

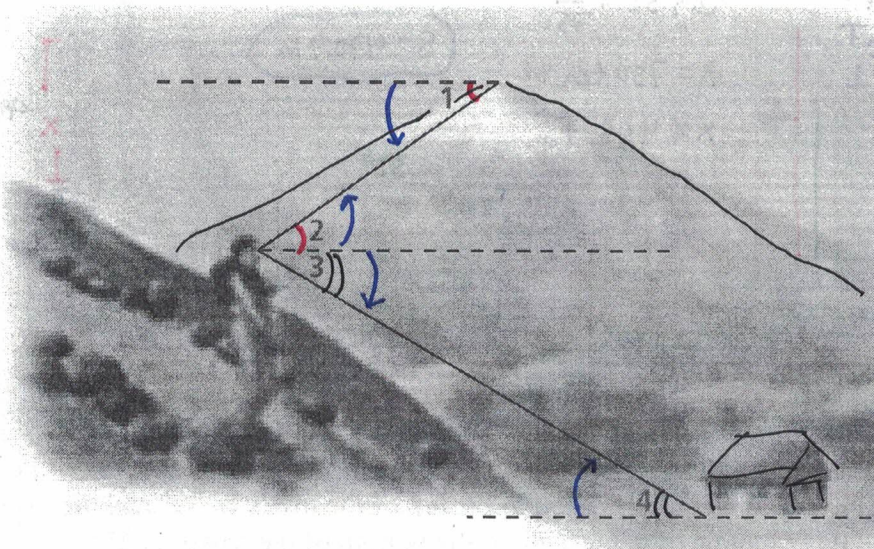
– **angle of elevation** → an angle between a horizontal line and a line of sight where the angle is ABOVE the horizontal line.

– **angle of depression** → an angle between a horizontal line and a line of sight where the angle is BELOW the horizontal line.

Couple of Things to Notice:

- 1.) The two horizontal lines are parallel to each other and the angle of elevation and depression are congruent. Angles that do this are called Alternate Interior Angles.
- 2.) If you draw in a vertical line, then a Right Triangle is formed.

Example 1: Describe each angle as it relates to the situation shown.



Angle 1: Angle of Depression
from the peak to hiker

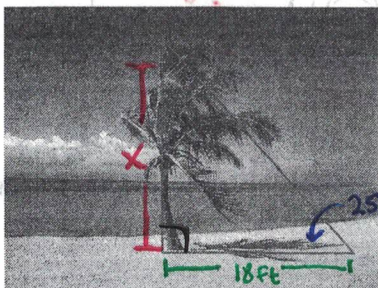
Angle 2: Angle of Elevation
from the hiker to the peak

Angle 3: Angle of Depression
from the hiker to the cabin

Angle 4: Angle of Elevation
from the cabin to the hiker

Example 2: Label each diagram and then complete each word problem. Round to tenth place.

a.) A palm tree casts a shadow of 18 feet long. The angle of elevation of the sun is 25.7° . Find the height of the palm tree.



$$\tan \theta = \frac{o}{a}$$

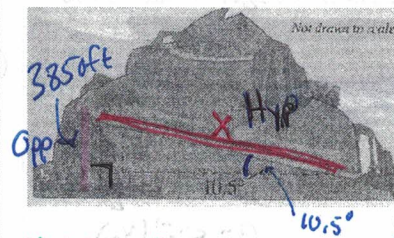
$$\tan 25.7 = \frac{x}{18}$$

$$x = 18 \tan 25.7$$

$$x \approx 8.7$$

Palm tree is 8.7 ft tall

b.) A sign on a roadway at bottom of a mountain road indicates that the road will incline 10.5° with the ground. The altitude for a car ascending up the mountain road is 3,850 ft. Find the length of the mountain road in miles.



$$\sin \theta = \frac{o}{h}$$

$$\sin 10.5 = \frac{3850}{x}$$

$$x = \frac{3850}{\sin 10.5}$$

$$x \approx 21126.5 \text{ ft}$$

* Convert to miles *

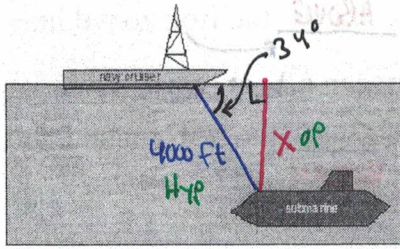
* 5280 ft = 1 mi

1760 yd = 1 mi

$$\frac{21126.5}{5280} = 4 \text{ mi}$$

The road is 4 miles long.

c.) The sonar of a navy cruiser detects a submarine that is 4000 feet from the cruiser. The angle between the water line and the submarine is 34° . How deep is the submarine? $\sin \theta = \frac{O}{H}$



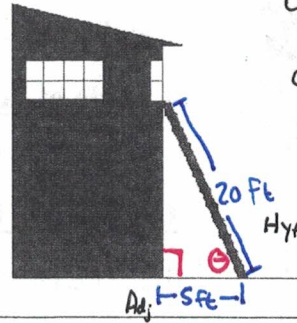
$$\sin 34 = \frac{X}{4000}$$

$$X = 4000 \sin 34$$

$$X \approx 2236.8 \text{ ft}$$

The depth of the submarine is 2236.8 ft

d.) A 20-ft ladder leans against a house and the base of the ladder is 5 feet from the base of the house. What is the angle formed by the ladder and the ground?



