Are there any questions from last day's assigned work you would like to see on the board?

pp. 261-262 # 2 - 9 3b, 8a 9b

Note: The correct answers for 8b) are $\theta = 67°$ and $\phi = 23°$.

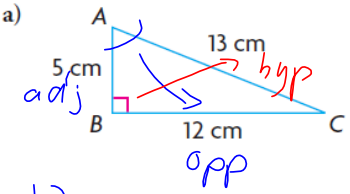
Today's Learning Goal(s): 2a,b 5a

By the end of the class, I will be able to:

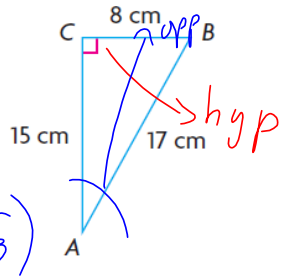
a) Use the primary trig ratios to solve real world applications.
b) Correctly identify an angle of elevation and an angle of depression.

p. 261 **2.** State the primary trigonometric ratios for $\angle A$. SOH CAH TOA

a)



b)



$\sin A = \frac{12}{13}$ $A = \sin^{-1}\left(\frac{12}{13}\right)$

$\cos A = \frac{5}{13}$

$\tan A = \frac{12}{5}$ $A = \tan^{-1}\left(\frac{12}{5}\right)$

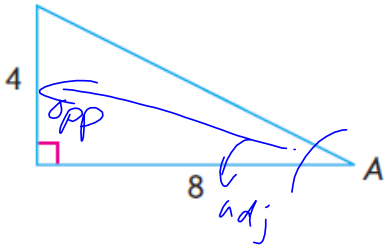
$\sin A = \frac{8}{17}$

$\cos A = \frac{15}{17}$

$\tan A = \frac{8}{15}$

p. 261 **3.** Calculate the measure of the indicated side or angle to the nearest unit.

a)



TOA

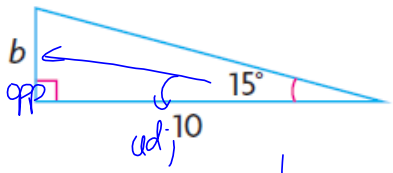
$\tan A = \frac{4}{8}$

$A = \tan^{-1}\left(\frac{4}{8}\right)$

$\doteq 26.5$

$\doteq 27^\circ$

b)



$\tan 15^\circ = \frac{b}{10}$

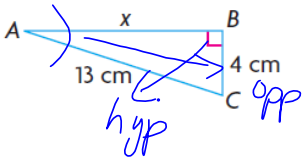
$b = 10 \tan 15^\circ$

$\doteq 2.6$

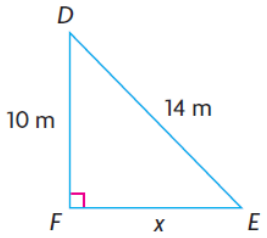
$\doteq 3$ cm

p. 262 **4.** Use the Pythagorean theorem to determine the value of x to the nearest unit.

a)



b)



5. Using the triangles in question 4, determine the primary trigonometric ratios for each given angle. Then determine the angle measure to the nearest degree.

SOH

a) $\angle A$ b) $\angle D$ c) $\angle C$

$\sin A = \frac{opp}{hyp}$

$= \frac{4}{13}$

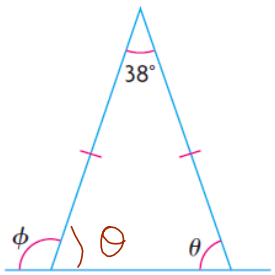
$A = \sin^{-1}\left(\frac{4}{13}\right)$

$\doteq 17.9$

$\doteq 18^\circ$

p. 262 **8.** Determine each unknown angle to the nearest degree.

