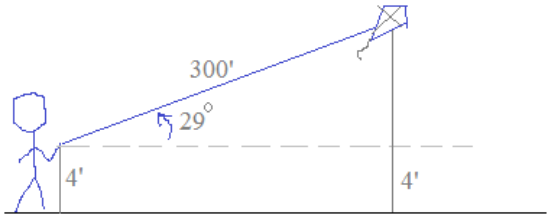
Trigonometry Word Problems

Basic Steps:

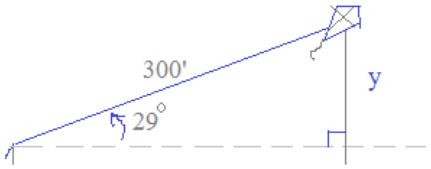
1) Draw a picture
2) Label the parts
3) Isolate the triangle
4) Solve
5) Answer the question

Example: You fly a kite 4 feet off the ground with 300 feet of string. There is a 40 mile per hour wind, and the kite forms a 29° angle from the ground.
How high is the kite (from the ground)?

Draw a picture and label the parts



Isolate the triangle and Solve



Since we have a right triangle -- with an angle and hypotenuse -- we can use the sine function to find the "opposite" side.

$$\sin(29^\circ) = \frac{y}{300'}$$

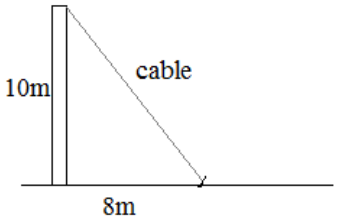
$$y = 300'(.485) = 145.4'$$

Answer the question! Since the triangle is 4 feet off the ground, we need to add 4' to determine the height of the kite *from the ground*.

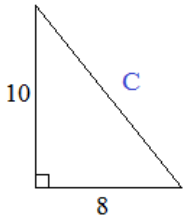
Therefore, the kite is approximately 149.4' from the ground.

Example: A cable is attached to a pole 10 meters high. If the other end is attached to the ground 8 meters from the base of the pole. How long is the cable?

Draw a picture and label the parts



Isolate the triangle and solve



Since it is a right triangle, Pythagorean theorem will determine the length of the cable...

$$8^2 + 10^2 = C^2$$

$$C^2 = 164$$

$$\text{Length of Cable} = \sqrt{164}$$

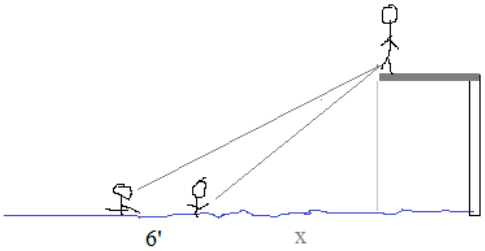
$$= 2\sqrt{41}$$

approx. 12.8 meters

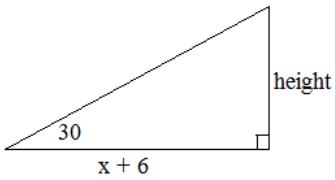
Trigonometry Word Problems

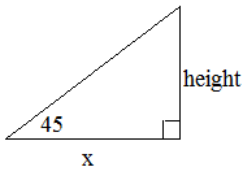
Example: A diver stands on a diving board above 2 swimmers.
The angle of depression from the diver to each swimmer
is 30 and 45 degrees.
If the swimmers are 6 feet apart, how high is the diving board?

Step 1: Draw a picture



Step 2: Determine the right triangle(s)





Step 3: Solve

$\tan(45) = \frac{(\text{height})}{x}$ $\quad h = x\tan(45)$

$\tan(30) = \frac{(\text{height})}{x+6}$ $\quad h = (x+6)\tan(30)$

$x\tan(45) = (x+6)\tan(30)$

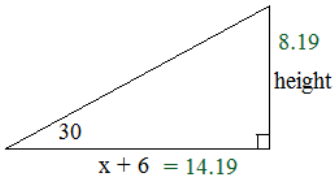
$x(1) = (x+6)(.577)$

$x = .577x + 3.464$

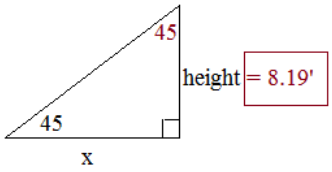
$.423x = 3.464$

$x = 8.19$ feet

Step 4: Check



Then, if x = 8.18....

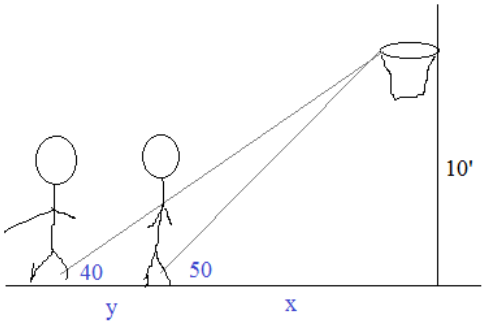


30-60-90 triangle...

