HOW Reminders

- **Preparedness:**
  - Be in the classroom when the bell rings
  - Have something to write with, a calculator, and your notebook

Engagement:

- Have your phone and computer put away

Warm-Up

Factor:

1) $x^2 - 7x + 6$

$(x-1)(x-6)$

2) $5x^2 + 24x - 5$

$(5x-1)(x+5)$

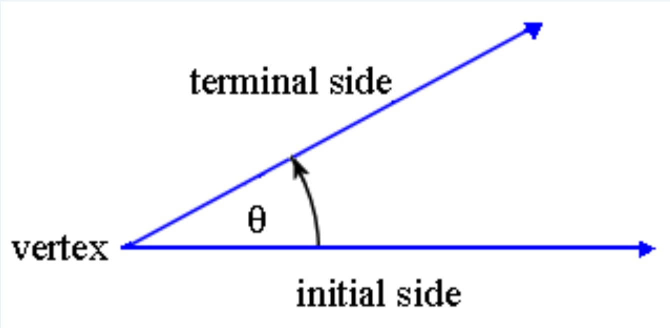
7-1 – Measurement of Angles

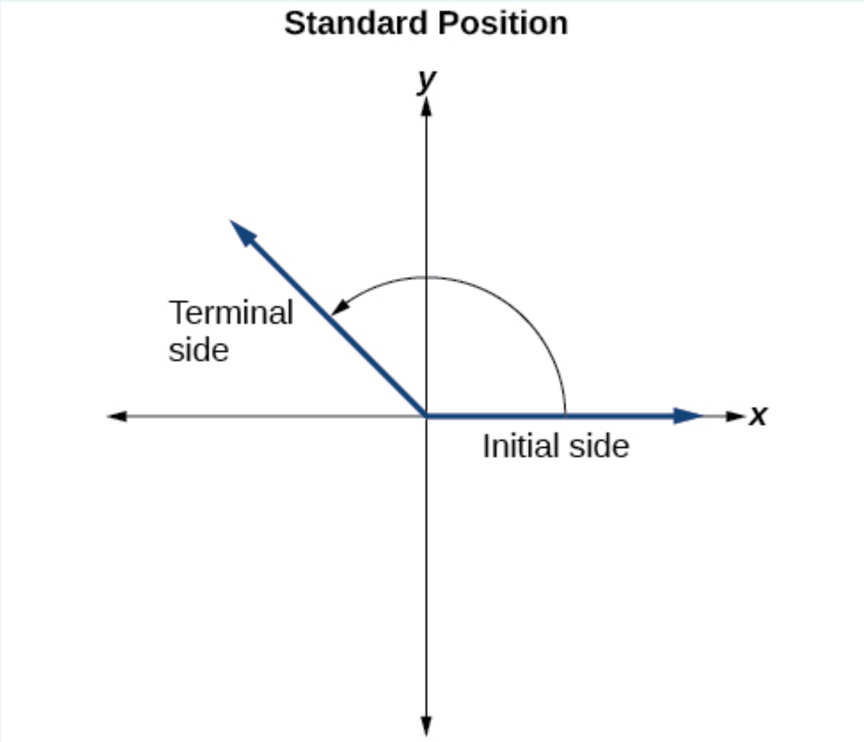
Chapter 7 – Trigonometric Functions

Learning Targets:

- Find the measure of an angle in either degrees or radians.
- Find coterminal angles.

Trigonometry: “triangle measurement”

