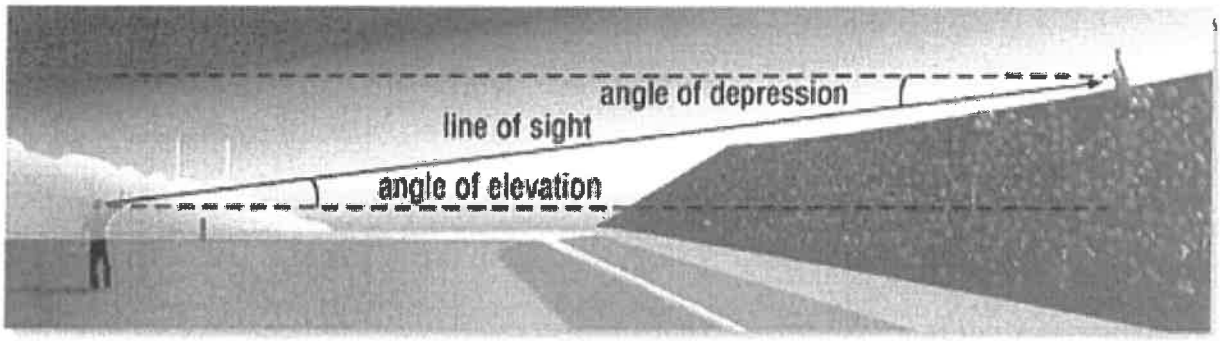
Angle of Elevation the angle formed by a horizontal line and an observers line of sight to an object above the horizontal line

Angle of Depression the angle formed by a horizontal line and an observers line of sight to an object below the horizontal line



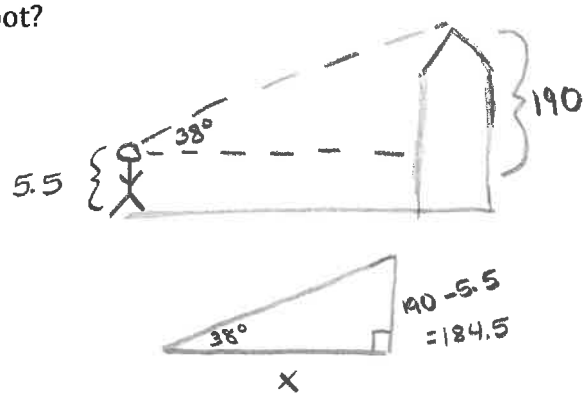
1. Leah wants to see a castle in an amusement park. She sights the top of the castle at an angle of elevation of 38°. She knows that the castle is 190 feet tall. If Leah is 5.5 feet tall, how far is she from the castle to the nearest foot?

$\tan 38 = \frac{184.5}{x}$

$x \tan 38 = 184.5$

$x = \frac{184.5}{\tan 38}$

$x \approx 236.1$ ft

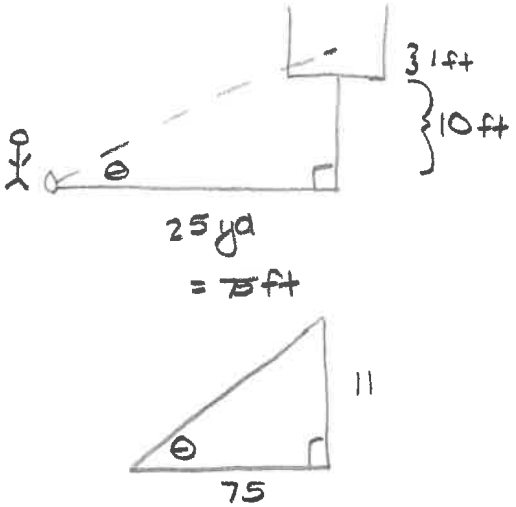


2. The cross bar of a goalpost is 10 feet high. If a field goal attempt is made 25 yards from the base of the goalpost that clears the goal by 1 foot, what is the smallest angle of elevation at which the ball could have been kicked to the nearest degree?

