Trigonometry Survival Sheet
Steps for solving Trig problems (examples on the back)

1. **Label each side of the triangle** as
   H for hypotenuse (opposite 90° and usually the diagonal side)
   A for side adjacent to given angle (A & H form the given angle)
   O for the side opposite the given angle

2. **Determine** using the information (sides and angles) given in the problem **which of the trig functions you need** to solve for variable

$$\sin(\text{angle}) = \frac{\text{opp}}{\text{hyp}} \qquad \cos(\text{angle}) = \frac{\text{adj}}{\text{hyp}} \qquad \tan(\text{angle}) = \frac{\text{opp}}{\text{adj}}$$

$$\text{SOH} \qquad\qquad \text{CAH} \qquad\qquad \text{TOA}$$

3. **Set up an equation** using the trig function and the variable

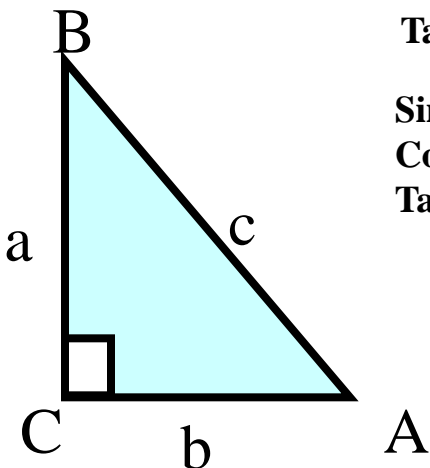4. **Solve for the variable** (based on where the variable is)

   Variable on top; multiply both sides by the bottom
   Variable on bottom: variable and trig function trade places
   Variable is angle: use inverse trig (2ⁿᵈ key then trig key)

$$\text{Trig function (angle°)} = \frac{\text{Some side}}{\text{Some other side}}$$

Trig Relationship between two acute angles

Sin A is opposite over hypotenuse: a/c
Cos A is adjacent over hypotenuse: b/c
Tan A is opposite over adjacent: a/b

Sin B is opposite over hypotenuse: b/c
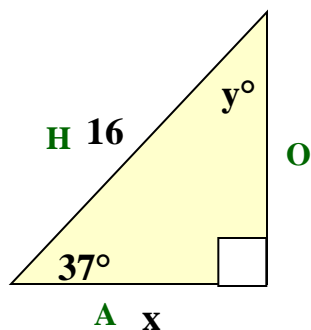Cos B is adjacent over hypotenuse: a/c
Tan B is opposite over adjacent: b/a

So, Sin A = Cos B and Cos A = Sin B

$a^2 + b^2 = c^2$ **(from Pythagorean Theorem)**

$m\angle A + m\angle B = 90°$ (3∠'s of △ = 180°)

Example 1: (variable on top)

1) 16 is H , x is A and no value for O
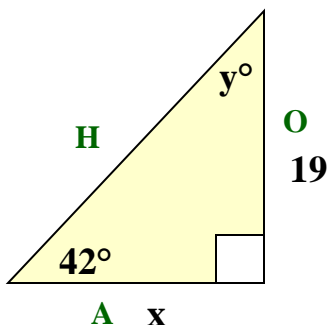
2) Since we have A and H we need to use cos

3) $\cos(37°) = \dfrac{x}{16}$ **(x is on top multiply both sides by bottom)**

4) $16 \cos(37°) = x = 12.78$

Use 90 – 37 = 53 to find the other angle, y

Example 2: (variable on bottom)

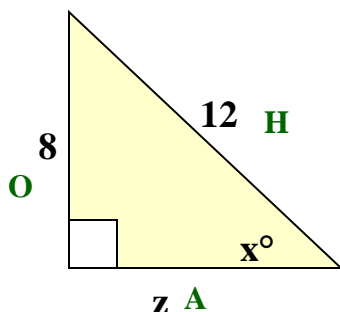1) 19 is O , x is A and no value for H

2) Since we have O and A (no H) we need to use tan

3) $\tan(42°) = \dfrac{19}{x}$ **(x is on bottom then switch it with the trig function)**

4) $x = \dfrac{19}{\tan(42°)} = 21.10$

Use 90 – 37 = 53 to find the other angle, y

Example 3: (variable is the angle)

1) 12 is H , 8 is O and no value for A -- x is the angle !

