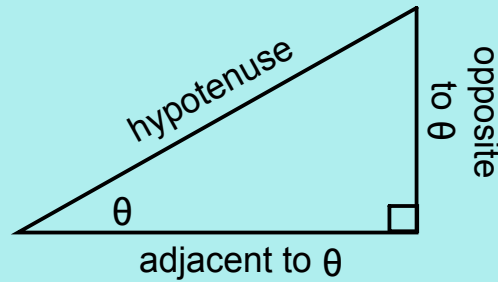


For any angle of interest, there are three (3) primary trigonometric ratios.

$$\text{sine of } \theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\text{cosine of } \theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\text{tangent of } \theta = \frac{\text{opposite}}{\text{adjacent}}$$



S o h C a h T o a

Dec 7-9:58 PM

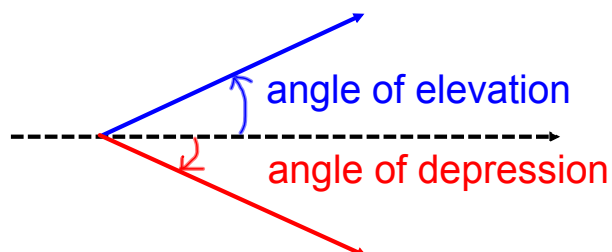
### Solving Problems with Trigonometric Ratios

Dec 13/2011

#### Terminology:

Angle of Elevation (or Inclination): the angle measured above the horizontal.

Angle of Depression (or Declination): the angle measured below the horizontal.



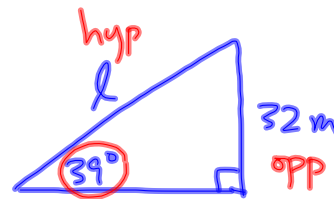
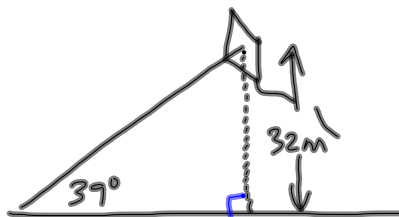
Dec 9-9:41 PM

Steps:

- 1) Identify the unknown (what are you looking for?)
- 2) Label the sides of the triangle as opposite, hypotenuse, and adjacent with respect to the given angle (or the unknown if angle is what you are looking for)
- 3) Identify the trigonometric ratio that relates to the unknown and two of the unknowns OR Pythagorean Theorem OR the sum of the angles in a triangle.
- 4) Solve

May 13-12:15 PM

Ex.1 A kite is 32 m above the ground. The string makes an angle of  $39^\circ$  with the ground. How long is the string?



~~Soh Cah Toa~~

$$\sin 39^\circ = \frac{32}{l}$$

$$l \sin 39^\circ = 32$$

$$l = \frac{32}{\sin 39^\circ}$$

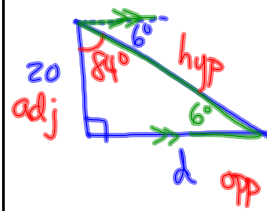
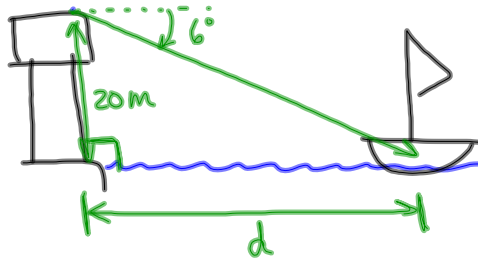
$$l = \frac{32}{0.6293}$$

$$l = 50.8$$

$\therefore$  the string  
is 50.8 m  
long.

Dec 10-10:22 PM

Ex.2 A lighthouse observation deck is about 20 m above sea level. A boat is viewed at an *angle of depression* of  $6^\circ$ . How far is the boat from the base of the lighthouse?