a)



psi

$38^\circ + \theta + \theta = 180^\circ$

$38^\circ + 2\theta = 180^\circ$

$2\theta = 180^\circ - 38^\circ$

$2\theta = 142^\circ$

$\theta = \frac{142^\circ}{2}$

$\theta = 71^\circ$

SAT

$\phi + \theta = 180$

$\phi = 180^\circ - 71$

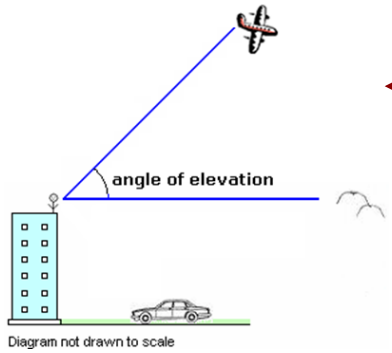
$= 109^\circ$

MCF 3MI

5.1 Applying the Primary Trigonometric Ratios

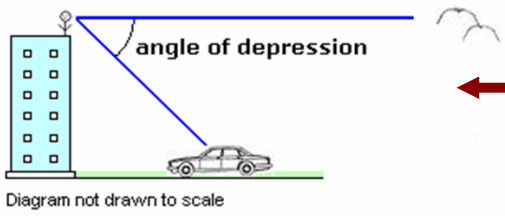
Date: NOV. 6/19

Recall: The **angle of elevation (inclination)** is the angle of view from a horizontal line segment (a.k.a. the line of sight) **up** to the object being viewed.



Sketch this example into your notes.

The **angle of depression** is the angle of view from a horizontal line segment (a.k.a. the line of sight) ***down*** to an object.



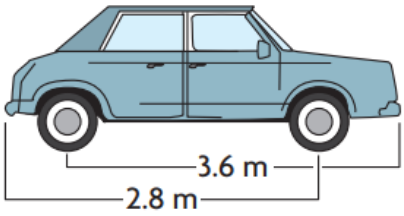
Sketch this example into your notes.

When working with problems involving trigonometry, there is often more than one way to approach and solve the problem.

Let's discuss the Example 1 from pp. 264-267

Eric's car alarm will sound if his car is disturbed, but it is designed to shut off if the car is being towed at an angle of elevation of more than 15°. Mike's tow truck can lift a bumper no more than 0.88 m higher than the bumper's original height above ground. Eric's car has these measurements:

- The front bumper is 3.6 m from the rear axle.
- The rear bumper is 2.8 m from the front axle.

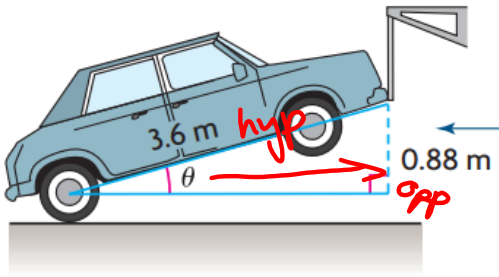


? Will Mike be able to tow Eric's car without the alarm sounding?

EXAMPLE 1 Selecting a strategy to solve a problem involving a right triangle

Determine whether the car alarm will sound.

Jason's Solution: Calculating the Angle of Elevation



If Eric's car is towed from the front, the car forms a right triangle with a hypotenuse of 3.6 m. The side opposite the angle of elevation, θ, is 0.88 m.

$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

In a right triangle, the sine ratio relates an angle to the opposite side and the hypotenuse.

$$\sin\theta = \frac{0.88}{3.6}$$

$$\theta = \sin^{-1}\left(\frac{0.88}{3.6}\right)$$

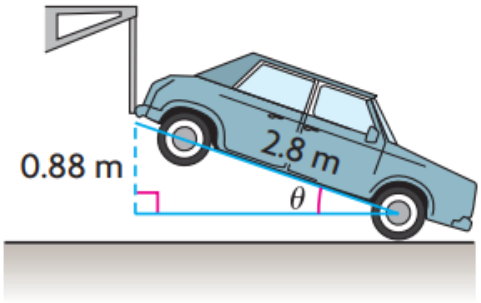
I used the inverse sine ratio to calculate the angle.

$$\theta \doteq 14°$$

I rounded to the nearest degree.

