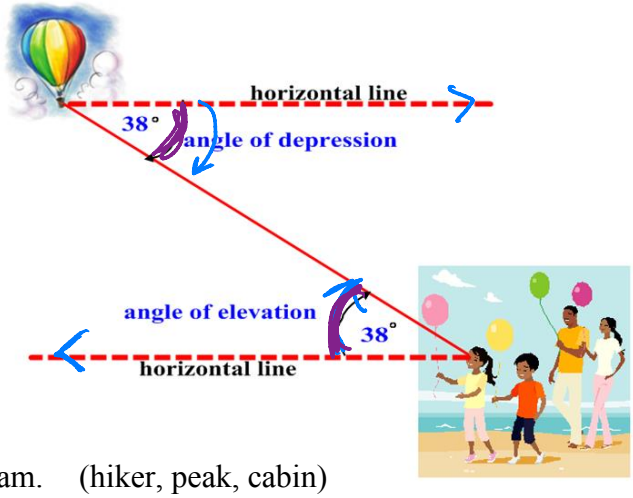
Honors Math 2: Angles of Elevation and Depression



Angles of Elevation and Depression

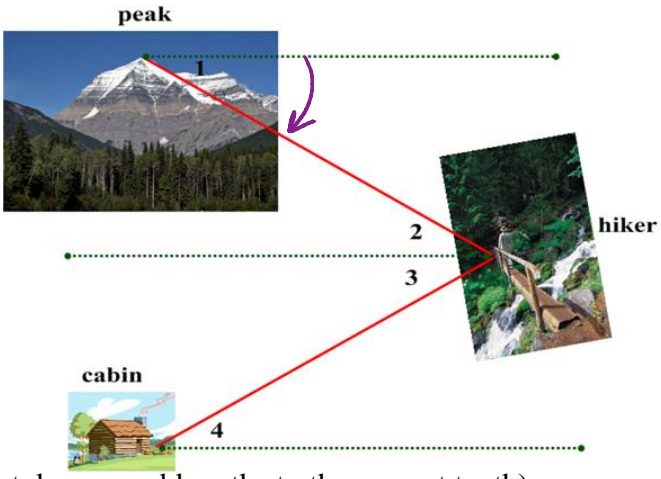
Angle of Elevation: the angle formed by a horizontal line and the line of sight to an object at a higher level

Angle of Depression: the angle formed by a horizontal line and the line of sight to an object at a lower level

1. Describe each angle as it relates to the objects in the diagram. (hiker, peak, cabin)

a.) ∠ 1 angle of depression

b.) ∠4 angle of elevation



2. Determine each angle from the description below:

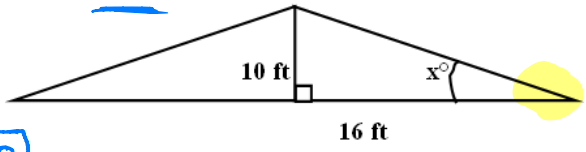
a.) angle of depression from hiker to cabin ∠3

b.) angle of elevation from hiker to peak ∠2

Trig Applications: (find angle measures to the nearest degree and lengths to the nearest tenth)

1. A roof is constructed as shown in the diagram. Find the pitch. (angle of elevation of the roof)

soh - cah - toa

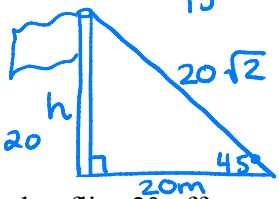


$\tan x = \frac{10}{16}$

$x = \tan^{-1}\left(\frac{10}{16}\right) \approx 32.0°$

2. At a point 20 meters from a flagpole, the angle of elevation to the top of the pole is 45°. How tall is the flagpole?

45° - 45° - 90°



20m

3. If a rocket flies 2° off course for 1000 miles, how far from the correct path will the rocket be?

$\sin 2° = \frac{x}{1000}$

$1000 \sin 2° = x$

$x \approx$ 34.9 miles

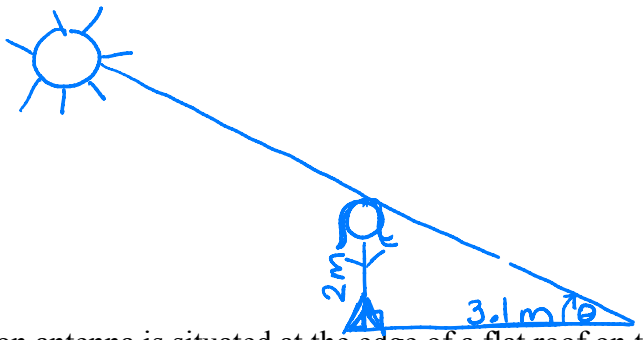
4. As it leans against a building, a 9-meter ladder makes an angle of 55° with the ground. How far is the bottom of the ladder from the base of the building?

