Class_15 Feb 28 - Starting Trigonometry

Sunday, February 26, 2023 12:54 PM

Tonight's Class:

- **Any questions from Chapter 4?**
- **Chapter 4 Test**
- **Working through sections 5.1 and 5.2**
  - **Trig review**
  - **Standard position angles, reference angles, special triangles**

p328

7. $y = -5x^2 + 2.5x + 7.5$

$= \frac{1}{10} \cdot 10(-5x^2 + 2.5x + 7.5)$

$= \frac{1}{10}(-50x^2 + 25x + 75)$

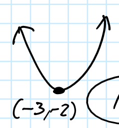
$= \frac{1}{10}(-25)(2x^2 - x - 3)$

$= \frac{-25}{10}(2x - 3)(x + 1)$

$y = -\frac{5}{2}(2x - 3)(x+1)$

$x = 3/2$ $\qquad$ $x = -1$

p334, #2 $\quad \boxed{y = \frac{1}{2}(x+3)^2 - 2}$



MIN

Vertex : $(-3, -2)$

$x \in \mathbb{R}$

range: $y \geq -2$

$\boxed{x = -3}$

X-intercepts, $y = 0$ $\qquad$ $0 = \frac{1}{2}(x+3)^2 - 2$

$+2 \qquad +2$

$2 \times 2 = \frac{1}{2})(x+3)^2 \times 2)$

$\pm\sqrt{4} = \sqrt{(x+3)^2}$

$\pm 2 = x + 3$

$x + 3 = 2$ $\qquad$ $x + 3 = -2$

$x = -1$ $\qquad$ $x = -5$

$(-1, 0)$ $\qquad$ $(-5, 0)$

p343 #4) x = one number

$x - 6$ = other number

product = $x(x-6)$

find minimum

$$\text{product} = x(x-6)$$

find minimum

$$= x^2 - 6x$$

$\left(\frac{b}{2}\right)^2 = \left(\frac{-6}{2}\right)^2 = 9$

$$= x^2 - 6x + 9 - 9$$

$$= (x-3)^2 - 9$$

$x = 3$

$x - 6 = 3 - 6 = -3$

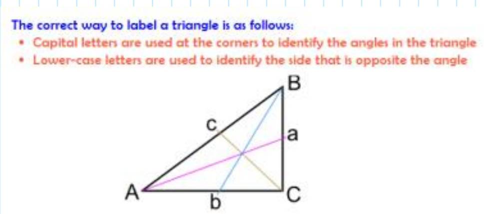
$V = (3, -9)$

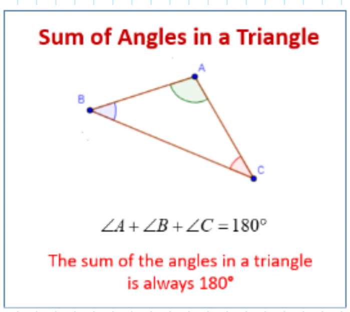
$\underbrace{3 \times -3}_{-9}$ minimum product

5.1 Trigonometry Review, Standard Position Angles in Quadrant 1

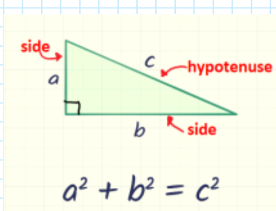
Focus: Relate primary trigonometric ratios to angles in standard position

Review





Pythagorean Theorem

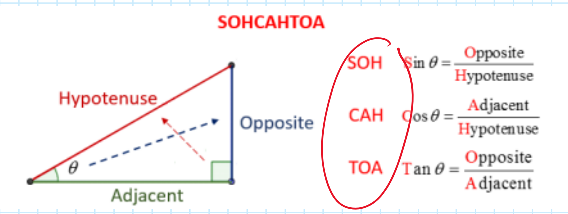


$(\text{side})^2 + (\text{side})^2 = (\text{hyp})^2$

Trigonometry is used to determine the ratios between sides and angles in a triangle. These ratios can be converted into sinusoidal waves that repeat. They model what happens in nature, for instance:

- the depth of water due to tides
- the behavior of sound and light waves

We'll use trigonometric ratios to find the size of angles, lengths of sides of triangles, and to solve application problems related to triangles.

