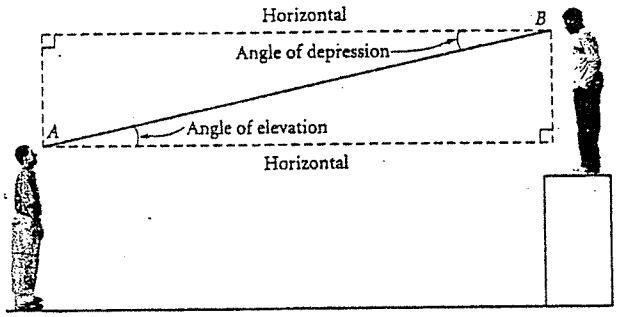
Geometry (H)
Section 8.7 – Applications of Trigonometry

Name: KEY

Right triangle trigonometry is often used indirectly to find the height of a tall object. To solve a problem of this type, measure the angle from the horizontal to your line of sight when you look at the top or bottom of the object. (See diagram below.)

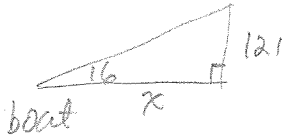
If you look up, you measure the **angle of elevation**.

If you look down, you measure the **angle of depression**.



Let's look at several examples.

1. The angle of elevation from a sailboat to the top of a 121-foot lighthouse on the shore measures 16°. To the nearest foot, how far is the sailboat from the shore?



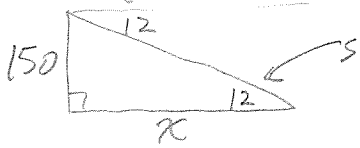
$\tan 16 = \frac{121}{x}$

$x \approx 422$ ft.

About 422 feet

* 2. From the top of a 150-foot high tower, an air traffic controller observes an airplane on the runway. To the nearest foot, how far from the base of the tower is the airplane?

Missing: ∠ of depression is 12°



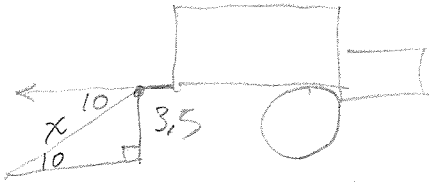
slow how arrive at 12

$\tan 12 = \frac{150}{x}$

$x \approx 705.7$

706 feet

3. The tailgate of a moving van is 3.5 feet above the ground. A loading ramp is attached to the rear of the van with an angle of depression of 10°. Find the length of the ramp to the nearest tenth of a foot.

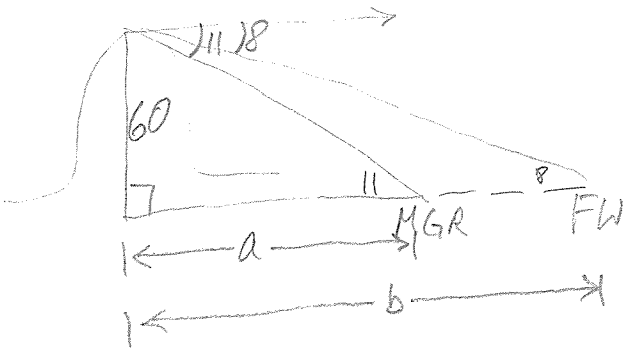


$\sin 10 = \frac{3.5}{x}$

$x \approx 20.1557$

About 20.2 ft.

4. From the top of a roller coaster, 60 yards above the ground, a rider looks down and sees the merry-go-round and the Ferris wheel. If the angles of depression are 11° and 8° respectively, how far apart are the merry-go-round and the Ferris wheel?



$\tan 11 = \frac{60}{a}$

$a \approx 308.6732$

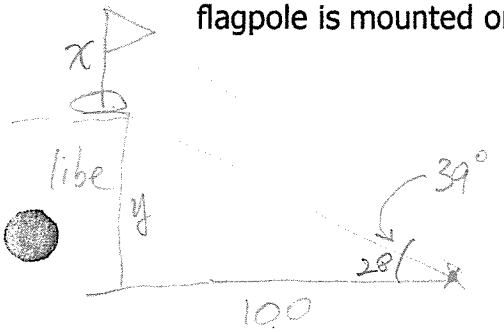
$\tan 8 = \frac{60}{b}$

$b \approx 426.9222$

$426.9 - 308.7 = 118.2$

≈ 118.2 yds apart

5. From a point 100 feet away in front of a public library, the angles of elevation to the base of the flagpole and the top of the flagpole are 28° and 39°, respectively. The flagpole is mounted on the front of the library's roof. Find the height of the pole.



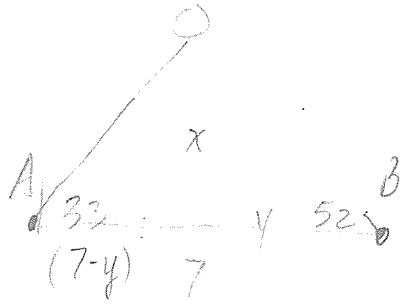
$\tan 28 = \frac{y}{100}$ $\quad \tan 39 = \frac{H}{100}$

$y \approx 53.1709$ $\quad H \approx 80.9784$

$80.9784 - 53.1709 \approx$ **27.8 ft.**

(last problem)

6. Two weather observation stations are 7 miles apart. A weather balloon is located between the stations. From Station A, the angle of elevation to the weather balloon is 33 °. From Station B, the angle of elevation to the balloon is 52°. Find the altitude of the balloon.



(B) $\tan 52 = \frac{x}{y}$ $\quad y \tan 52 = x$

(A) $\tan 33 = \frac{y \tan 52}{(7-y)}$ ← substituted $x = y \tan 52$

$(7-y)\tan 33 = y \tan 52$

no calculator

$7\tan 33 - y\tan 33 = y\tan 52$

$7\tan 33 = y(\tan 52 + \tan 33)$

calculator → $\frac{7\tan 33}{(\tan 52 + \tan 33)} = y$

$2.3562 \approx y$

$x = 2.3562 \tan 52$

$x \approx 3.0157$

altitude is about 3 miles.

height $= \frac{7(\tan 33)(\tan 52)}{(\tan 52 + \tan 33)}$ ← exact