Angles of Depression and Elevation

1. At a point on the ground 40 meters from the foot of a tree, the angle of elevation to the top of the tree is 38°. Find the height of the tree.

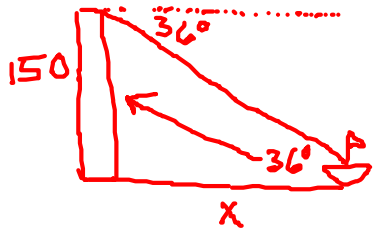
$$\tan x = \frac{opp}{adj}$$

$$\frac{\tan 38}{1} = \frac{x}{40}$$

$$x = 40 \cdot \tan 38$$

$$\boxed{x = 31 \text{ meters}}$$

2. From the top of a lighthouse 150 feet above sea level, the angle of depression of a boat at sea is 36°. Find the distance from the boat to the base of the lighthouse.



$$\tan x = \frac{opp}{adj}$$

$$\frac{\tan 36}{1} = \frac{150}{x}$$

$$\frac{\tan 36 \cdot x}{\tan 36} = \frac{150}{\tan 36}$$

$$x = \frac{150}{\tan 36}$$

$$\boxed{x = 206 \text{ feet}}$$

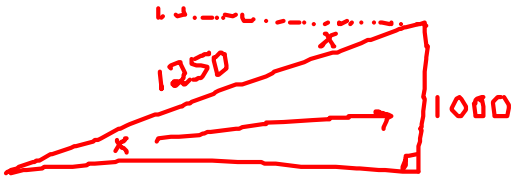
3. A train rises vertically 35 feet over a horizontal distance of 650 feet. What is the train's angle of elevation?

$$\tan x = \frac{opp}{adj}$$

$$\tan x = \frac{35}{650}$$

$$\boxed{x = 3^\circ}$$

4. Danielle is at the top of a ski slope that is 1,000 feet high. If the length of the slope is 1,250 feet, what is the angle of depression from the top of the ski slope to the bottom?

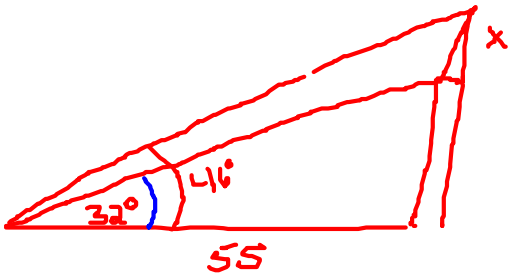


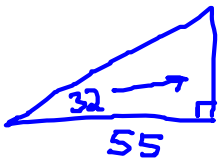
$$\sin x = \frac{opp}{hyp}$$

$$\sin x = \frac{1000}{1250}$$

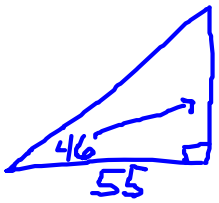
$$\boxed{x = 53^\circ}$$

5. From a point 55 feet from a church, the angles of elevation to the base and top of the steeple are 32° and 46° respectively. Find the height of the steeple.





a = height of church



b = height of church and steeple

$\tan x = \frac{opp}{adj}$

$\frac{\tan 32}{1} = \frac{a}{55}$

$a = 55 \cdot \tan 32$

$a = 34$ feet (height of church)

$\tan x = \frac{opp}{adj}$

$\frac{\tan 46}{1} = \frac{b}{55}$

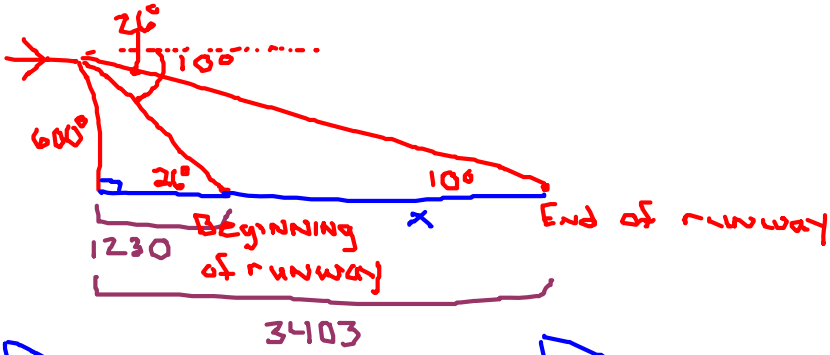
$b = 55 \cdot \tan 46$

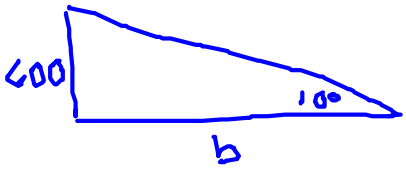
$b = 57$ feet (height of church + steeple)

$57 - 34$

$= \boxed{23 \text{ feet (steeple)}}$

6. An airplane approaches a runway. The angle of depression from the pilot to the end of the runway is 10° and the angle of depression to the beginning of the runway is 26°. Find the length of the runway if the airplane is 600 feet above the ground?





$3403 - 1230$

$= 2173$ feet length of runway

$\tan x = \frac{opp}{adj}$

$\frac{\tan 26}{1} = \frac{600}{a}$

$a \cdot \frac{\tan 26}{\tan 26} = \frac{600}{\tan 26}$

$a = 1230$ feet

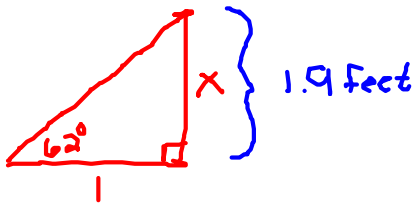
$\tan x = \frac{opp}{adj}$

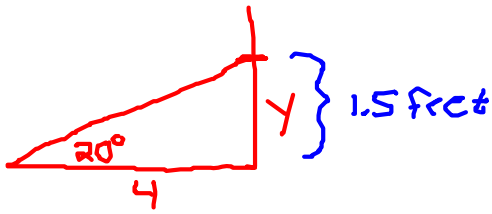
$\frac{\tan 10}{1} = \frac{600}{b}$

$b \cdot \frac{\tan 10}{\tan 10} = \frac{600}{\tan 10}$

$b = 3403$ feet

7. A ladder leans against a wall. When the ladder is 1 foot from the wall, the angle between the ground and the base of the ladder is 62°. When the base of the ladder is moved so that it is 4 feet from the wall, the angle between the ground and the base of the ladder is 20°. Find the difference in the height up the wall from when the ladder is 1 foot and 4 feet from the wall.





$\tan x = \frac{opp}{adj}$

$\tan 62 = \frac{x}{1}$

$x = \tan 62$

$x = 1.9$ feet

$\tan x = \frac{opp}{adj}$

$\tan 20 = \frac{y}{4}$

$y = 4 \cdot \tan 20$

$y = 1.5$ feet

$$\begin{array}{r} 1.9 \\ -1.5 \\ \hline .4 \end{array}$$

$\boxed{\text{.4 feet} \quad \text{4.8 inches}}$