Wednesday, October 31, 2018
6:39 PM

KEY

Precalc 4.1A & B: Radian & Degree Measure

Obj: To apply radian and degree measure to measure angles and determine the quadrant in which an angle lies

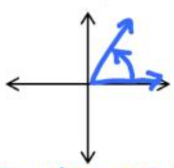
Hwk: 4.1 Day 2 #7 – 23 odd, 51, 53, 79, 83, 89; Check ans!

Quarter 1 Test Tuesday, Nov. 13

Do Now: must be **2 positive** angles add or subtract multiples of 360°

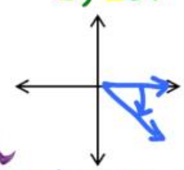
Draw each angle in Standard Position (S.P.) Determine in which quadrant each angle falls. Give the complement & supplement (if possible) for each. Lastly, give a coterminal angle for each.

a) 57° I



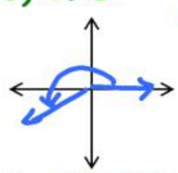
Complement: 33°
Supplement: 123°
Coterminal angle: 417°, -303°

b) -57° IV



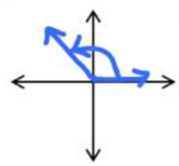
Complement: none
Supplement: none
Coterminal angle: 303°, -417°

c) 195° III



Complement: none
Supplement: none
Coterminal angle: 555°, -165°

d) 140° II



Complement: none
Supplement: 40°
Coterminal angle: 500°, -220°

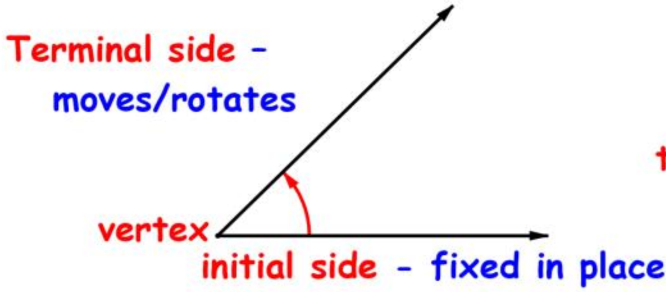
Trigonometry – the "measurement of triangles" – first discovered & studied to det. relationships bet. sides and angles of triangles.

First used in: astronomy, navigation, surveying

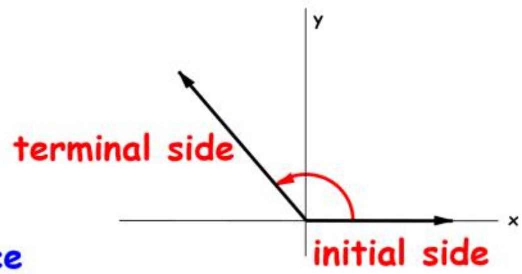
Developments in calculus and the physical sciences led mathematicians to look at trig relationships as functions with the set of real numbers as the domain. They applied trig to studying:

- rotations
- vibrations
- sound waves
- light rays
- orbits of planets and atomic particles
- vibrations of strings (sound)
- pendulums

**Angle:** determined by rotating a ray about its endpoint (vertex)
a.k.a. the opening between 2 rays




Angle

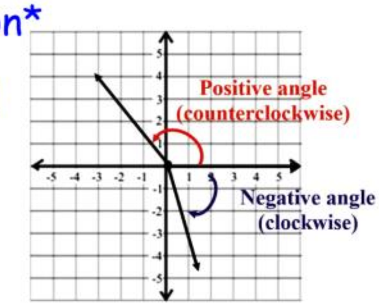



Angle in standard position

**Standard position:** has vertex at the origin and initial side on the positive x-axis

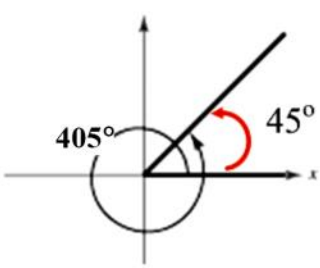
**Positive angles:** rotate in a *counter-clockwise* dir.*
**Negative angles:** rotate in a *clockwise* direction*

*NOTE: Use ARROWS to show direction!!!
- Angles are named with Greek letters ($\alpha$ - alpha, $\beta$ - beta, $\theta$ – theta, etc.)




- If the terminal side of an angle lies ON an axis, it does NOT lie in a quadrant. Called a quadrantal angle.

**Coterminal angles:** Have the same initial and terminal sides.
Each angle has an infinite number of coterminal angles (pos & neg)




- To find a coterminal angle, add or subtract 1 rotation (360°) for positive or negative $\angle$ respectively. ($\angle$s can have more than 360°)

**New Material:**

All of these can be applied to RADIANS – the unit of measure we used with our unit circles on Tuesday.

Ex. 1) Det. the quadrant in which each angle falls by sketching angle in SP.

a) $\frac{5\pi}{4}$ III  b) $-\frac{7\pi}{10}$ III  c) $\frac{15\pi}{18}$ II  d) $-\frac{13\pi}{9}$ II

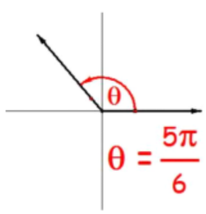

Ex. 2) Det. the quadrant in which each angle falls by sketching angle in SP. NO ° symbol! We are in Radians!

a) 2.9 II  b) -1 IV  c) 6.02 IV  d) 4.71 Quadrantal

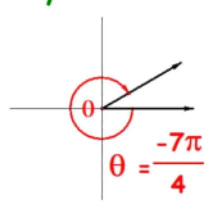

Ex. 3) Give a positive and negative coterminal angle for each:
*(HINT: How much should you add or subtract for each?)

