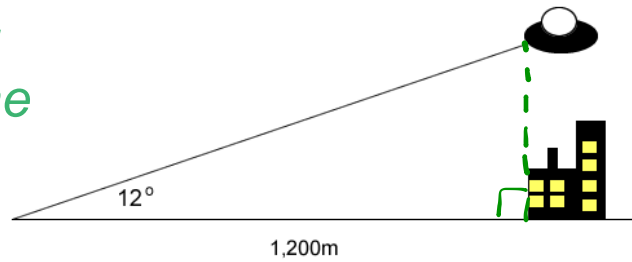


What is "Trigonometry"?

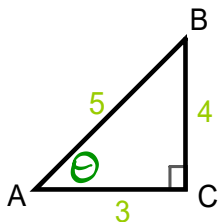


9.4 - 9.6 Trig Ratios: Tangent, Sine, Cosine



- The word *trigonometry* comes from two Greek terms, *trigon* meaning triangle and *metron* meaning measure. The study of trigonometry involves triangle measure.

Dec 9-3:22 PM



The *three most common* ratios are **sine**, **cosine**, and **tangent**.

Trigonometric Ratio	Abbreviation	Definition	Example
Sine of A SOH	Sin A	<u>Opposite Leg</u> Hypotenuse	$\sin A = \frac{BC}{AB}$ $= \frac{4}{5}$
Cosine of A CAH	Cos A	<u>Adjacent Leg</u> Hypotenuse	$\cos A = \frac{AC}{AB}$ $= \frac{3}{5}$
Tangent of A TOA	Tan A	<u>Opposite Leg</u> Adjacent Leg	$\tan A = \frac{BC}{AC}$ $= \frac{4}{3}$

Dec 9-3:22 PM

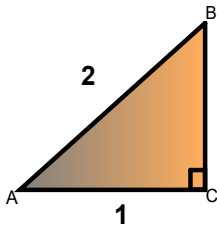
9.4 - 9.6 Tangent, Sine, Cosine Ratios with work



Pronounce as "so - ka - toe - ah"

"SOH CAH TOA"

$$\text{Sin} = \frac{\text{Opposite}}{\text{Hypotenuse}} \quad \text{Cos} = \frac{\text{Adjacent}}{\text{Hypotenuse}} \quad \text{Tan} = \frac{\text{Opposite}}{\text{Adjacent}}$$



A way to remember the relationship between the trigonometric function of an angle of a right triangle and the length of the various sides. (Created by Darren Sonenstahl)

Dec 15-1:39 PM

Warning: Calculator must be set to degrees!!
 Using scientific calculators to evaluate expressions involving trigonometric ratios.

[link to trig ratio chart](#)

Examples:

• $\cos 41^\circ =$

CAH
 $\frac{\text{Adj}}{\text{Hyp}}$

ENTER: $\text{Cos } 41 = 0.75470958$

Round answers to **ten thousandths**:
 $\cos 41 \approx 0.7547$

• $\sin 78^\circ =$

SOH
 $\frac{\text{opp}}{\text{hyp}}$

ENTER: $\text{Sin } 78 = 0.9781476$

Round to **ten thousandths**:
 $\sin 78 \approx 0.9781$

• $\sin x^\circ = 0.79$

Enter: $2^{\text{nd}} \sin 0.79 = 52^\circ$

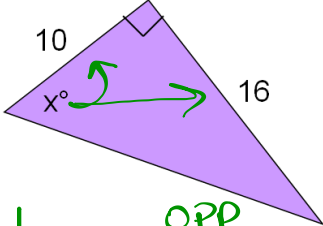
• $\tan x^\circ = 2.14$

TOA = $\frac{\text{opp}}{\text{adj}}$

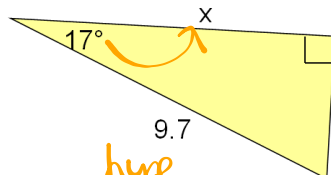
Enter: $2^{\text{nd}} \tan (2.14) = 65^\circ$