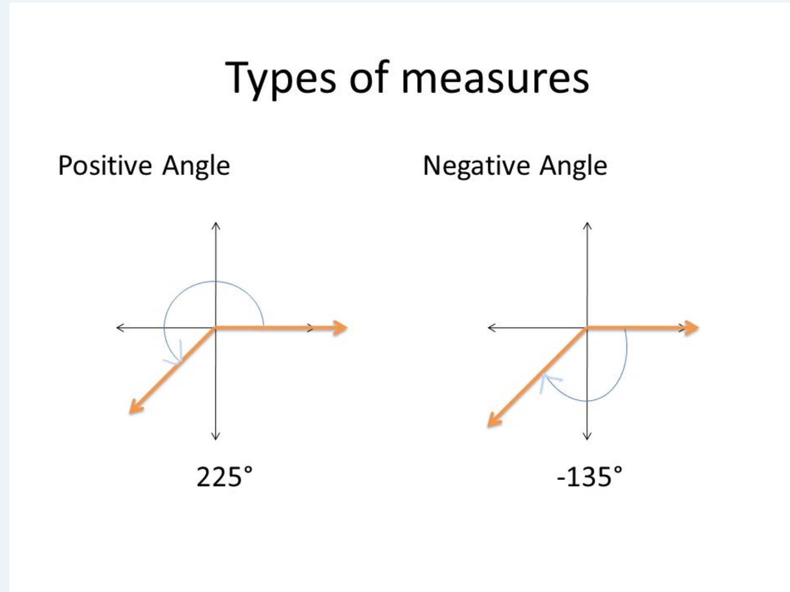


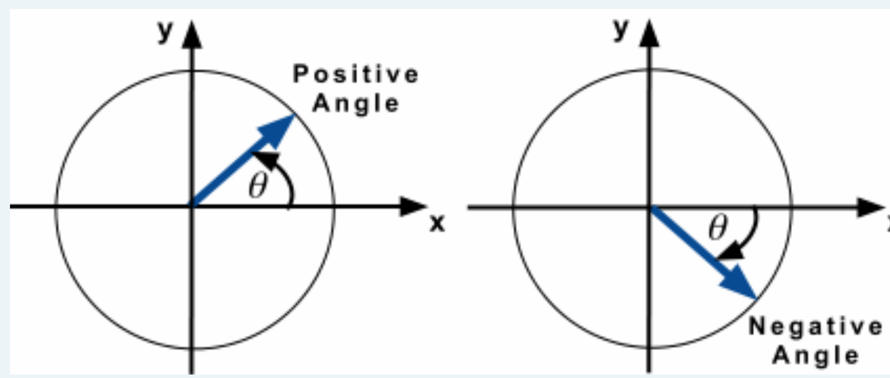


If the terminal ray lies on an axis, the angle it forms is called a quadrantal angle.

Positive angles are generated from a counterclockwise rotation.

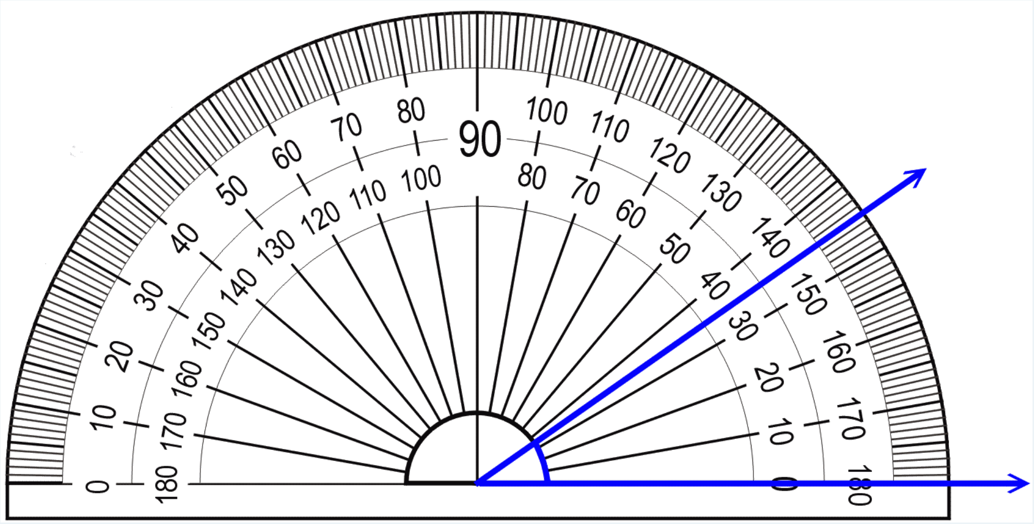
Negative angles are generated from a clockwise rotation.





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

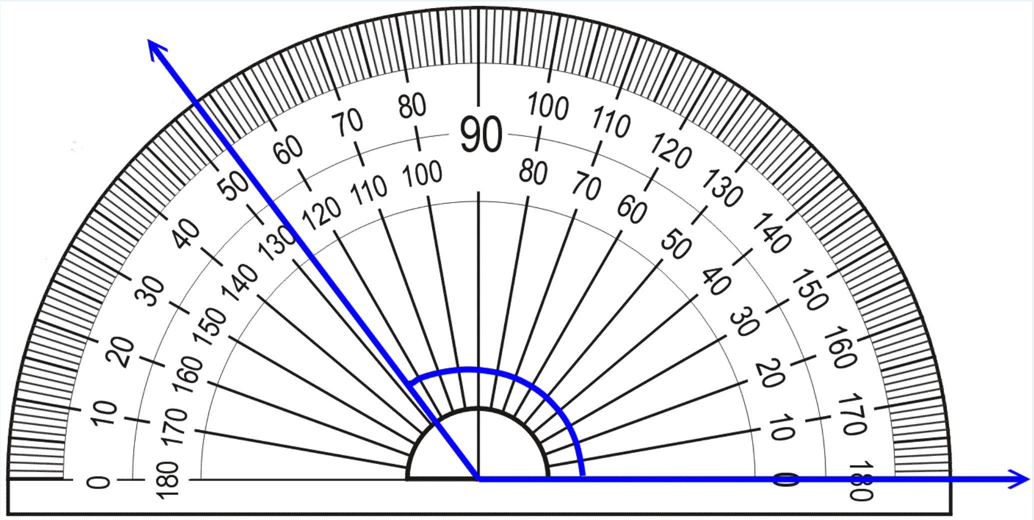
One way to measure an angle is in *degrees*.