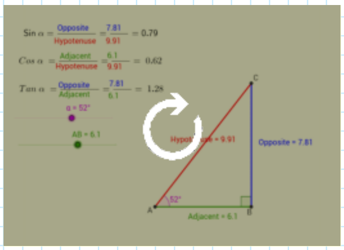


$S = \frac{O}{H}$

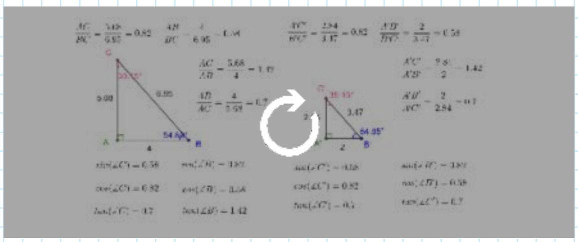
$C = \frac{A}{H}$

$T = \frac{O}{A}$

ACCESS - Trig Intro

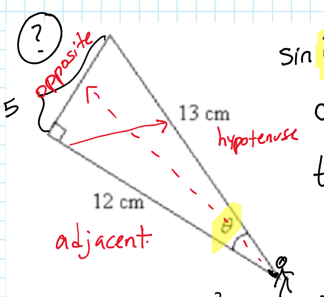


Trig Ratios



What are the values of the trigonometric ratios for the marked angle, in each triangle?

"theta"



$\sin\theta = \frac{opp}{hyp} = \frac{5}{13}$

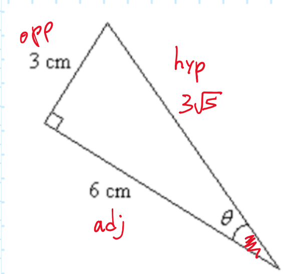
$\cos\theta = \frac{adj}{hyp} = \frac{12}{13}$

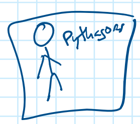
$\tan\theta = \frac{opp}{adj} = \frac{5}{12}$

★ leave in fraction form or exact form

$(side)^2 + (side)^2 = (hyp)^2$

$x^2 + 12^2 = 13^2$





1) Find the missing length.

2) label "opp", "hyp" and "adj"

3) Find all 3 ratios in exact form.

$3^2 + 6^2 = (hyp)^2$

$9 + 36 = (hyp)^2$

$45 = (hyp)^2$

$\sqrt{45} = hyp$

$\sqrt{3 \cdot 3 \cdot 5} = hyp$

$3\sqrt{5} = hyp$

$\sin\theta = \frac{O}{...} = \frac{3}{...}$

$\cos\theta = \frac{A}{...}$

$(\text{side})^2 + (\text{side})^2 = (\text{hyp})^2$

$x^2 + 12^2 = 13^2$

$x^2 = 13^2 - 12^2$

$x^2 = 169 - 144$

$x^2 = 25, \quad \boxed{x = 5} \qquad x = \sqrt{13^2 - 12^2}$

form
or
exact form

exact
form.