Dec 9-3:22 PM

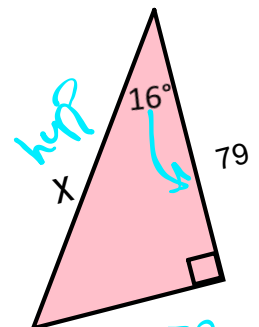
Putting it to practice



$\tan = \frac{\text{OPP}}{\text{adj}}$
 $\tan x = \frac{16}{10}$
 $\tan^{-1}\left(\frac{16}{10}\right) = \boxed{x = 58^\circ}$



$\cos 17 = \frac{x}{9.7}$
 $x = 9.7(\cos 17)$
 ≈ 9.276



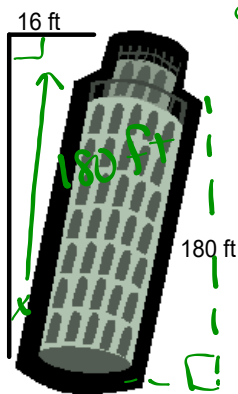
$\cos 16 = \frac{79}{x}$
 $x(\cos 16) = 79$
 $x = \frac{79}{\cos 16} \approx 82.184$

Hint: move Δ to find answer.

Dec 9-3:22 PM

Application Examples

- Can you find the angle at which the tower leans?



SOH

$$\sin x = \frac{16}{180}$$

$$\sin^{-1}\left(\frac{16}{180}\right) = x$$

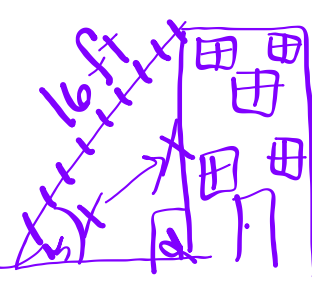
$\boxed{5^\circ}$

- A 16 ft ladder is propped against a building. The angle it forms with the ground measures 55 degrees. How far up the side of the building does the ladder reach?