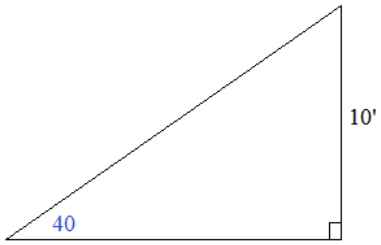
8.18 x $\sqrt{3}$ = 14.184 ✓

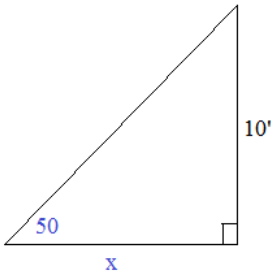
Example: Two players stand on a basketball court.
The angles of elevation from the foot of each player to the 10' high basket are
40 and 50 degrees.
How far apart are the players from each other?

Step 1: Sketch



Step 2: Identify triangles and label





Step 3: Solve

$\tan(50) = \frac{10'}{x}$ $\qquad \tan(40) = \frac{10'}{x+y}$

$x = \frac{10'}{1.19} = 8.39$ $\qquad x + y = \frac{10'}{.84} = 11.91$

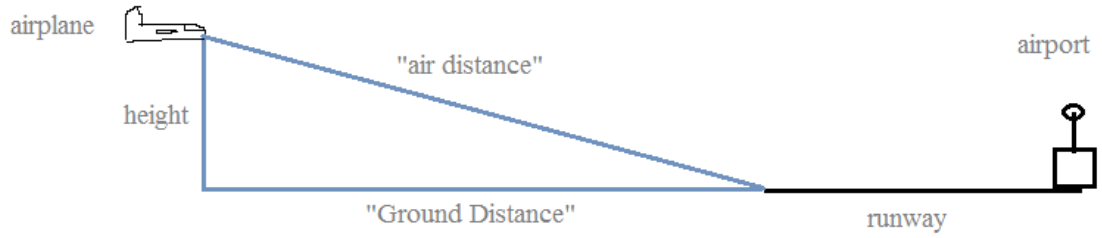
therefore, y = 3.52 feet

Angle of Elevation vs. Angle of Depression

Recognizing and identifying angle of elevation or angle of depression can be confusing.
Perhaps, this example will clarify the differences...

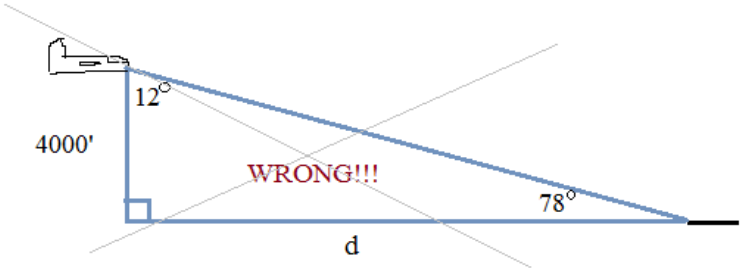
Example: An airplane is flying 4000 feet above the ground. If the angle of depression to the airport runway is 12 degrees, how far is the airplane from the runway? (what is the "ground distance?")

Step 1: Draw a picture



Step 2: Label the parts

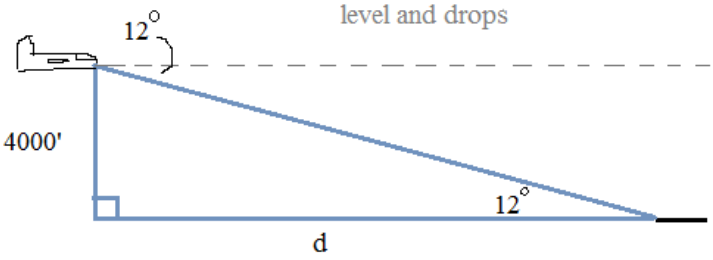
Step 3: Isolate the triangle



The *angle of depression* (from the plane to the runway) is 12 degrees..
Therefore the *angle of elevation* (from the runway to the plane) is also 12 degrees!

NOTE: From geometry theorems, "if parallel lines cut by a transversal, then *alternate interior angles* are congruent"...

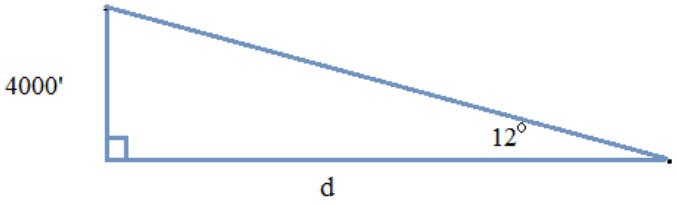
Notice, the angle of depression begins at the airplane's horizon level and drops



Step 4: Solve

$$\tan(12^\circ) = \frac{4000'}{d}$$

$$d = \frac{4000'}{\tan(12^\circ)} = 18{,}818 \text{ feet}$$



Step 5: Answer the question

The "ground distance" of the plane to the runway is approximately 18,818 feet