Algebra III: *Hutschenreuter*
Chapter 7
Trigonometric Functions

Name KEY

Date _____

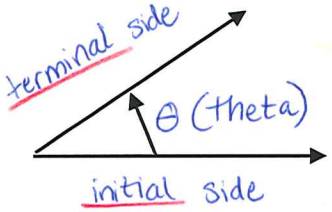
Section 7.1: Measurement of Angles

Essential Question: How to you convert degrees to radians and vice versa?

How do you convert radians to DMS?

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



Measurements

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

Examples

1) Given 24° 18′ 20″ convert to decimal degrees

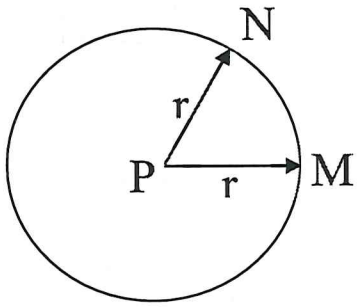
$$24^\circ + \frac{18}{60} + \frac{20}{3600} = 24.305^\circ$$

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

$$19.7 = 19 + .7(60) = 19^\circ 42'$$

(multiply decimal by 60)

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



$\overset{\frown}{NM}$ is the arc intercepted by $\angle NPM$
(minor arc)

RADIAN MEASURE

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

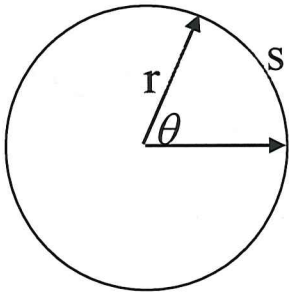
DEGREE MEASURE – amount of turn

RADIAN MEASURE – length

s = arc length

r = radius

θ = angle measure in radians



Arc Length

$s = r \cdot \theta$

* θ is radians

Angle Measure

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

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

Remember the circumference of a circle is $C = 2\pi r$ or $C = d \cdot \pi$ (d = diameter = 2 · radius)

…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 = 360°

CONVERSIONS

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

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

Examples

3) Convert 190 ° to radian measure

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

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

$240\left(\frac{\pi}{180}\right) = \frac{240\pi}{180} = \frac{24\pi}{18} = \frac{4\pi}{3}$

5) Convert 2.6 radians to degrees

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

6) Convert 4.3 radians to DMS

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

$.37(60) = 22.2$

$.2(60) = 12$

$246^\circ 22' 12''$

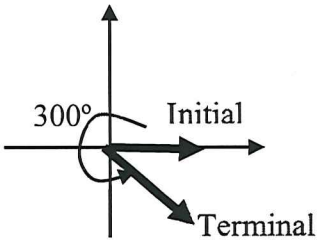
Commonly Used Radian Measures

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

Standard Position

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

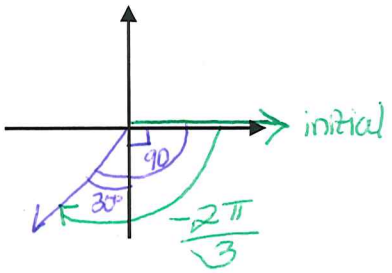
II	I
III	IV



Counterclockwise

IV Quadrant Angle

Ex:



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

3 Q Angle

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

*convert to degrees to make easier to graph

Quadrantal Angles

- Terminal side of angle in standard position lies on an axis
- Always a multiple of $\pm 90°$ or $\pm \pi/2$

Coterminal Angles

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

Ex 8: Give a positive & negative coterminal angle of 45 ° (degrees and radians)

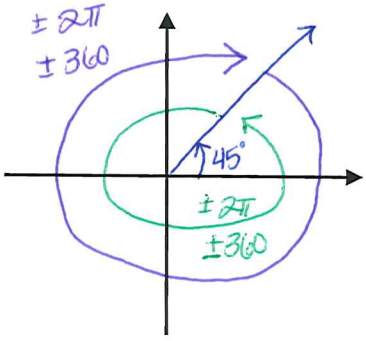
$45° + 360 = 405$

$45° - 360 = -315°$

(Add/subtract full circle to end in same position)

$45° = \frac{\pi}{4}$

$\pm 2\pi$
± 360



$\frac{\pi}{4} + 2\pi = \frac{\pi}{4} + \frac{8\pi}{4} = \frac{9\pi}{4}$

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

Section 7.1 Summary:

1 radian $= \frac{180°}{\pi}$

1 degree $= \frac{\pi}{180}$

D → R multiply degree by $\left(\frac{\pi}{180}\right)$

R → D multiply radian by $\left(\frac{180}{\pi}\right)$

Radian → DMS multiply radian by $\left(\frac{180}{\pi}\right)$ then decimal by 60 then multiply new decimal by 60 again