SOH

$$\sin 55 = \frac{x}{16}$$

$$x = 16(\sin 55)$$

$$\approx 13.106 \text{ ft}$$


Jan 6-7:47 AM

Angles of Elevation and Depression

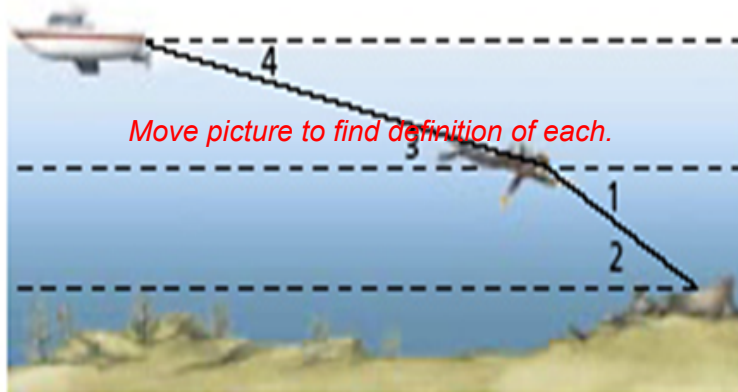
#4
#1

← Depression

→ #2 $\frac{1}{2}$ #3

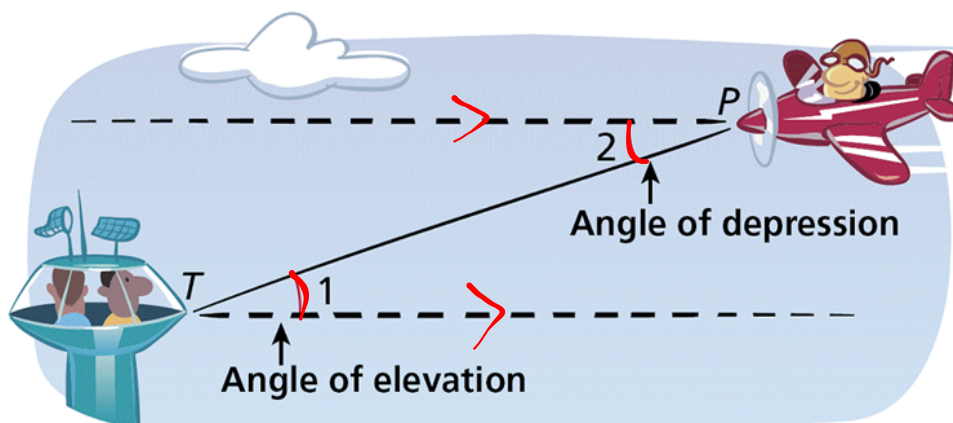
Angle of Elevation - formed by horizontal line and a line of sight to a point above the line

Angle of Depression – formed by a horizontal line and a line of sight to a point below the line.



Dec 9-3:51 PM

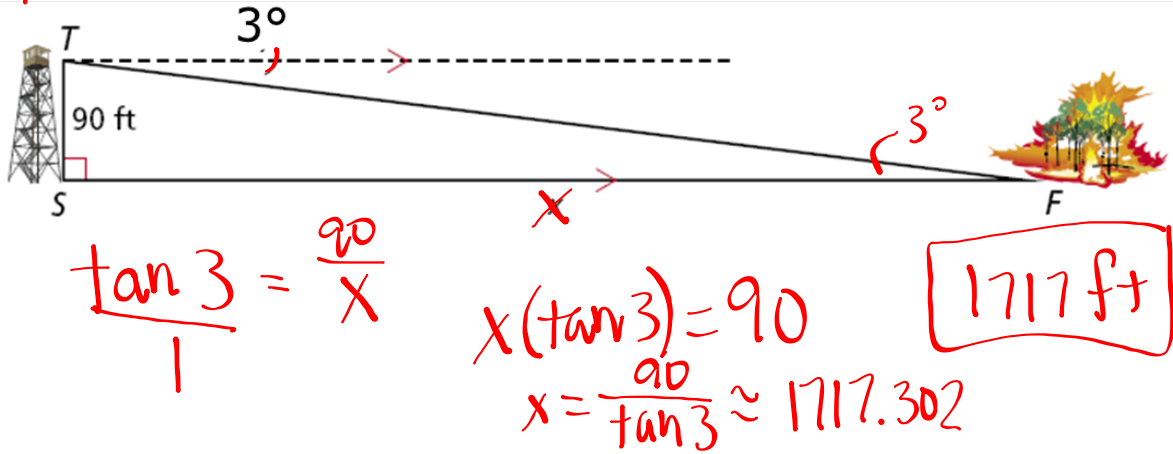
Since horizontal lines are parallel, $\angle 1 \cong \angle 2$ by the Alternate Interior Angles Theorem. Therefore the angle of elevation from one point is congruent to the angle of depression from the other point.



Jan 6-4:55 PM

Angle of Depression Example

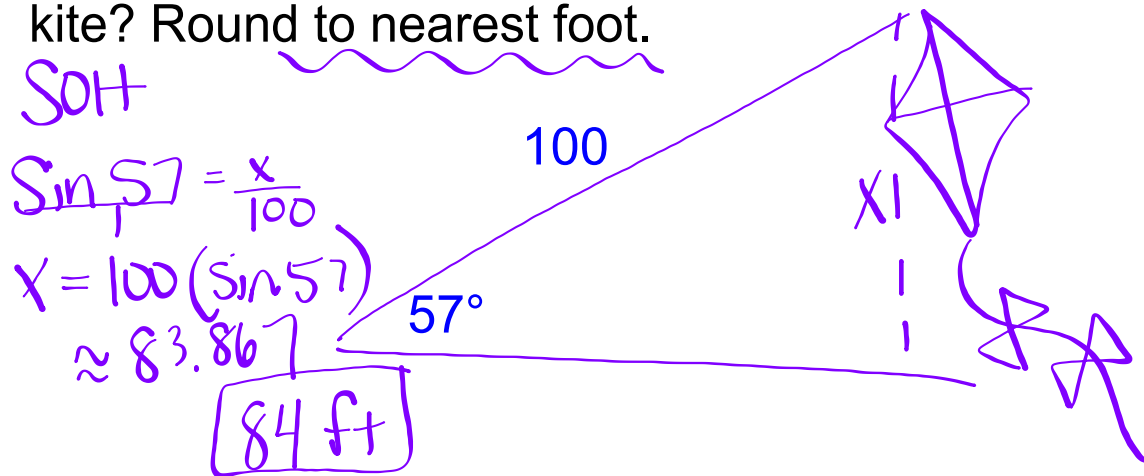
Suppose the ranger in a tower 90 feet high spots fire at an angle of depression of 3° . What is the horizontal distance to this fire? Round to the nearest foot.