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

$$\cos \theta = \frac{5}{20}$$

$$\theta = \cos^{-1}(5/20)$$

$$\theta = 75.5^\circ$$

The angle formed is 75.5°

e.) From a point on the ground 500 feet from the base of the building, it is observed that the angle of elevation to the top of the building is 24° and the angle of elevation to the top of the flagpole atop of the building is 27° . Find the height of the flagpole.

① Find h

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

$$\tan 24 = \frac{h}{500}$$

$$h = 500 \tan 24$$

$$h \approx 222.6 \text{ ft}$$

② Find k

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

$$\tan 27 = \frac{k}{500}$$

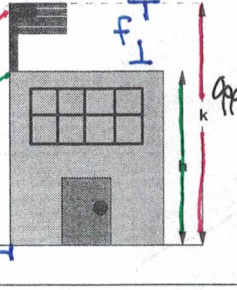
$$k = 500 \tan 27$$

$$k \approx 254.8 \text{ ft}$$

③ $f = k - h$

$$f = 254.8 - 222.6$$

$$f = 32.2 \text{ ft}$$



Flag pole is 32.2 ft tall

f.) A 2 meter television camera at ground level is filming the lift-off of a space shuttle at a point 750 meters from the launch pad. The camera's angle of elevation to the shuttle is 32° at this specific time. Find the height of the shuttle.

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

$$\tan 32 = \frac{X}{750}$$

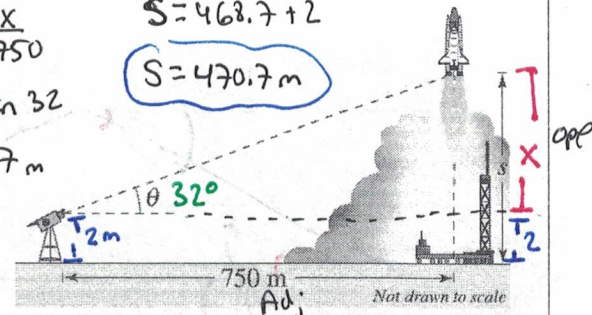
$$X = 750 \tan 32$$

$$X \approx 468.7 \text{ m}$$

$$S = X + 2$$

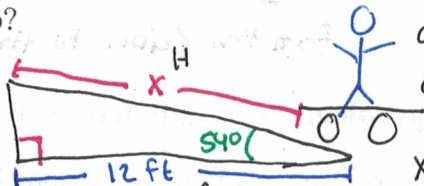
$$S = 468.7 + 2$$

$$S = 470.7 \text{ m}$$



Example 3: Draw a diagram and then complete each word problem. Round to tenth place.

a.) A skateboard ramp at a park has an inclination of 54° and its base is 12 feet long. What is the length of the ramp?



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

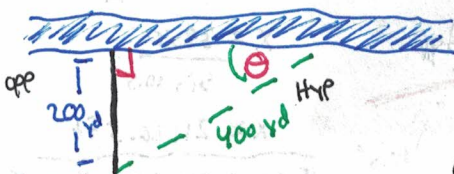
$$\cos 54 = \frac{12}{X}$$

$$X = \frac{12}{\cos 54}$$

$$X = 20.4 \text{ ft}$$

The ramp is 20.4 ft long

b.) You are 200 yards from a river. Rather than walking directly to the river, you walk 400 yards along a straight path to the river's edge. What is the angle between this path and the river's edge?



$$\sin \theta = \frac{O}{H}$$

$$\sin \theta = \frac{200}{400}$$

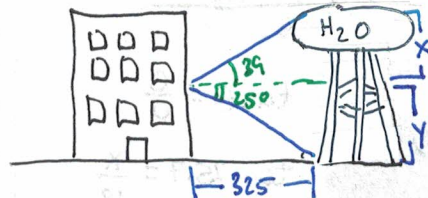
$$\sin \theta = \frac{1}{2}$$

$$\theta = \sin^{-1}(1/2)$$

$$\theta = 30^\circ$$

The angle is 30°

c.) A water tower is located 325 feet from a building. From a window in the building it is observed that the angle of elevation to the top of the tower is 39° and the angle of depression to the bottom of the tower is 25° . How tall is the tower?



$$t = x + y$$

$$\textcircled{1} \tan 39 = \frac{x}{325}$$

$$x = 325 \tan 39$$

$$x = 263.2 \text{ ft}$$

$$\textcircled{2} \tan 25 = \frac{y}{325}$$

$$y = 325 \tan 25$$

$$y = 151.5$$

$$\textcircled{3} t = x + y$$

$$= 263.2 + 151.5$$

$$t = 414.7 \text{ ft}$$

Water tower is 414.7 ft tall