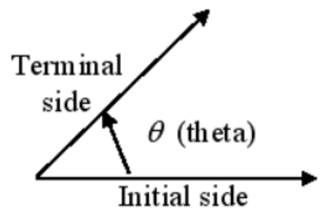
Chapter 7: Trigonometric Functions

Section 7.1: Measurement of Angles

Trigonometry

- Comes from two Greek words...TRIGONON and METRON meaning "*triangle measurement*"
- Ancient Egypt used trigonometry to survey land
- Today trigonometry is used for more modern applications such as radio waves



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Measurements

- *ANGLE* - rotation from a point
- *REVOULTION* - common unit used to measure very large angles
  - Example: car tire measure rev/min (rpm's)
- *DEGREE* - Common unit for small angles
  - 1 Revolution = 360°
- *Minutes and Seconds* - more precise unit of measure
  - 1 degree = 60 minutes (60′)
  - 1 minute = 60 seconds (60″)
  - 1 degree = 3600 seconds

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Examples

1) Given $24° 18' 20''$ convert to decimal degrees

$$24+\frac{18}{60}+\frac{20}{3600}= 24.305°$$

2) Given $19.7°$ convert to DMS (Degree Minute Second)

$$19.7° = 19° + .7(60) = 19° 42'$$

(multiply the decimal by 60)

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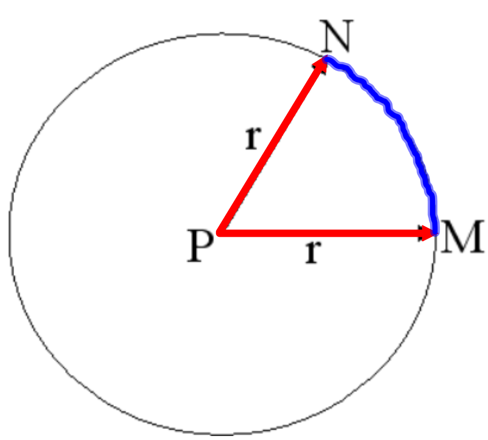
$\angle NPM$ is a **central angle**
(the center of the circle is the vertex of the angle)

NM is the arc intercepted by $\angle NPM$



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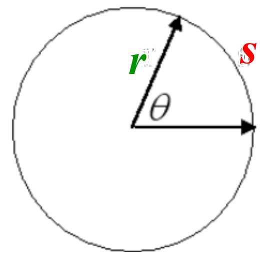
RADIAN MEASURE
Number of radius units in the length of an arc intercepted by a central angle

DEGREE MEASURE - amount of turn
RADIAN MEASURE - length



s = arc length
r = radius
θ= angle measure in radians

Arc Length

$$s = r\theta$$

Angle Measure

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

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Remember the circumference of a circle is $C = 2\pi r$ or $C = d\pi$

…but when we talk about radian and degree measures we are referring to a UNIT CIRCLE which is a circle with a radius of 1 unit

1 revolution in radians = 2π
1 revolution in degrees = 360º

CONVERSIONS
2π radians = 360º or divide by 2 to get… π radians = 180º

1 radian = $\frac{180°}{\pi}$ or 1 degree = $\frac{\pi}{180°}$

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Examples

3) Convert 190 ° to radian measure

$190^\circ\left(\frac{\pi}{180^\circ}\right) = \boxed{3.32}$

4) Convert 240 ° to radians (leave in terms of π)

$\frac{240}{1}\left(\frac{\pi}{180}\right) = \frac{240\pi}{180} = \boxed{\frac{4\pi}{3}}$

5) Convert 2.6 radians to degrees

$2.6\left(\frac{180}{\pi}\right) = \boxed{149^\circ}$

6) Convert 4.3 radians to DMS

$4.3\left(\frac{180}{\pi}\right) = 246.37^\circ$

$.37(60) = 22.2$

$.2(60) = 12$

$\boxed{246^\circ\ 22'\ 12''}$

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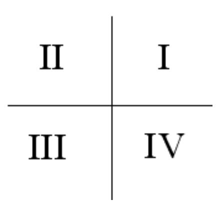
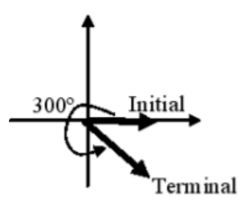
Commonly Used Radian Measures

Multiples of… $90^\circ = \frac{\pi}{2}$ $45^\circ = \frac{\pi}{4}$ $60^\circ = \frac{\pi}{3}$ $30^\circ = \frac{\pi}{6}$

Standard Position

- Vertex is at the origin
- Initial ray on positive x-axis

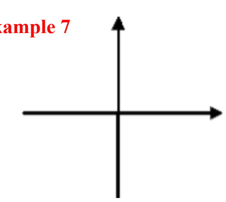




Counterclockwise

IV Quadrant Angle

Example 7



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

____Q Angle

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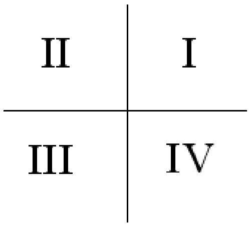
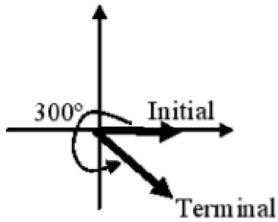
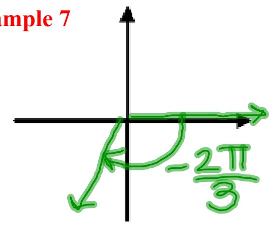




Example 7



Counterclockwise → positive

IV Quadrant Angle

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

3 Q Angle

$-\frac{2\pi}{3}\left(\frac{180}{\pi}\right) = -120^\circ$

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Quadrantal Angles

- Terminal side of angle in standard position lies on an axis
- Always a multiple of $\pm 90^\circ$ or $\pm\frac{\pi}{2}$

Coterminal Angles

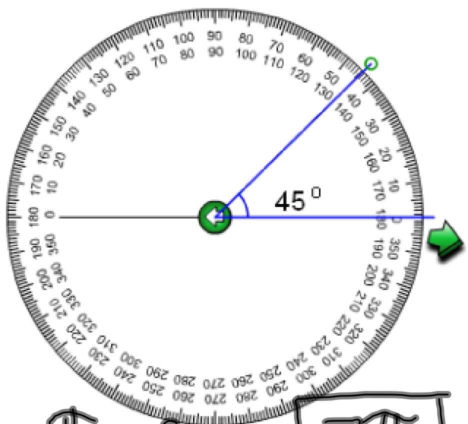
- Two angles that have the same terminal side
- There are infinitely many coterminal

Ex 8: Give a positive & negative coterminal angle of 45°

$45^\circ \pm 360$

$45 + 360 = \boxed{405^\circ}$

$45 - 360 = \boxed{-315^\circ}$



$\frac{\pi}{4} + \frac{2\pi \cdot 4}{1 \cdot 4}$ $\frac{\pi}{4} + \frac{8\pi}{4} = \boxed{\frac{9\pi}{4}}$ $\frac{\pi}{4} - \frac{8\pi}{4} = \boxed{\frac{-7\pi}{4}}$

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