Jan 6-5:04 PM

Angle of Elevation Example

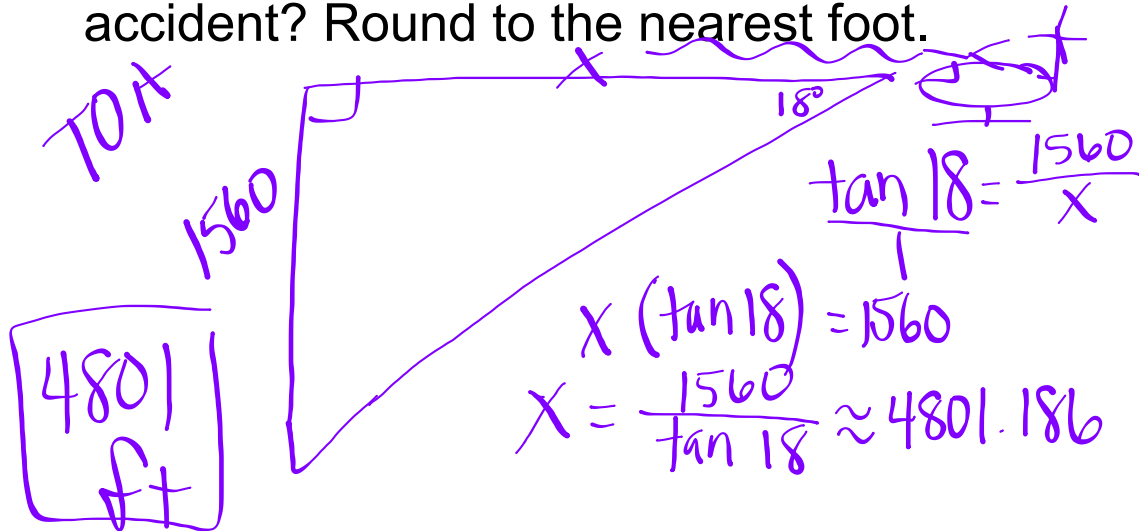
Tim is flying a kite one sunny Saturday afternoon at an angle of elevation of 57° . If the kite's string is 100 feet long, how high is the kite? Round to nearest foot.



