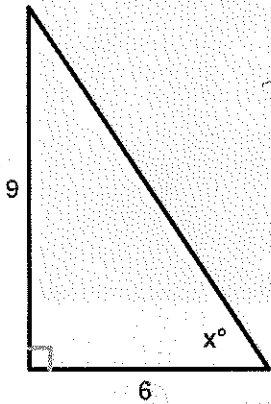


## 4.8 – Word Problems again!!

### Review of Solving a Triangle

1) Solve for the side or angle:

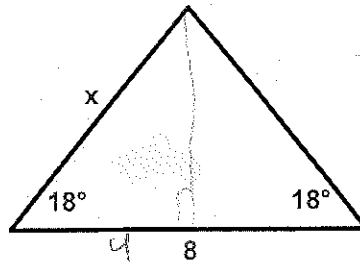


$$\tan x = \frac{9}{6} = \frac{3}{2}$$

$$x = \arctan \frac{3}{2} \approx 56.31^\circ$$

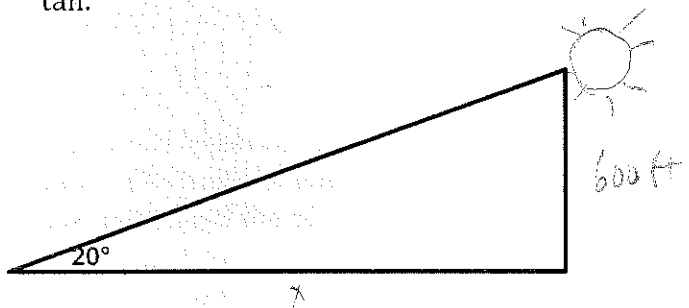
$$\cos 18^\circ = \frac{4}{x}$$

$$x = \frac{4}{\cos 18^\circ} \approx 4.21$$



### Review of Right Triangle Word Problems

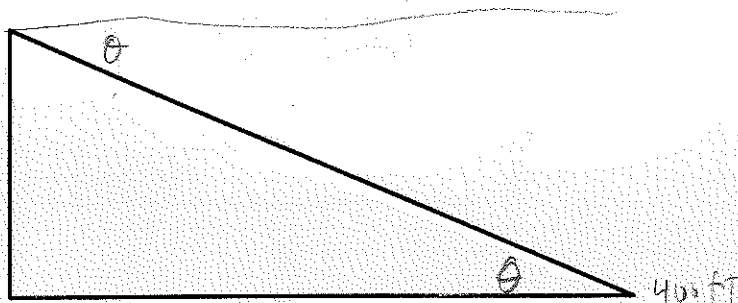
2) The sun is  $20^\circ$  above the horizon. Find the **length of a shadow** cast by a building that is 600 feet tall.



$$\tan 20^\circ = \frac{600}{x}$$

$$x = \frac{600}{\tan 20^\circ} \approx 1,648.49 \text{ ft}$$

3) A cellular telephone tower that is 150ft tall is placed on top of a mountain that is 1200ft above sea level. **What is the angle of depression** from the top of the tower to a cell phone user who is 5 horizontal miles away and 400 feet above sea level?



$$\tan \theta = \frac{950}{26,400}$$

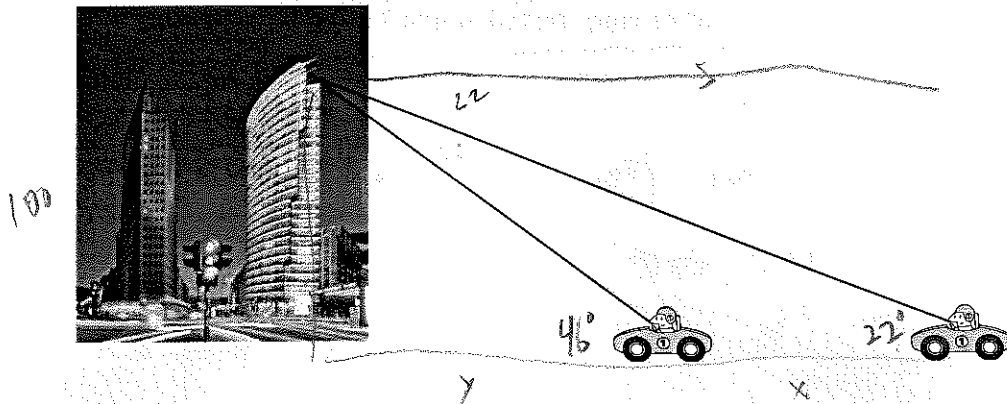
$$\theta = \arctan \left( \frac{95}{2640} \right)$$