This angle is 35°.

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

One way to measure an angle is in *degrees*.

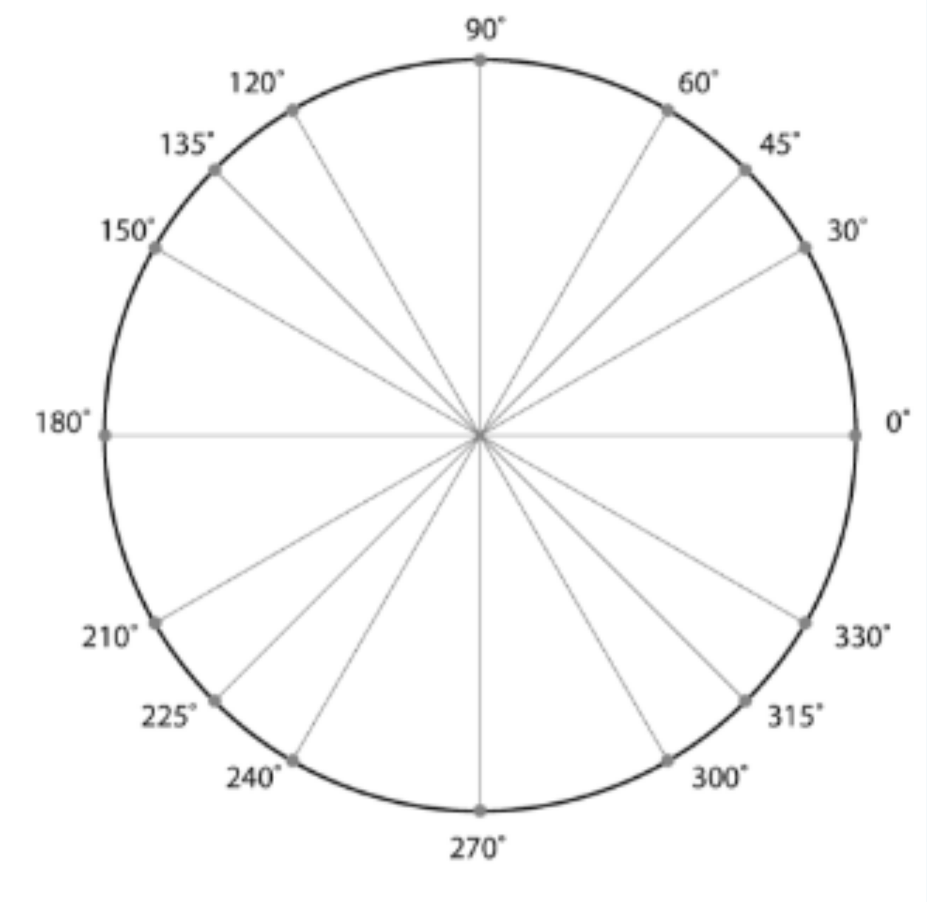


This angle is 127°.

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

One way to measure an angle is in *degrees*.

A full rotation is 360°.



Angles can be measured more precisely by dividing 1 degree into 60 *minutes*, and by dividing 1 minute into 60 *seconds*.

$$1' = \left(\frac{1}{60}\right)^{\circ} \longleftrightarrow 60' = 1^{\circ}$$

$$1'' = \left(\frac{1}{60}\right)' = \left(\frac{1}{3600}\right)^{\circ} \longleftrightarrow 60'' = 1'$$

Examples: Convert each decimal degree measure into degrees-minutes-seconds.

1) $119.59^{\circ} = \underline{\ 119^{\circ}}\ \underline{\ 35'}\ \underline{24}''$

$0.59 \times (60)' = 35.4'$

$0.4 \times (60)'' = 24''$

2) $130.1775^{\circ} = \underline{\ 130\ }^{\circ}\ \underline{\ 10\ }'\ \underline{\ 39\ }''$

$0.1775 \times (60)' = 10.65'$

$0.65 \times (60)'' = 39''$

Angles can be measured more precisely by dividing 1 degree into 60 *minutes*, and by dividing 1 minute into 60 *seconds*.