$\cos 55° = \frac{x}{9}$

$9\cos 55° = x$

$x \approx \boxed{5.2\text{m}}$

5. What is the angle of elevation of the sun when a woman who is 2 meters tall casts a shadow of 3.1 meters?

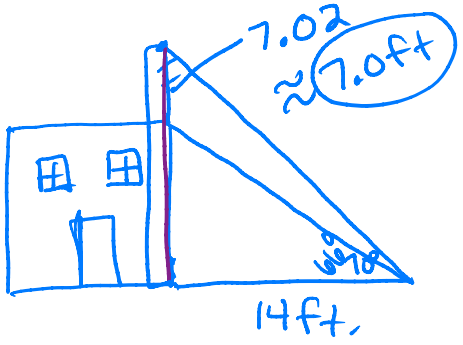


$\tan\theta = \frac{2}{3.1}$ TOA

$\theta = \tan^{-1}\left(\frac{2}{3.1}\right)$

$\theta \approx \boxed{32.8°}$

6. A television antenna is situated at the edge of a flat roof on top of a house that is located on level ground. From a point 14 feet from the base of the house on the side where the antenna is placed, the angles of elevation to the top and bottom of the antenna measure 70° and 66°, respectively. How tall is the house? How tall is the antenna?



$\tan 66° = \frac{h}{14}$

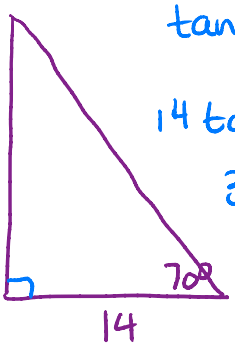
$14\tan 66° = h$

31.44ft. ft.

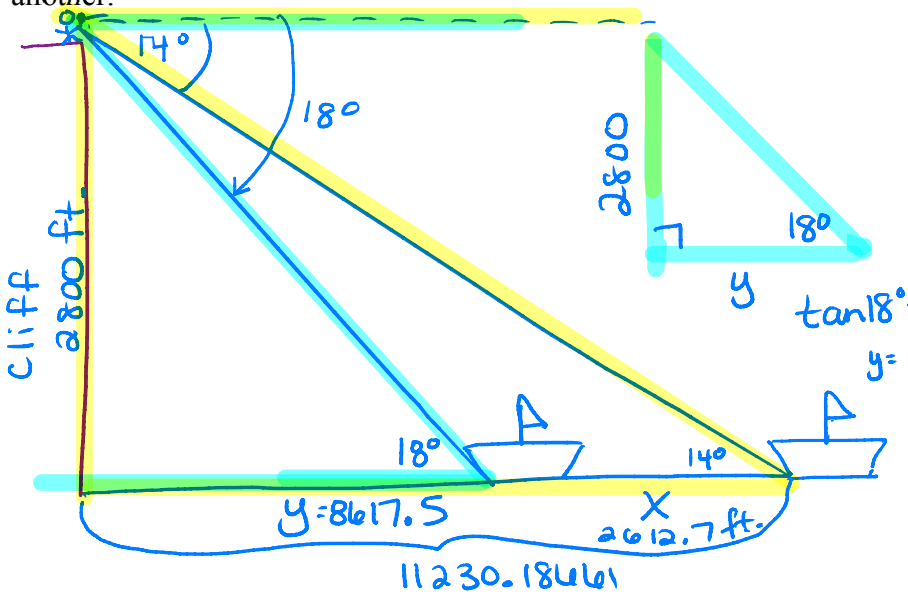
$\tan 70° = \frac{d}{14}$

$14\tan 70° = d$

38.46ft.



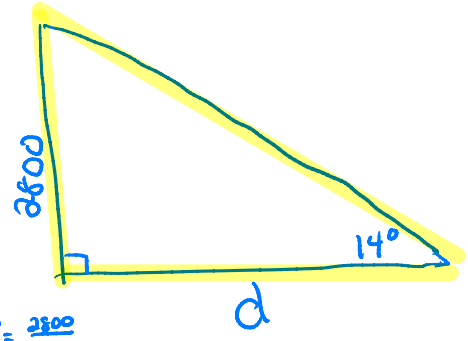
7. From the top of a cliff, an observer views two boats sailing on a lake. The observer and the two boats lie in the same vertical plane and the base of the cliff is on the lake shore. If the observer's eyes are 2800 feet above lake level and the angles of depression are 18° and 14°, find the distance from one boat to another.