Since the angle is less than 15°, the car has not been lifted enough to shut off the alarm.

Since the angle is less than 15°, the car has not been lifted enough to shut off the alarm.



If the car is towed from the rear, the car still forms a right triangle. The opposite side is still 0.88, but the hypotenuse is now 2.8 m.

$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\sin\theta = \frac{0.88}{2.8}$$

$$\theta = \sin^{-1}\left(\frac{0.88}{2.8}\right)$$

$$\theta \doteq 18°$$

To determine the angle of elevation, θ, I used the sine ratio, since I knew the lengths of the opposite side and the hypotenuse.

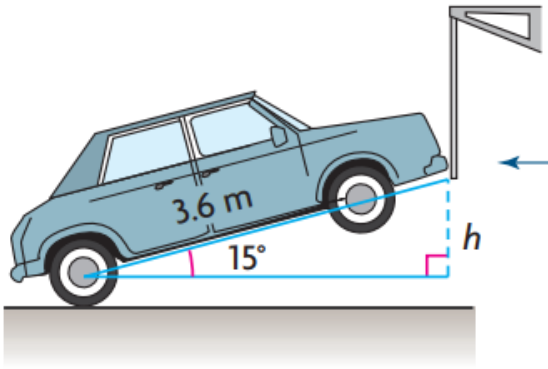
I used the inverse sine ratio to calculate the angle.

I rounded to the nearest degree.

Since the angle is greater than 15°, the car alarm will shut off.

For the car alarm to shut off, Mike should tow Eric's car from the back.

Monica's Solution: Calculating the Minimum Height



For an angle of elevation of 15°, I wanted to know the height the car must be lifted to shut off the alarm. I started with the front of the car being lifted. I drew a right triangle and labelled the height as h. I knew an angle and the hypotenuse.

$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

Side h is opposite the 15° angle, so I used the sine ratio to calculate h.

$$\sin 15° = \frac{h}{3.6}$$

$$3.6 \times \sin 15° = \cancel{3.6}^{1} \times \frac{h}{\cancel{3.6}_{1}}$$

I solved for h by multiplying both sides of the equation by 3.6.

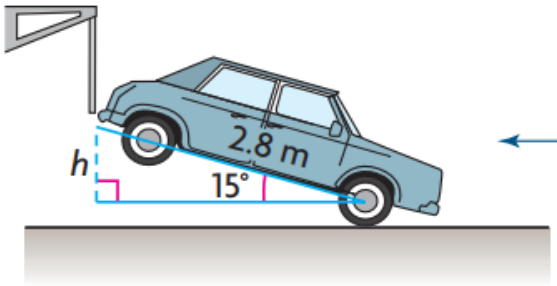
$$h = 3.6 \times \sin 15°$$

$$h \doteq 0.93 \text{ m}$$

When the front of the car is lifted 15°, the front bumper is about 0.93 m above its original height.

Mike can't raise the car high enough from the front to shut off the alarm.

This won't work because Mike can lift the bumper only 0.88 m.



I used the same method, but with the rear of the car being lifted.

$$\sin 15° = \frac{h}{2.8}$$

I used the sine ratio because I knew the opposite side and the hypotenuse.

$$2.8 \times \sin 15° = \cancel{2.8}^{1} \times \frac{h}{\cancel{2.8}_{1}}$$

I solved for h by multiplying both sides of the equation by 2.8.

$$h = 2.8 \times \sin 15°$$

$$h \doteq 0.72 \text{ m}$$

When the rear of the car is lifted 15°, the rear bumper is about 0.72 m above its original height.

For the alarm to shut off, Mike should tow Eric's car from the rear.

This will work, since Mike can lift a car more than that.