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$$1'' = \left(\frac{1}{60}\right)' = \left(\frac{1}{3600}\right)^{\circ} \longleftrightarrow 60'' = 1'$$

Examples: Convert each degrees-minutes-seconds into decimal degrees.

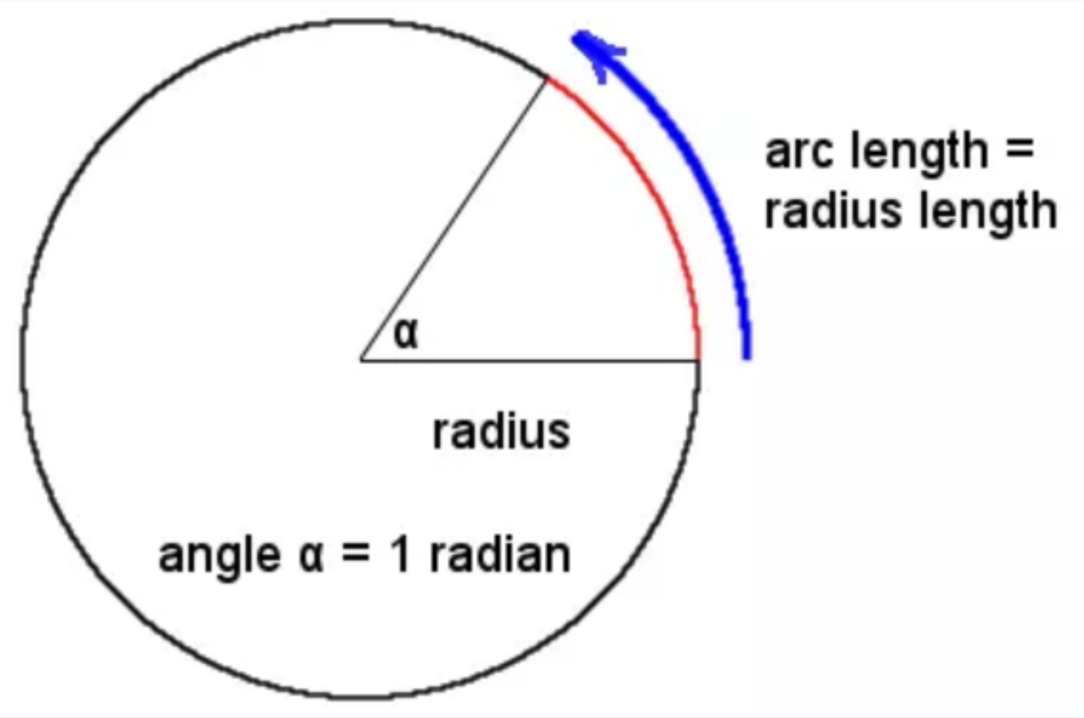
1) $25°20'6'' = 25° + \left(\frac{20}{60}\right)^{\circ} + \left(\frac{6}{3600}\right)^{\circ} = 25.335°$

2) $327°46'12'' = 327° + \left(\frac{46}{60}\right)^{\circ} + \left(\frac{12}{3600}\right)^{\circ} = 327.77°$

Another way to measure an angle is in *radians*.