Dec 9-3:51 PM

Angle of Depression Example

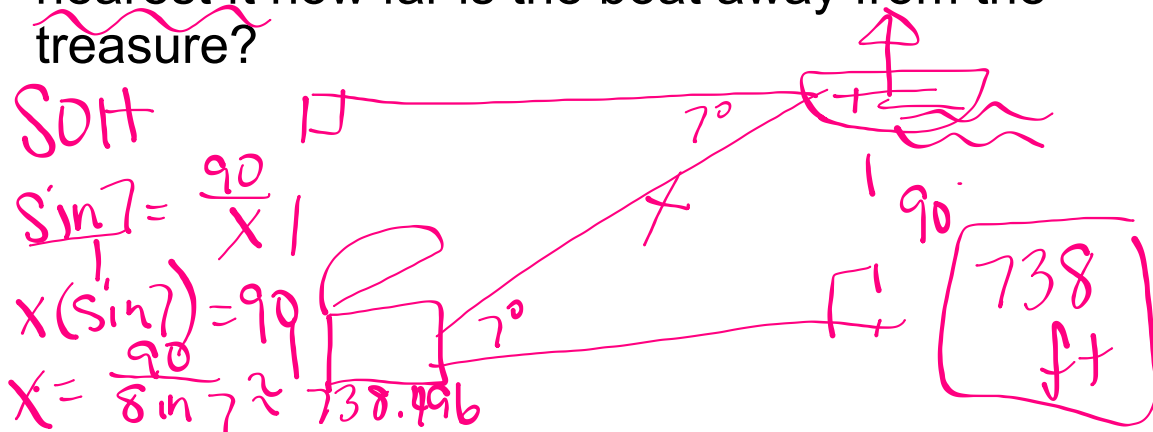
The pilot of a traffic helicopter sights an accident at an angle of depression of 18° . The helicopter's altitude is 1560 ft. What is the horizontal distance from the helicopter to the accident? Round to the nearest foot.



Dec 9-3:51 PM

Practice 1

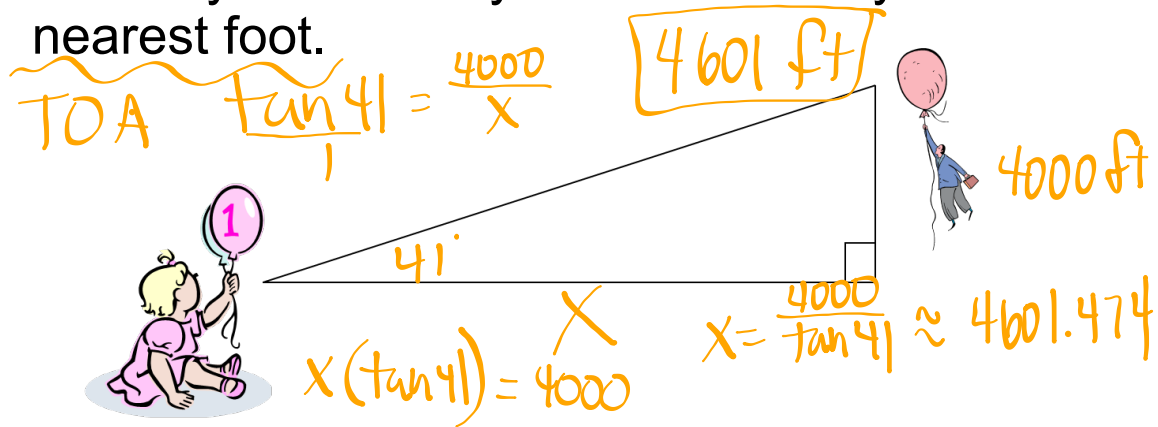
A boat's radar picks up the signal of a buried treasure at an angle of depression of 7° . If the ocean floor is 90 feet below the boat, to the nearest ft how far is the boat away from the treasure?



Dec 9-3:51 PM

Practice 2

Abby sees a man being dragged away by his balloon at an angle of elevation of 41° . If the man yells down that he is 4000 ft high, how far away horizontally is he from Abby to the nearest foot.



Dec 9-3:51 PM

9.4: pg. 491:

A: 11, 17, 19, 21, 23, 25, 27 - 29

B: 1, 5, 9, 11, 15, 17, 19, 21, 25, 27 - 29

C: 1 - 15 (o), 27 - 29

9.5: pg. 498:

A: 23, 25, 27, 29, 31, 37, 41 - 44

B: 1, 7, 11, 15, 21, 23, 25, 27, 29, 31, 41 - 44

C: 1 - 29 (o), 41 - 44

9.6: pg. 505:

A: 5, 11, 13, 17, 19, 21, 27, 35

B: 5, 9, 11, 13, 17, 19, 21, 27, 33, 35

C: 3 - 21 (o), 21, 33

Homework

$$28x = \frac{7\sqrt{3}}{3} \approx 4.041$$

$$42x = 12\sqrt{2} \approx 16.971; \text{ no}$$

$$44x = 6\sqrt{2} \approx 8.485; \text{ no}$$

Dec 14-1:37 PM

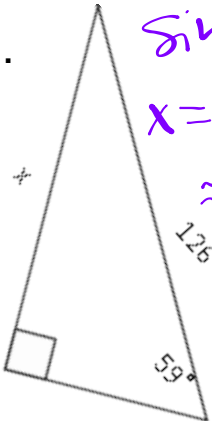
DAY TWO: Warm-up grade

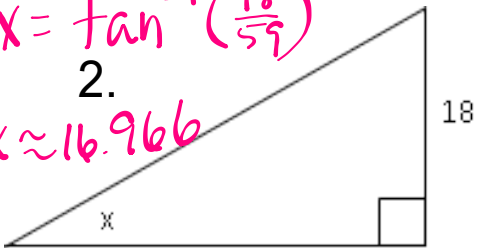
<https://tinyurl.com/b2dumla>

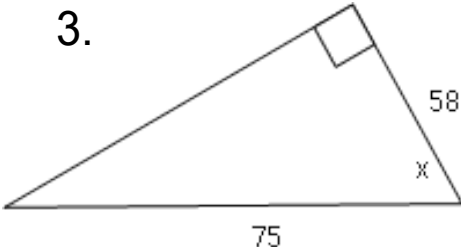
1. Go to this website.
2. Refresh your mind from yesterday's lesson.
3. Answer the 10 question quiz at the bottom.
4. Email me a screenshot for a grade at noblem@lancastersd.k12.wi.us

Apr 13-2:21 PM

Get a white board and solve the following:

1.  $\sin 59 = \frac{x}{126}$
 $x = 126(\sin 59)$
 ≈ 108.003

2.  $x = \tan^{-1}\left(\frac{18}{59}\right)$
 $x \approx 16.966$
 $x \approx 17^\circ$

3.  $x = \cos^{-1}\left(\frac{58}{75}\right)$
 $x \approx 39.346$
 $\approx 39^\circ$

Dec 15-8:58 AM

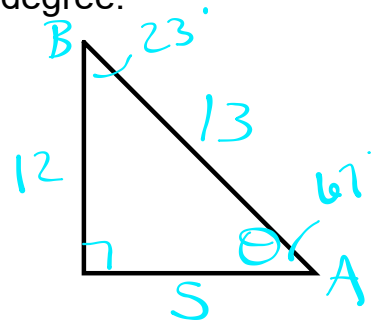
9.4 - 9.6 Tangent, Sine, Cosine Ratios with work

4. The side lengths of a right triangle are given below. Find the measure of the acute angles in the triangle. Round to nearest degree.