2) Since we have O and H we need to use sin

3) $\sin(x°) = \dfrac{8}{12}$ **(x is angle use inverse sin)**

4) $x = \sin^{-1}(8/12) = 48.19°$

Use Pythagorean Theorem to find one missing side
$12^2 = z^2 + 8^2$ → $144 = z^2 + 64$ → $80 = z^2$ → $8.94 = z$

Steps for solving Trig word problems (∠'s of elevation/depression)

0. **Draw a Triangle exactly the way it is drawn below (Remember the angle of depression and the angle of elevation are equal → alt interior angles of parallel lines). This triangle works in 99% of all problems.**

angle in problem goes here

H

O

angle

A
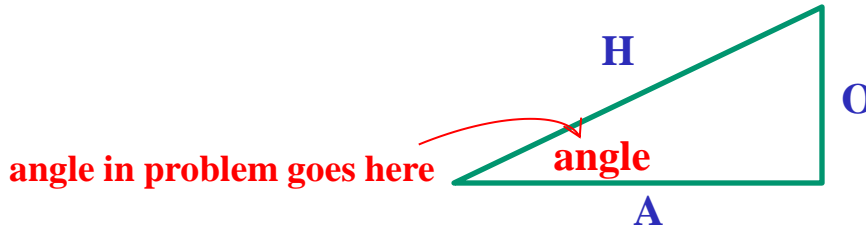
1. **Label each side of the triangle as shown in the picture:**
   H for hypotenuse (opposite 90°) –
   examples: ladder length, kite string length or diagonal distance of hill

   O for side opposite the given angle
   examples: anything vertical – height of tree, wall height or vertical distance above the ground

   A for side adjacent to given angle
   examples: horizontal distances – distance on the ground, distance away from or length of a shadow

2. **Determine using the information (sides and angles) given in the word problem which piece of information goes in which part of the triangle. Then using the trig definitions below you need to solve for variable**

$$\sin(\text{angle}) = \frac{\text{opp}}{\text{hyp}} \qquad \cos(\text{angle}) = \frac{\text{adj}}{\text{hyp}} \qquad \tan(\text{angle}) = \frac{\text{opp}}{\text{adj}}$$
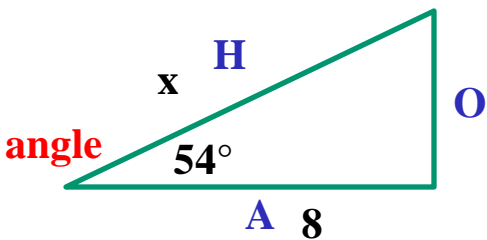
   SOH   **CAH**   **TOA**

3. **Set up an equation using the trig function and the variable**

4. **Solve for the variable (based on where the variable is)**

   Variable on top; multiply both sides by the bottom
   Variable on bottom: variable and trig function trade places
   Variable is angle: use inverse trig (2ⁿᵈ key then trig key)

Example 1: The bottom of the board leaning up against a barn is 8 feet away from the side of the barn. If the board forms a 54° angle with the ground, how long is the board?
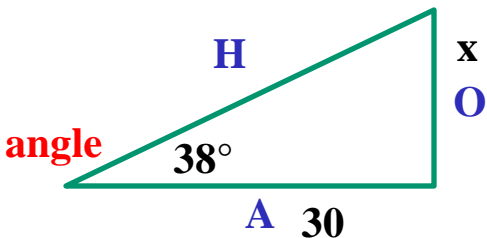
H

x

angle

54°

A 8

O

Draw and label the triangle: x (H) is the length of the board and it is 8 feet away (A) (along the ground) from the vertical side of the barn (O).

Since we have A and H, we need to use cos

Since x is on bottom, we switch the variable and the trig function

$\cos 54° = 8/x$ [variable on bottom]

$x = 8/(\cos 54°) = 13.61$ feet

Example 2: A person walks 30 feet from the base of a tree and measures the angle to the top of the tree as 38°. How tall is the tree?
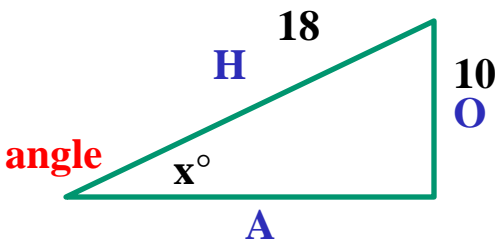
H

angle

38°

A 30

x
O

Draw and label the triangle: x (O) is the height of the tree. 30 feet away (A) (along the ground) from tree the angle is measured. The slant distance (H) is unknown and not needed.

Since we have O and A, we need to use tan

Since x is on top, we multiply both sides by the bottom

$\tan 38° = x/30$ [variable on top]

$30 \tan 38° = x = 23.44$ foot tall tree

Example 3: What angle is formed between a 18 foot ladder and the floor, if the end of the ladder is 10 feet up the side of the gym?

18

H

10
O

angle

x°

A

Draw and label the triangle: 18 (H) is the length of the ladder and it is 10 feet up (O) the vertical wall of the gym. x is the angle the ladder forms with the floor and (A) is not given.

Since we have O and H, we need to use sin

Since x is the angle, we need to use inverse trig function, 2nd Key then trig function

$\sin x° = 10/18$ [variable is angle]

$\sin^{-1}(10/18) = x = 33.75°$