pi}{180} \right)$

$-\frac{11}{9}\pi$

(C)  $390^\circ$

**1 Example** Given the radian measure, find its equivalent degree measure.

Leave answer as exact value in most reduced form.

**A**  $\frac{5\pi}{6} \left(\frac{180}{\pi}\right)$   
 $\frac{900}{6} = 150^\circ$

**B**  $\frac{3\pi}{4} \left(\frac{180}{\pi}\right)$   
 $\frac{540}{4} = 135^\circ$

**C**  $\frac{7\pi}{5}$

~~$\frac{11\pi}{3}$~~

~~$\frac{23\pi}{6}$~~

$-\frac{15\pi}{4}$

Example

Find two conterminal angles for:

9.  $\frac{2\pi}{5}$

$\frac{2\pi}{5} + 2\pi$   
 $\frac{2\pi}{5} + \frac{10\pi}{5} = \frac{12\pi}{5}$

$\frac{2\pi}{5} - 2\pi$   
 $\frac{2\pi}{5} - \frac{10\pi}{5} = \frac{-8\pi}{5}$

10.  $-\frac{4\pi}{5}$

$-\frac{4\pi}{5} + 2\pi$   
 $-\frac{4\pi}{5} + \frac{10\pi}{5} = \frac{6\pi}{5}$

$-\frac{4\pi}{5} - 2\pi$   
 $-\frac{4\pi}{5} - \frac{10\pi}{5} = \frac{-14\pi}{5}$



Example

$$90^\circ / \frac{\pi}{2}$$

$$180^\circ / \pi$$

If possible, find the complement and supplement of:

7.  $\frac{2\pi}{5}$

8.  $\frac{4\pi}{5}$

a) Complement

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

$$\frac{5\pi}{10} - \frac{4\pi}{10}$$

$$\frac{\pi}{10}$$

b) Supplementary

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

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

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