Reflecting

A. Compare the two solutions. How are they the same and how are they different?

B. Which solution do you prefer? Why?

C. Could the cosine or tangent ratios be used instead of the sine ratio to solve this problem? Explain.

Ex. 1: You will see three types of trig equations. (Solve each to 1 decimal place) .

a) the variable on the top

$$\tan 55° = \frac{x}{8}$$

$$x = 8 \times \tan 55°$$

$$x \doteq 11.42$$

$$x \doteq 11.4 \text{ cm}$$

b) the variable on the bottom

$$\sin 35° = \frac{4.3}{y}$$

$$y = \frac{4.3}{\sin 35°}$$

$$y \doteq 7.49$$

$$y \doteq 7.5 \text{ cm}$$

c) the variable is the angle

$$\cos Z = \frac{2.9}{5.6}$$

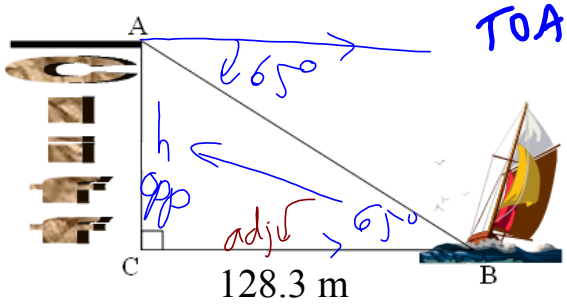
$$Z = \cos^{-1}\left(\frac{2.9}{5.6}\right)$$

$$Z \doteq 58.81$$

$$Z \doteq 58.8°$$

Ex. 2 A sailboat is 128.3 m from a cliff.
The angle of depression from the top of the cliff to the sailboat is 65˚.
Write the trigonometric ratio for the height of the cliff.

Let *h* represent the height of the cliff, in m.



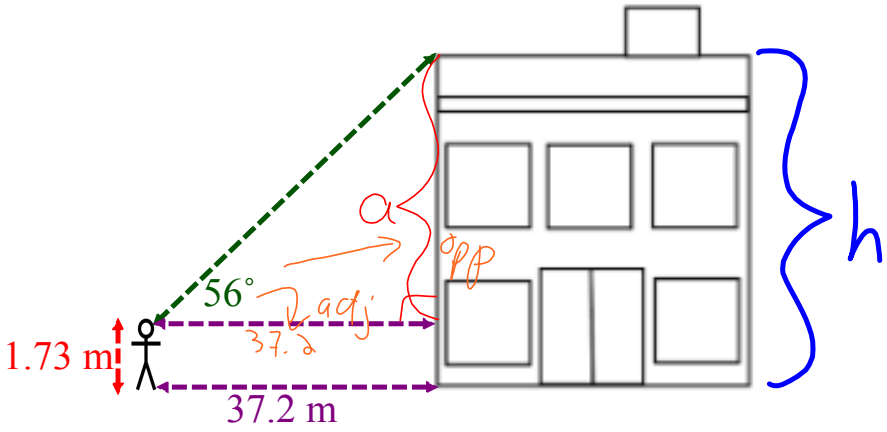
Solution: $\tan 65° = \frac{h}{128.3}$

NOT $\tan 65° = \frac{128.3}{h}$

Method:

Name the sides based on the indicated angle (sketch first if necessary).
Choose the correct Trig ratio using SOH, CAH, TOA (based on the given information from the diagram).
Write the Trig equation, then ISOLATE the variable.
Use a calculator to solve the equation.
Round your **final** answer, and give a concluding ( ) statement (including units).

Ex. 3 Use the diagram to estimate the height of the building, to 2 decimal places.



Let h **represent the height of the building, in m.**

$h = a + 1.73$

$\doteq 55.151 + 1.73$

$\doteq 56.881$

TOA

$\tan 56^\circ = \frac{a}{37.2}$

$a = 37.2 \tan 56^\circ$

$\doteq 55.151$

$\doteq 55.151$

the building's height is 56.88 m **m.**

Review the learning goals. Were we successful today?

a) Use the primary trig ratios to solve real world applications.
b) Correctly identify an angle of elevation and an angle of depression.

Today's Homework:

READ p. 270 "In Summary" **AND**
pp. 271-273 # 3 – 5, 7 – 11, 14