$\sin\theta = \frac{O}{H} = \frac{3}{3\sqrt{5}}$

$= \frac{1}{\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}}$

$= \frac{\sqrt{5}}{5}$

$\cos\theta = \frac{A}{H}$

$= \frac{6}{3\sqrt{5}}$

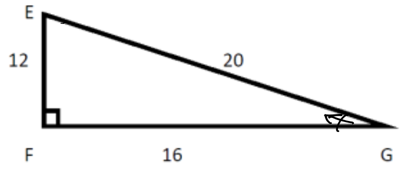
$= \frac{2}{\sqrt{5}}$

$\tan\theta = \frac{O}{A}$

$= \frac{3}{6}$

$= \frac{1}{2}$

1. Determine the indicated trigonometric ratios for Δ EFG.



a) sin E = $\frac{O}{H} = \frac{16}{20} = \frac{4}{5}$

b) cos E =

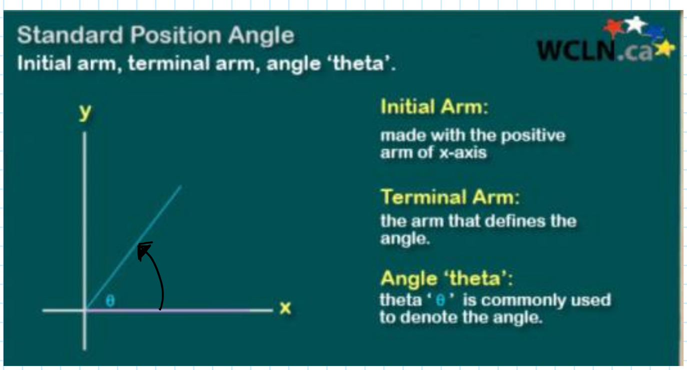
c) tan E =

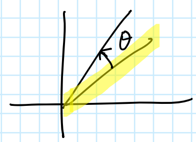
d) sin G = $\frac{O}{H} = \frac{12}{20} = \frac{3}{5}$

e) cos G =

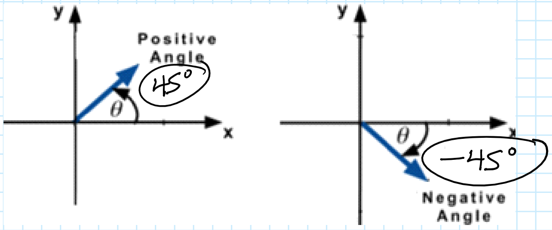
f) tan G =

Standard Position Angles





p409
#3



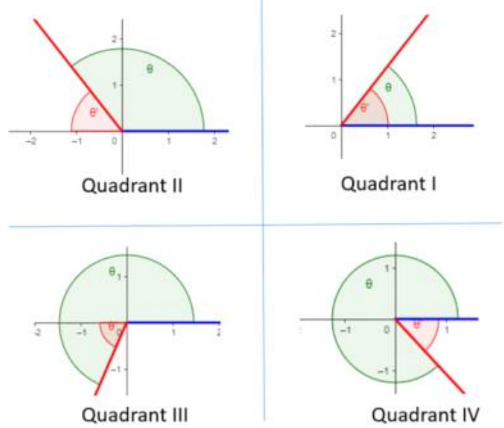
Reference angle - the positive, acute angle between the terminal arm of an angle and the nearest part of the x-axis

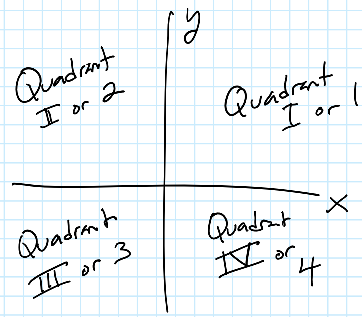
(between 0° and 90°)

Reference Angle

Standard Angle = θ

Reference Angle = θ'

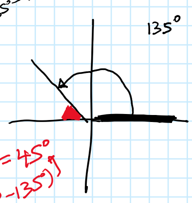




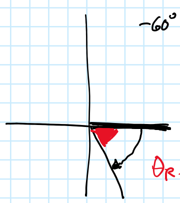
Draw each of the following angles in standard position AND find each one's reference angle. (between the x-axis and the terminal arm)

135°
-60°
-100°
570°

$135° - 90° = 45°$

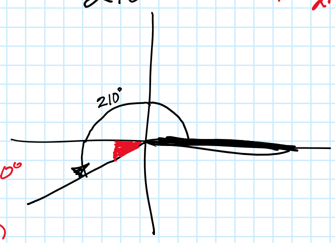


$\theta_R = 45°$ $(180° - 135°)$

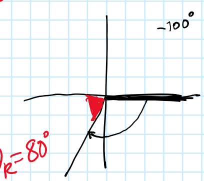


$\theta_R = 60°$

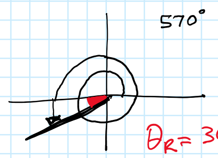
210°



$\theta_R = 30°$ (reference angle)