± mults of 2π!

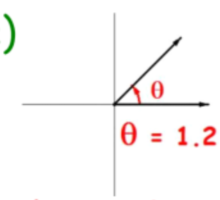
a)




b)




c)




a) $\frac{5\pi}{6} + 2\pi\cdot\frac{6}{6} = \frac{5\pi}{6} + \frac{12\pi}{6} = \boxed{\frac{17\pi}{6}}$

$\frac{5\pi}{6} - \frac{12\pi}{6} = \boxed{\frac{-7\pi}{6}}$

b) $-\frac{7\pi}{4} + 2\pi\cdot\frac{4}{4} = -\frac{7\pi}{4} + \frac{8\pi}{4} = \boxed{\frac{\pi}{4}}$

$-\frac{7\pi}{4} - \frac{8\pi}{4} = \boxed{-\frac{15\pi}{4}}$

c) $\pm 2\pi$  $\pm 6.28$

$1.2 + 6.28 = \boxed{7.48}$

$1.2 - 6.28 = \boxed{-5.08}$

Ex. 4) Give a pos. and neg. coterminal angle for each. (Careful!)

a) $\frac{13\pi}{6}$  b) $-\frac{9\pi}{4}$

a) $\frac{13\pi}{6} + 2\pi\cdot\frac{6}{6} = \frac{13\pi}{6} + \frac{12\pi}{6} = \boxed{\frac{25\pi}{6}}$

$\frac{13\pi}{6} - \frac{12\pi}{6} = \frac{\pi}{6} - \frac{12\pi}{6} = \boxed{\frac{-11\pi}{6}}$

b) $-\frac{9\pi}{4} + 2\pi\cdot\frac{4}{4} = -\frac{9\pi}{4} + \frac{8\pi}{4} = \boxed{\frac{-\pi}{4}}$

$-\frac{\pi}{4} + \frac{8\pi}{4} = \boxed{\frac{7\pi}{4}}$

**Acute angle:** an $\angle$ bet. 0° and 90° or $0 < \theta < \frac{\pi}{2}$

**Obtuse angle:** an $\angle$ bet. 90° and 180° or $\frac{\pi}{2} < \theta < \pi$

**Complementary angles:** two positive $\angle$s whose sum is $\frac{\pi}{2}$ or 90°

**Supplementary angles:** two positive $\angle$s whose sum is $\pi$ or 180°

***NOTE: not all angles have a complement or supplement**

Ex. 5) Find the complement, supplement (if poss.) for each:

a) $\frac{3\pi}{4}$

Complement: $\frac{2}{2}\frac{\pi}{2} - \frac{3\pi}{4} = \frac{2\pi}{4} - \frac{3\pi}{4} = \boxed{\frac{-\pi}{4}}$

Supplement: $\frac{4}{4}\pi - \frac{3\pi}{4} = \frac{4\pi}{4} - \frac{3\pi}{4} = \boxed{\frac{\pi}{4}}$

b) $-\frac{5\pi}{6}$

Complement: none

Supplement: none

c) 1.2 Radians!

Complement: $\frac{\pi}{2} - 1.2 = \boxed{3.7}$

Supplement: $\pi - 1.2 = \boxed{1.94}$

d) -124°

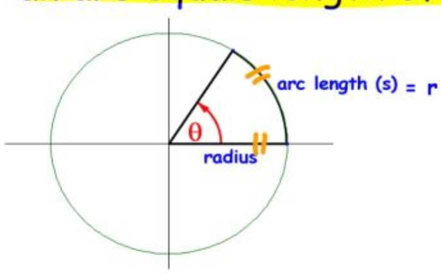
Complement: none

Supplement: none

So what is a radian??

**Central angle:** an angle whose vertex is the center of a circle

**Radian:** measure of a central angle formed when the length of an arc equals length of radius of circle.




$$\boxed{\theta_{\text{radians}} = \frac{\text{arc length}}{\text{radius}} = \frac{s}{r}}$$

Think of measuring one radius around circle w/ pipe cleaner

- Formula is in RADIANS!!! Convert from degrees if nec.
- Radian measure has no units (degrees, feet, inches, etc)

Ex. 6) Find the radian measure of the central angle given:

a. Radius (r) = 14 ft, arc length (s) = 8 ft

$$\theta = \frac{s}{r} = \frac{8\,ft}{14\,ft} = \boxed{\frac{4}{7}}$$

b. Radius (r) = 80 mm, arc length (s) = 160 mm

$$\theta = \frac{s}{r} = \frac{160\,mm}{80\,mm} = \boxed{2}$$

Ex. 7) Find arc length (s) on a circle given:

a. r = 4" and central angle of $\frac{4\pi}{3}$

$$\theta = \frac{s}{r} \qquad \frac{4\pi}{3} = \frac{s}{4} \qquad \frac{3s}{3} = \frac{16\pi}{3} \qquad s = \boxed{\frac{16\pi}{3}}$$

b. r = 27 and central angle of 150°

$$150° \cdot \frac{\pi \text{ radians}}{180°} = \frac{5\pi}{6} \qquad \theta = \frac{s}{r} \qquad \frac{5\pi}{6} = \frac{s}{27}$$

* Convert to radians

$$6s = 135\pi$$

$$s = \frac{135}{6}\pi$$

$$s = \boxed{\frac{45\pi}{2}}$$

Closure: For $\theta = \frac{7\pi}{12}$, find:

a) Supplement

b) Positive coterminal angle

c) Negative coterminal angle

d) Arc length if r = 12 cm.

e) Sketch $\theta$ in standard position