$\tan 18° = \frac{2800}{y}$

$y = \frac{2800}{\tan 18°}$

$y = 8617.5$



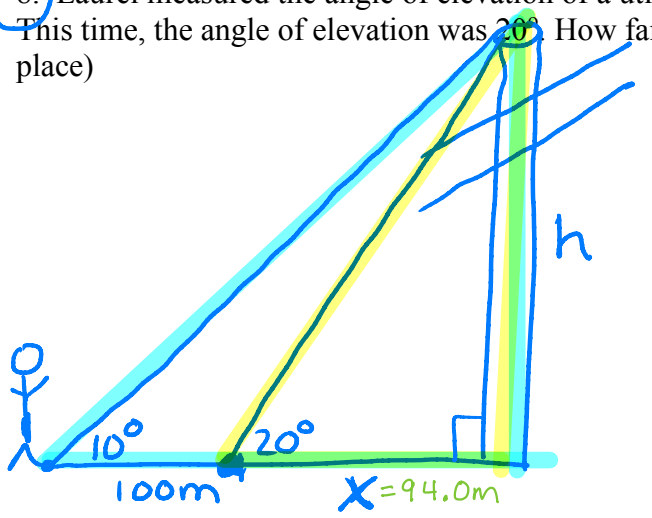
$\tan 14° = \frac{2800}{d}$

$d = \frac{2800}{\tan 14°}$

$d = 11230.186461$

★ Extra credit!

8. Laurel measured the angle of elevation of a utility pole and found it to be 10°. She walked 100m closer. This time, the angle of elevation was 20°. How far is she now from the base of the pole? (answer to 1 decimal place)



$x \tan 20° = \frac{h}{x} \cdot x$

$x \tan 20° = h$

$(x+100)\tan 10° = \frac{h}{(x+100)} \cdot (x+100)$

$(x+100)\tan 10° = h$

$x \tan 20° = (x+100)\tan 10°$

$x\tan 20° = x\tan 10° + 100\tan 10°$

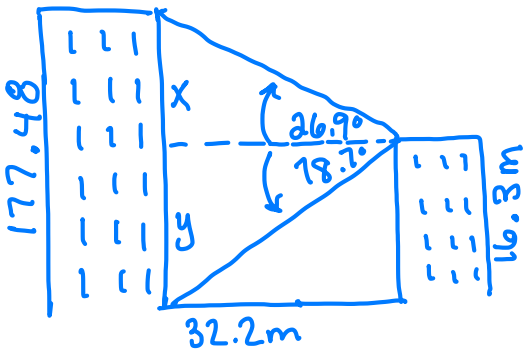
$x\tan 20° - x\tan 10° = 100\tan 10°$

$x(\tan 20° - \tan 10°) = 100\tan(10°)$

$\frac{x(\tan 20° - \tan 10°)}{(\tan 20° - \tan 10°)} = \frac{100\tan(10°)}{\tan(20°) - \tan(10°)}$

$x \approx 94.0\text{ m}$

9. Two towers are 32.2m apart. From the top of the shorter one, the angle of elevation to the top of the other is 26.9°, while the angle of depression to the base is 78.7°. Find the sum of the tower heights to the nearest tenth of a meter.



$\tan 26.9° = \frac{x}{32.2}$

$32.2\tan 26.9° = x$

$x \approx 16.336$

$\tan 78.7° = \frac{x}{32.2}$

$32.2\tan 78.7 = x$

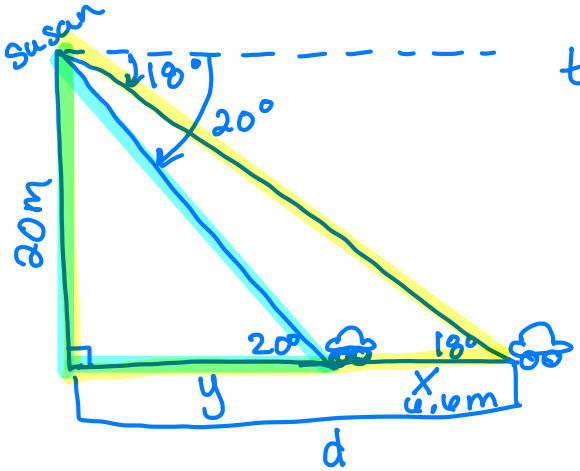
161.145

Sum = taller + shorter

Sum = $x + y$ + x

Sum = $2x + y = \boxed{193.8\text{ m}}$

10. From the window of a building Susan is 20m above the street. She looks from the window and sees two cars. One is at an angle of depression of 18° and the other at an angle of depression of 20°. The cars and the building are in a straight line (the cars are on the same side of the building). Find the distance between the cars to the nearest tenth of a meter.



$\tan 20° = \frac{20}{y}$

$y = \frac{20}{\tan 20°}$

$y \approx 54.9495$

$\tan 18° = \frac{20}{d}$

$d = \frac{20}{\tan 18°}$

$d \approx 61.55367$

$x = d - y$

$x = \frac{20}{\tan 18°} - \frac{20}{\tan 20°}$

$x \approx \boxed{6.6\text{m}}$