$$\approx 2.06^\circ$$

## 4.8 – Word Problems again!!

### Slightly more complex

- 4) From the top of a 100 foot building a man observes a car moving toward the building. If the angle of depression of the car changes from  $22^\circ$  to  $46^\circ$  during the period of observation, how far does the car travel?



$$\tan 22^\circ = \frac{100}{x+y} \Rightarrow x+y = \frac{100}{\tan 22^\circ} \Rightarrow x = \frac{100}{\tan 22^\circ} - \frac{100}{\tan 46^\circ} \approx 150.94 \text{ ft}$$

$$\tan 46^\circ = \frac{100}{y} \Rightarrow y = \frac{100}{\tan 46^\circ}$$

- 5) A plane is observed approaching your home and you assume that its speed is 550 miles per hour. The angle of elevation of the plane is  $16^\circ$  right now and  $57^\circ$  one minute later. Approximate the altitude of the plane.

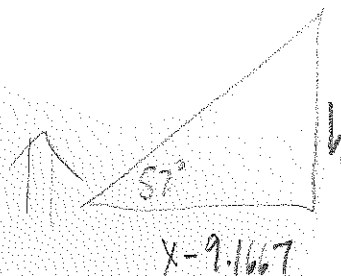
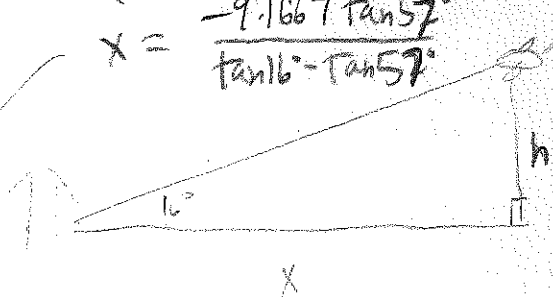
$$x \tan 16^\circ = x \tan 57^\circ - 9.1667 \tan 57^\circ$$

$$x \tan 16^\circ - x \tan 57^\circ = -9.1667 \tan 57^\circ$$

$$x(\tan 16^\circ - \tan 57^\circ) = -9.1667 \tan 57^\circ$$

$$x = \frac{-9.1667 \tan 57^\circ}{\tan 16^\circ - \tan 57^\circ}$$

$$\frac{550 \text{ mi}}{60 \text{ min}} = 9.1667 \frac{\text{mi}}{\text{min}}$$



$$\tan 16^\circ = \frac{h}{x}$$

$$h = x \tan 16^\circ$$

$$\tan 57^\circ = \frac{h}{x - 9.1667}$$

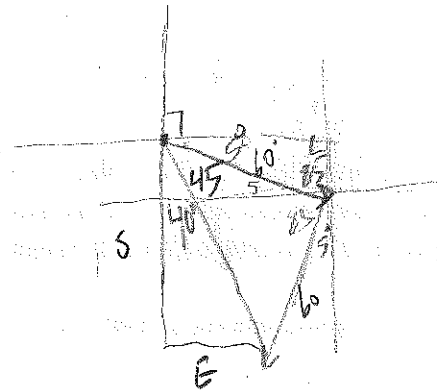
$$h = (x - 9.1667) \tan 57^\circ$$

$$h = \left( \frac{-9.1667 \tan 57^\circ}{\tan 16^\circ - \tan 57^\circ} \right) \tan 16^\circ \approx 3.23 \text{ m}$$