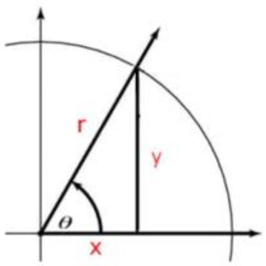
$\theta_R = 80°$



$\theta_R = 30°$

$(570° - 360° = 210°)$

Finding Trig Ratios Given a Point on Terminal Arm



Step 1: Plot the point (x, y)

Step 2: Find the value of r

$r = \sqrt{x^2 + y^2}$

Step 3: Write the trig ratios

$\sin\theta = \frac{y}{r}$

$\cos\theta = \frac{x}{r}$

$\tan\theta = \frac{y}{x}$

WT page 406

Example 1 **Determining the Trigonometric Ratios of an Angle Given a Terminal Point**

The point P(4, 7) is on the terminal arm of an angle θ in standard position. Step 0) draw a picture!

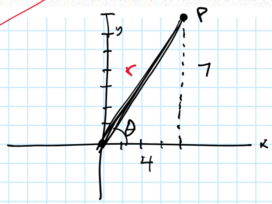
a) Determine the distance r from the origin to P.

b) Determine the primary trigonometric ratios of θ.

c) Determine the measure of θ to the nearest degree.

- plot point
- Connect the point to (0,0)
- connect straight down to the x-axis, from your point

sin θ
cos θ
tan θ



a) $4^2 + 7^2 = r^2$

$\sqrt{4^2+7^2} = r$

$\sqrt{16+49} = r$

$\sqrt{65} = r$

b) $\sin\theta = \frac{O}{H} = \frac{7}{\sqrt{65}}$

$\cos\theta = \frac{A}{H} = \frac{4}{\sqrt{65}}$

$\tan\theta = \frac{O}{A} = \frac{7}{4}$

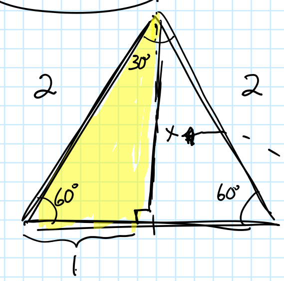
c) $\tan^{-1}(\tan\theta) = \tan^{-1}\left(\frac{7}{4}\right)$

$\theta = \tan^{-1}\left(\frac{7}{4}\right)$

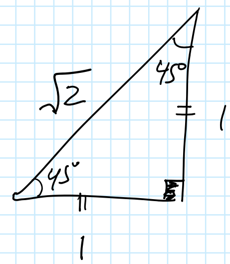
$\theta \doteq 60^\circ$

Page 406, "Check your understanding" ; page 409, #3, 4

Special Triangles and Exact Values of the Trig Ratios



$$1^2 + x^2 = 2^2$$
$$1 + x^2 = 4$$
$$x^2 = 3$$
$$x = \sqrt{3}$$



$$1^2 + 1^2 = (hyp)^2$$
$$1 + 1 = (hyp)^2$$
$$2 = (hyp)^2$$
$$\sqrt{2} = hyp$$

sin 45° $= \frac{O}{H} = \frac{1}{\sqrt{2}}$

cos 45° $= \frac{A}{H} = \frac{1}{\sqrt{2}}$

tan 45° $= \frac{O}{A} = \frac{1}{1} = 1$

sin 30° $= \frac{O}{H} = \frac{1}{2}$

cos 30° $= \frac{A}{H} = \frac{\sqrt{3}}{2}$

tan 30° $= \frac{O}{A} = \frac{1}{\sqrt{3}}$

sin 60° $= \frac{\sqrt{3}}{2}$

cos 60° $= \frac{1}{2}$

tan 60° $= \frac{\sqrt{3}}{1} = \sqrt{3}$