$\tan \theta = \frac{11}{75}$

$\theta = \tan^{-1}(11/75)$

$\theta = 8.3°$

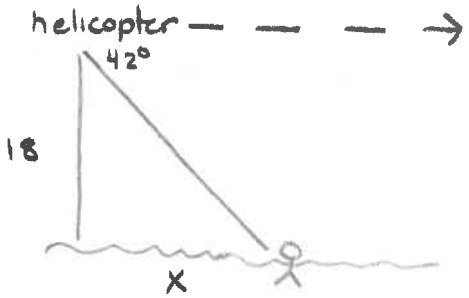


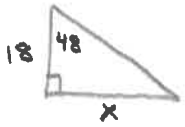
3. A search and rescue team is airlifting people from the scene of a boating accident when they observe another person in need of help. If the angle of depression to this other person is 42° and the helicopter is 18 feet above the water, what is the horizontal distance from the rescuers to this person to the nearest foot?

$\tan 48 = \frac{x}{18}$

$18 \tan 48 = x$

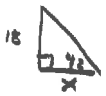
20 ft $\approx x$





90 - 42 = 48

or

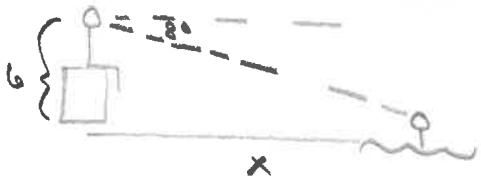


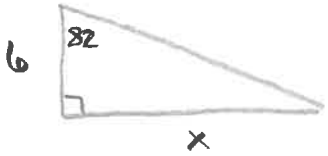
4. A lifeguard is watching a beach from a line of sight 6 feet above the ground. She sees a swimmer at an angle of depression of 8°. How far away from the tower is the swimmer?

$\tan 82 = \frac{x}{6}$

$6 \tan 82 = x$

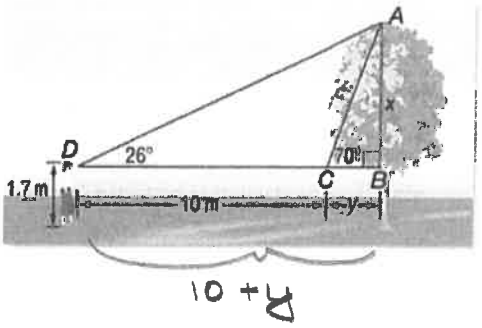
42.7 ft $\approx x$





Angles of Elevation or Depression to **two** different objects can be used to estimate the distance between those objects. Similarly, the angles from two different positions of observation to the same object can be used to estimate the object's height.

5. To estimate the height of a tree she wants removed, Mrs. Long sights the tree's top at a 70° angle of elevation. She then steps back 10 meters and sights the top at a 26° angle. If Mrs. Long's line of sight is 1.7 meters above the ground, how tall is the tree to the nearest meter?



ΔABC $\qquad$ ΔABD

$\tan 70 = \frac{x}{y}$ $\qquad$ $\tan 26 = \frac{x}{10+y}$

* both have x → substitute!

$y\tan 70 = x$ $\qquad$ $(10+y)\tan 26 = x$

$y\tan 70 = (10+y)\tan 26$

$y\tan 70 = 10\tan 26 + y\tan 26$

$y\tan 70 - y\tan 26 = 10\tan 26$

$y(\tan 70 - \tan 26) = 10\tan 26$

$y = \frac{10\tan 26}{\tan 70 - \tan 26}$

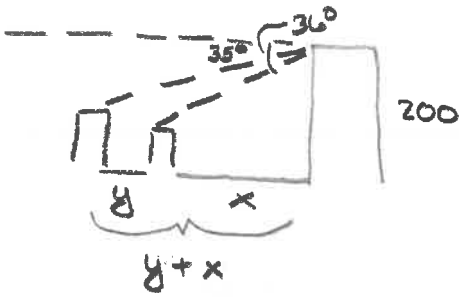
$y \approx 2.16$ $\qquad$ * use + x

$2.16\tan 70 = x$ $\qquad$ $x \approx 5.9$

Tree = 5.9 + 1.7

≈ 8 m

6. Two buildings are sited from atop a 200-meter skyscraper. Building A is sited at a 35° angle of depression, while Building B is sited at a 36° angle of depression. How far apart are the two buildings to the nearest meter?



$\tan 54 = \frac{x}{200}$ $\qquad$ $\tan 55 = \frac{y+x}{200}$

$200\tan 54 = x$ $\qquad$ $200\tan 55 = y + x$

$200\tan 55 - y = x$

$200\tan 54 = 200\tan 55 - y$

$y = 200\tan 55 - 200\tan 54$

$y \approx 10.35\text{m}$