5, 12, 13

$$\tan^{-1}\left(\frac{12}{5}\right) \approx 67.4 \quad \boxed{67^\circ}$$

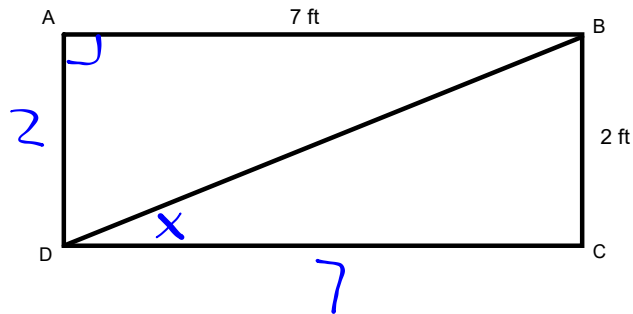
$$\boxed{23^\circ}$$



5. Find the $m\angle BDC$ in the rectangle below. Round to nearest degree.

$$\tan^{-1}\left(\frac{2}{7}\right) \approx 15.945$$

$$\boxed{16^\circ}$$



Dec 14-6:32 PM

6. For a 45 degree angle, the SIN and COS ratios are equal.



7. Find the tangent of the greater acute angle in a triangle with side lengths of 7, 24, 25 centimeters.

$$\tan A = \frac{24}{7} \approx 3.428 \approx \boxed{74^\circ}$$

8. Find the value of x . Then find AB, BC, and AC. Round unit to nearest unit.

$$\tan 42 = \frac{3x+3}{4x}$$

$$4x(\tan 42) = 3x+3$$

$$4x \tan 42 - 3x = 3$$

$$x(4 \tan 42 - 3) = 3$$

$$x = \frac{3}{4 \tan 42 - 3}$$

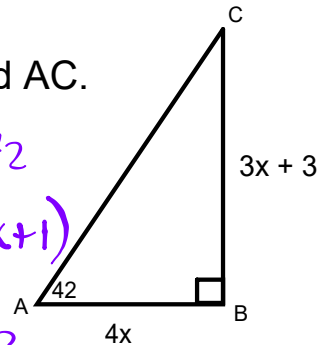
$$x = \frac{3(x+1)}{4 \tan 42}$$

$$x = 0.833(x+1)$$

$$x = 0.833x + 0.833$$

$$0.167x = 0.833$$

$$\boxed{x = 4.988}$$



$$\boxed{AB = 20m \quad AC = 27m}$$

$$\boxed{BC = 18m}$$

Dec 14-5:38 PM

9.4 - 9.6 Tangent, Sine, Cosine Ratios with work

A. At what angle will the fireman's hose have to be in order to stop the fire and save the house if the second story is 14 feet high and the fireman is 23 feet away from house? Is this an angle of elevation or angle of depression?

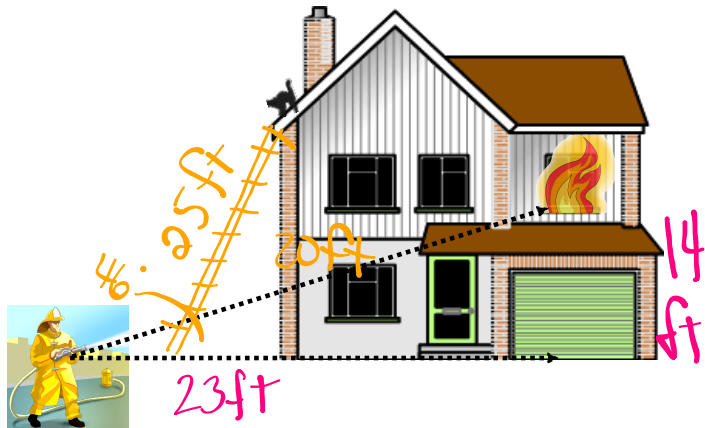
B. Would a 25 foot ladder be long enough to rescue the cat if the angle of the ladder and the ground was 46 degrees and the cat was 20 feet high?

$$\sin 46 = \frac{x}{25}$$

$$x = 25 \sin 46$$

$$= 17.983$$

NO, $17.983 < 20$



Jan 6-1:59 PM

Lindsey shouts to Pete from her third-story window.

A. Lindsey is 9.2 meters up, and the angle of depression from Lindsey to Pete is 79 degrees. Find the distance from Pete to the base of the building to the nearest tenth of a meter.

B. To see Lindsey better, Pete walks out into the street so he is 4.3 meters from the base of the building. Find the angle of depression from Lindsey to Pete to the nearest degree.

$$A. \tan 79 = \frac{9.2}{x}$$

$$x = \frac{9.2}{\tan 79} \approx 1.788 \text{ m}$$

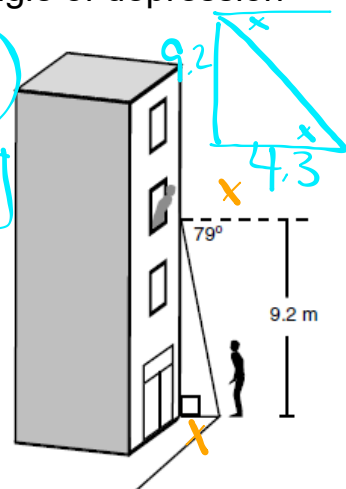
$$x = \tan^{-1}\left(\frac{9.2}{4.3}\right) \approx 64.949^\circ \approx 65^\circ$$