## 4.8 – Word Problems again!!

**Course and Bearing:** The biggest thing to know is that NORTH is degree 0 (instead of east, like it normally is on the x-axis)

- 6) The Coast Guard Cutter travels at 30 knots (nautical miles) from its home port of Corpus Christi on a course of  $95^\circ$  for 2 hours, and the changes to a course of  $185^\circ$  for 2 hours. Find the **distance** and **bearing** from the Corpus Christi port to the boat.



$$60\sqrt{2} \text{ nm}$$

$$90 + 50 = 140^\circ$$

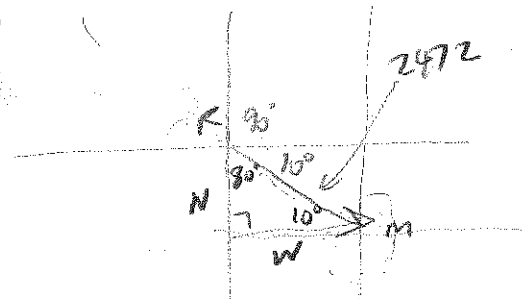
or  $54^\circ \text{ E}$

- 7) A jet leaves Reno, Nevada and is headed toward Miami, Florida at a bearing of  $100^\circ$ . The distance between the two cities is approximately 2472 miles.

a) How far north and how far west is Reno relative to Miami?

$$\sin 10^\circ = \frac{N}{2472} \Rightarrow N = 2472 \sin 10^\circ \approx 429.26 \text{ m}$$

$$\cos 10^\circ = \frac{W}{2472} \Rightarrow W = 2472 \cos 10^\circ \approx 2437.47 \text{ m}$$



b) If the jet is to return directly to Reno from Miami, at what bearing should it travel?

$$280^\circ \quad \text{N } 80^\circ \text{ W}$$

## 4.8 – Word Problems again!!

### Harmonic Motion:

A point that moves on a coordinate line is said to be in simple harmonic motion if its distance  $d$  from the origin at time  $t$  is given by either

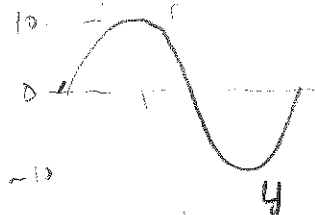
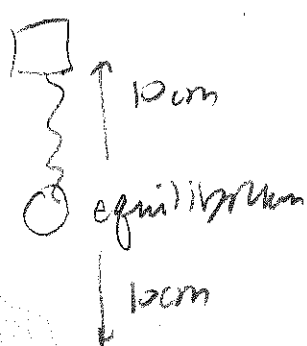
$$d = a \sin \omega t \quad \text{or} \quad d = a \cos \omega t$$

Where  $a$  and  $\omega$  are real numbers such that  $\omega > 0$ .

The motion has amplitude  $|a|$ , period  $\frac{2\pi}{\omega}$  and frequency  $\frac{\omega}{2\pi}$

8) A ball is bobbing up and down on the end of a spring. You know that 10 cm is the maximum distance the ball moves vertically upward or downward from its equilibrium (at rest) position. It takes the ball 4 seconds to complete one full cycle of traveling between its max and min. *and back again*

- a) Write an equation for simple harmonic motion of the ball.



$$d = 10 \sin \frac{\pi}{2} t$$

$$4 = \frac{2\pi}{\omega} \Rightarrow \omega = \frac{2\pi}{4} = \frac{\pi}{2}$$

- b) What is the frequency of this harmonic motion?

$$4 = \frac{2\pi}{\omega} \Rightarrow \omega = \frac{\pi}{2}$$

$$\text{freq} = \frac{\frac{\pi}{2}}{2\pi} \cdot \frac{1}{\frac{1}{2\pi}} = \frac{1}{4} \text{ cycle per second}$$

## 4.8 – Word Problems again!!

HW: 4.8 p.359-361 #3,8,17,21,26,31,34,37,40, 60 (slightly different than the online assignment)