Soh Cah Toa

$$\tan 84^\circ = \frac{d}{20}$$

$$d = 20 \tan 84^\circ$$

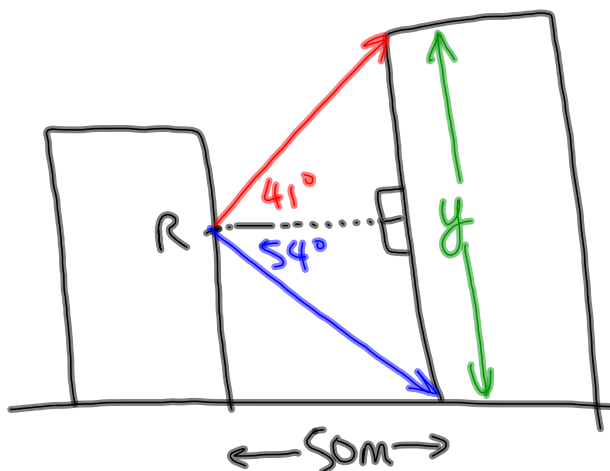
$$d \approx 20 (9.5143)$$

$$d \approx 190.287$$

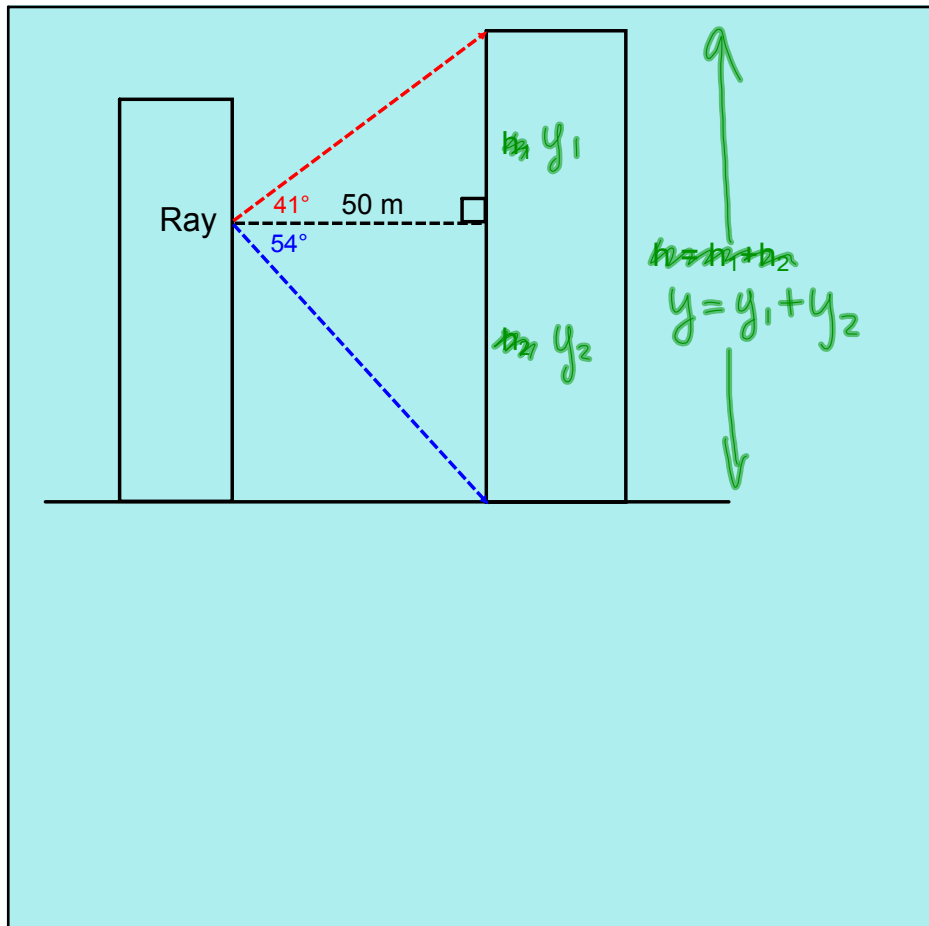
$\therefore$  the boat is 190 m from lighthouse

Dec 10-10:23 PM

Ex.3 From the window of a building, Ray finds the angle of elevation to the top of a second building to be  $41^\circ$ . The angle of depression to the bottom is  $54^\circ$ . The buildings are 50 m apart. How tall is the second building?



Dec 10-10:25 PM



Dec 10-10:33 PM

Solve one triangle for  $y_1$  and the other triangle for  $y_2$

Soh Cah Toa

$$\tan 41^\circ = \frac{y_1}{50}$$

$$y_1 = 50 \tan 41^\circ$$

$$y_1 = 50 (0.8693)$$

$$y_1 = 43.4643$$

Soh Cah Toa

$$\tan 54^\circ = \frac{y_2}{50}$$

$$y_2 = 50 \tan 54^\circ$$

$$y_2 = 68.8190$$

$$y = y_1 + y_2$$

$$y = 112.2833$$

$\therefore$  the 2nd building is 112.3 m high.

Dec 10-10:33 PM

Assigned Work:

p.412 # 2, 3, 7, 10, 11

Dec 10-10:43 PM

7.

$3\text{m} = 300\text{cm}$

$2.5\text{cm}$

$\theta$

adj

opp

hyp

Soh Cah (Toa)

$$\tan \theta = \frac{2.5}{300}$$
$$\theta \doteq 0.5^\circ$$

$\therefore$  the pipe must be installed at an angle of  $0.5^\circ$ .

Dec 14-9:13 AM

10.

opp  
48km

350km  
hyp

adj

$\theta$

Soh Cah Toa

$$\sin \theta = \frac{48}{350}$$

$$\theta = 7.9^\circ$$

$\therefore$  the plane is  $7.9^\circ$  off course.

Dec 14-9:18 AM

11.

35°

30°

65m

x

65-x

y

Soh Cah Toa

Soh Cah Toa

$$\tan 35^\circ = \frac{y}{x}$$

$$0.7002 = \frac{y}{x}$$

$$0.7002x = y \quad \text{①}$$

$$\tan 30^\circ = \frac{y}{65-x}$$

$$0.5774 = \frac{y}{65-x}$$

$$0.5774(65-x) = y \quad \text{②}$$

Sub ① into ②

$$37.5278 - 0.5774x = 0.7002x$$

$$37.5278 = 0.7002x + 0.5774x$$

$$37.5278 = 1.2776x$$

$$\frac{37.5278}{1.2776} = \frac{1.2776x}{1.2776}$$

$$x = 29.3737$$

Sub x into  $y = 0.7002x$

$$y = 0.7002(29.3737)$$

$$y = 20.5675$$

$\therefore$  the tree is 20.6 m tall.

Dec 14-9:23 AM