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

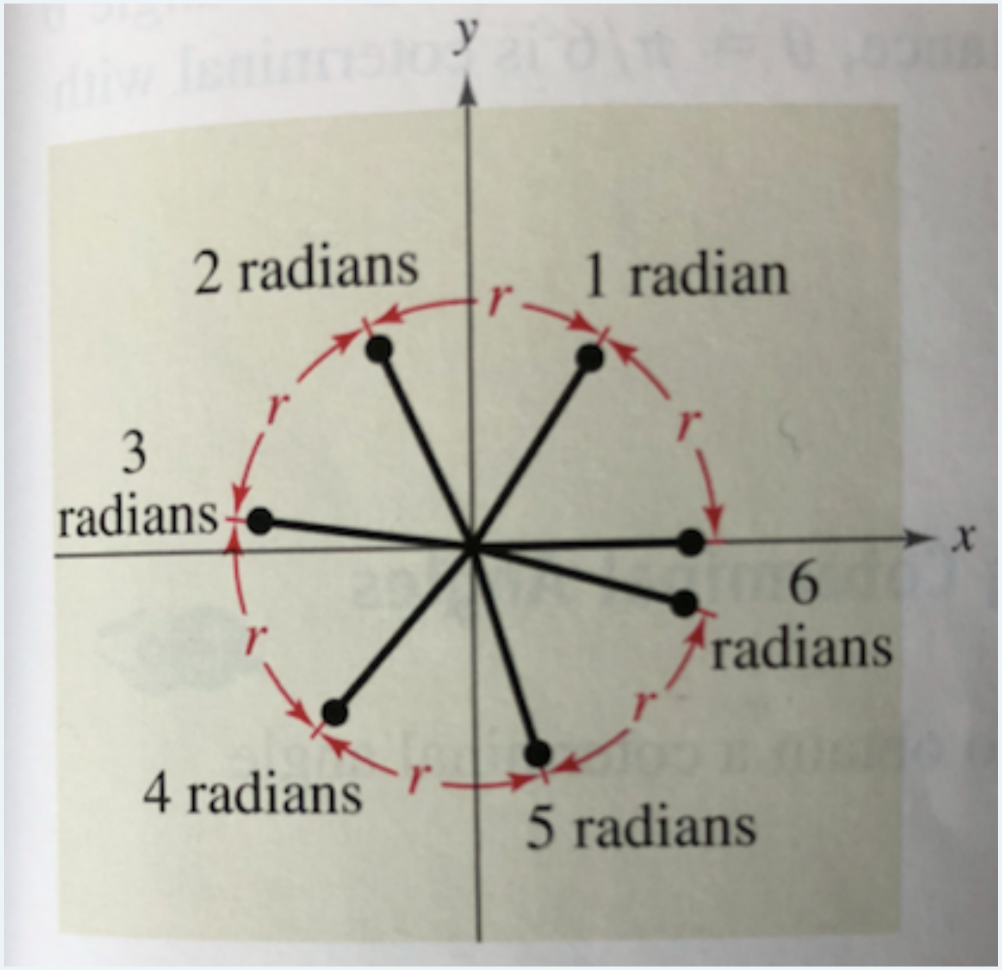
$$\boldsymbol{\theta = \frac{s}{r}}$$

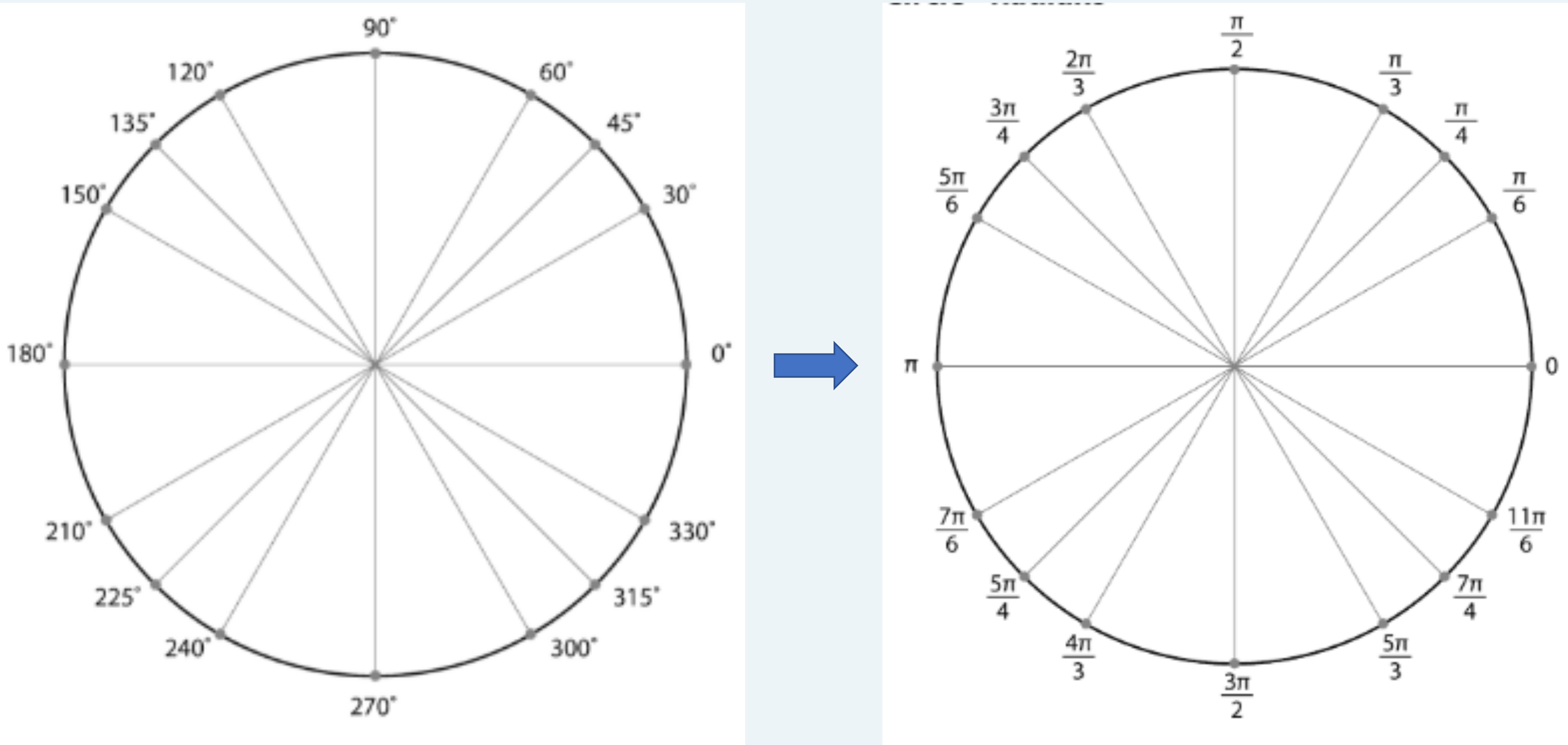


$\frac{1}{2}$ of a revolution = π radians

1 full revolution = 2π radians

$\frac{1}{4}$ of a revolution = $\frac{\pi}{2}$ radians




90°
120°
60°
135°
45°
150°
30°
180°
0°
210°
330°
225°
315°
240°
300°
270°
$\frac{\pi}{2}$
$\frac{2\pi}{3}$
$\frac{\pi}{3}$
$\frac{3\pi}{4}$
$\frac{\pi}{4}$
$\frac{5\pi}{6}$
$\frac{\pi}{6}$
π
0
$\frac{7\pi}{6}$
$\frac{11\pi}{6}$
$\frac{5\pi}{4}$
$\frac{7\pi}{4}$
$\frac{4\pi}{3}$
$\frac{5\pi}{3}$
$\frac{3\pi}{2}$

Converting between degrees & radians

To convert from degrees to radians:	To convert from radians to degrees:
Degree $\times \dfrac{\pi}{180°}$	Radian $\times \dfrac{180°}{\pi}$

Examples: Convert the angle measurement.

1) $25°$ $\qquad 25° \times \frac{\pi}{180°} = 5 \times \frac{\pi}{36} = \frac{5\pi}{36}$

2) $103°$ $\qquad 103° \times \frac{\pi}{180°} = \frac{103\pi}{180}$

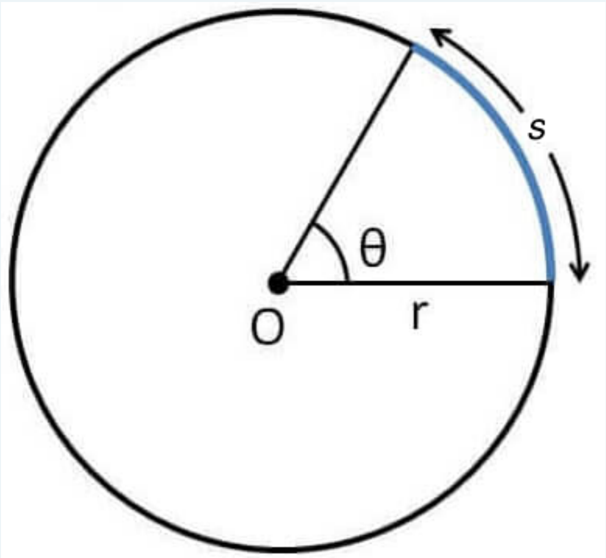
3) $\frac{\pi}{3}$ $\qquad \frac{\pi}{3} \times \frac{180°}{\pi} = \frac{1}{1} \times \frac{60°}{1} = 60°$

4) $\frac{2\pi}{5}$ $\qquad \frac{2\pi}{5} \times \frac{180°}{\pi} = \frac{2}{1} \times \frac{36°}{1} = 72°$

Finding Arc Length

The radian measure formula below can be used to find an arc length *s* along a circle whose radius is *r* and central angle is θ.

$$s = r\theta$$



Examples: Find the arc length given its central angle measure and radius.