C. Mr. Shea lives in Lindsey's building. While Pete is still out in the street, Mr. Shea leans out his window to tell Lindsey and Pete to stop all the shouting. The angle of elevation from Pete to Mr. Shea is 72 degrees. Tell whether Mr. Shea lives above or below Lindsey.

$$\tan 72 = \frac{x}{4.3}$$

$$x = 4.3 \tan 72 = 13.234 \text{ m}$$

(above)

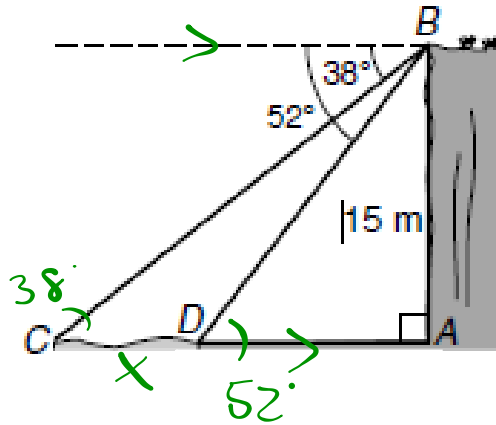


Jan 10-7:47 AM

9.4 - 9.6 Tangent, Sine, Cosine Ratios with work

Lamar is on top of a 15-meter cliff looking down at a river (CD). The angle of depression to one bank is 52 degrees and to the other bank is 38 degrees.

A. Describe how Lamar can find the width of the river.
(Hint: What is special about the angles of depression?)



AIA R \cong When \leftrightarrow
R //.

B. Find the width of the river to the nearest tenth of a meter.

$$\tan 52 = \frac{15}{x}$$

$$x = \frac{15}{\tan 52} \approx 11.719$$

$$\tan 38 = \frac{15}{x}$$

$$x = \frac{15}{\tan 38} \approx 19.199$$

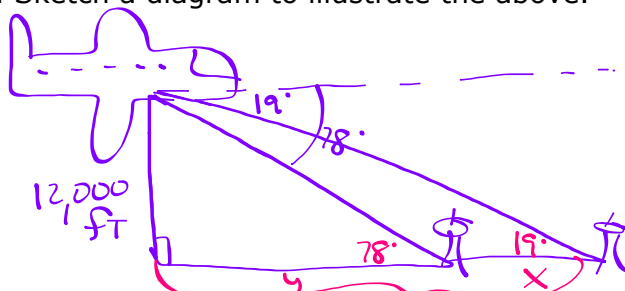
$$\begin{array}{r} 19.199 \\ - 11.719 \\ \hline 7.480 \end{array}$$

1.48m

Jan 6-5:12 PM

A pilot flying at an altitude of 12,000 ft sights two airports directly in front of him. The angle of depression to one airport is 78°, and the angle of depression to the second airport is 19°.

A. Sketch a diagram to illustrate the above.



B. What is the distance between the two airports? Round to the nearest foot.

$$\tan 78 = \frac{12000}{y} \quad (z - y = x)$$

$$y = \frac{12000}{\tan 78} \approx 2550.679 \text{ ft}$$

$$\tan 19 = \frac{12000}{z}$$

$$z = \frac{12000}{\tan 19} \approx 34,850.531$$

$$z - y = x$$

$$34,850.531 - 2550.679 = 32,299.852$$

32,300 ft

Jan 6-4:50 PM

Practice Worksheets

- Trig Basics WS I:
 - > ALL
- Trig WS II:
 - > 1st: EVENS 7th: ODDS
- Trig WS III Application:
 - > 1st: EVENTS 7th: ODDS

Feb 22-8:35 AM