$$s = r\theta$$

1) r = 6in, $\theta = \frac{\pi}{5}$

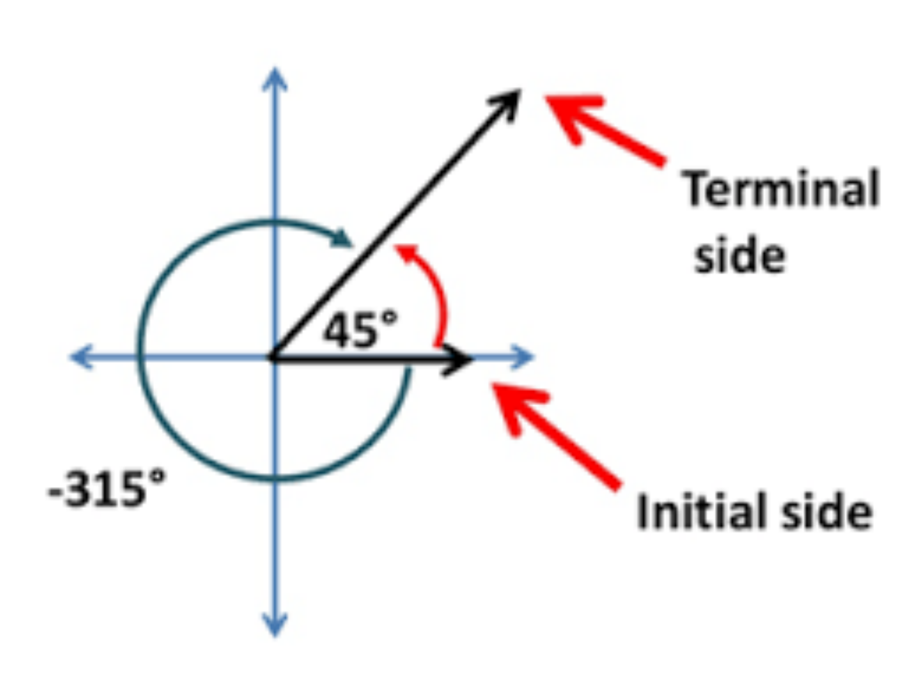
$$s = 6 \times \frac{\pi}{5} = \frac{6\pi}{5} \approx 3.77\text{in}$$

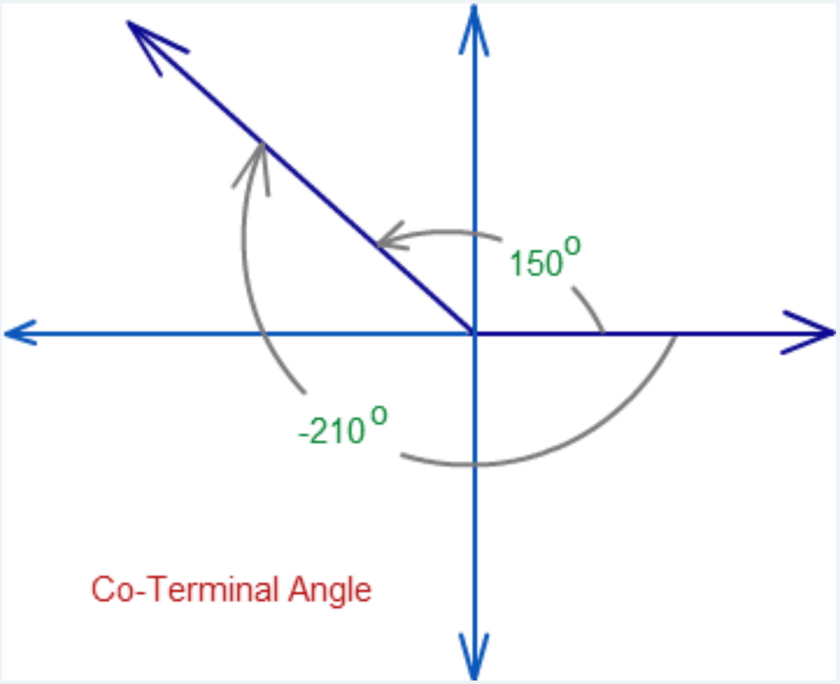
2) r = 3.2in, θ = 44°

$$44° \times \frac{\pi}{180°} = 11 \times \frac{\pi}{45} = \frac{11\pi}{45}$$

$$s = 3.2 \times \frac{11\pi}{45} = \frac{35.2\pi}{45} \approx 2.46\text{in}$$

Two angles are *coterminal* if they have the same initial and terminal sides.





Examples: Find two coterminal angles.

[Interactive unit circle]

1) 20 °

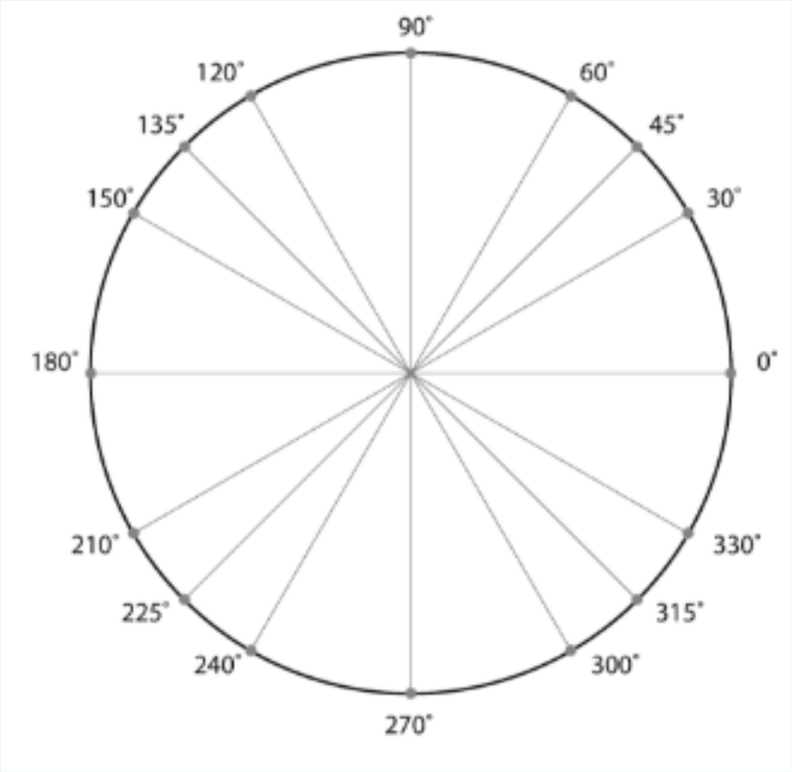
$$20° - 360° = -340°$$
$$20° + 360° = 380°$$

2) 120°

$$120° - 360° = -240°$$
$$120° + 360° = 480°$$

3) −40°

$$-40° + 360° = 320°$$
$$-40° - 360° = -400°$$



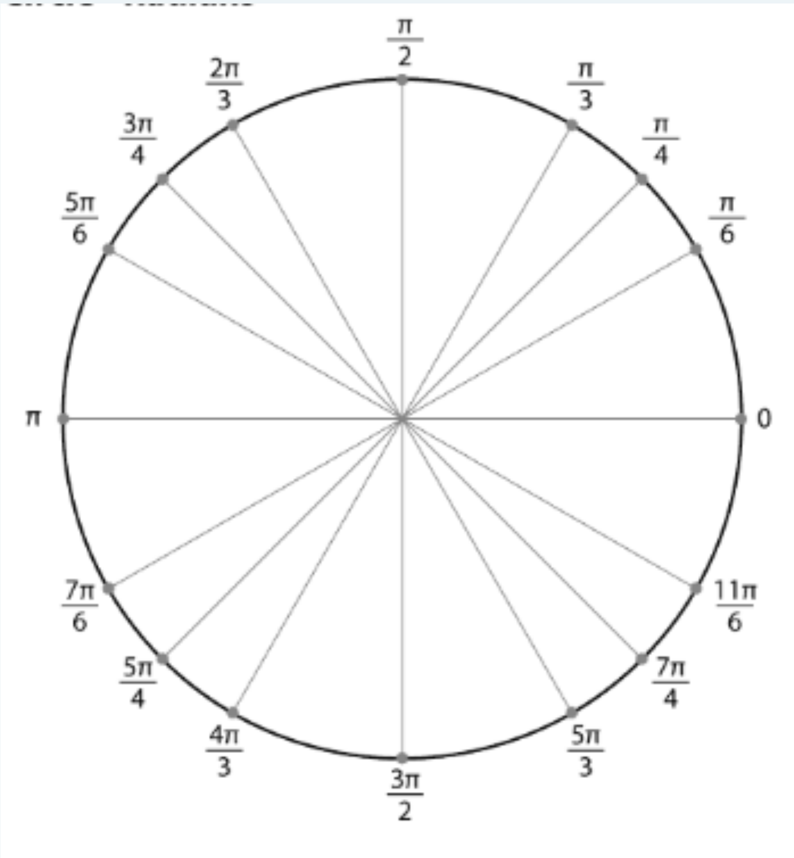
Examples: Find a coterminal angle.

[Interactive unit circle]

4) π $\quad \pi - 2\pi = -\pi$

5) $\frac{\pi}{4}$ $\quad \frac{\pi}{4} - 2\pi = \frac{\pi}{4} - \frac{8\pi}{4} = -\frac{7\pi}{4}$

6) $\frac{7\pi}{6}$ $\quad \frac{7\pi}{6} - 2\pi = \frac{7\pi}{6} - \frac{12\pi}{6} = -\frac{5\pi}{6}$



Practice Problems

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#1, 2, 5, 6, 9, 11, 13, 17, 21, 23, 25