TRIGONOMETRY

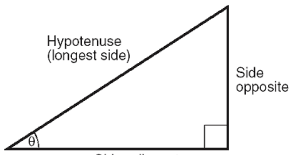
Trigonometry is the branch of mathematics dealing with the relations of the sides and angles of triangles and with the relevant functions of any angles. Simply, it helps us calculate the distance and angles.

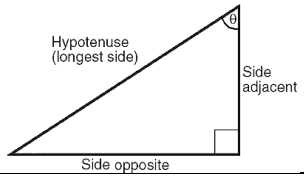
The triangle with a 90 degree is called a right triangle.

Labelling the right triangle right is the most crucial step in trigonometry.

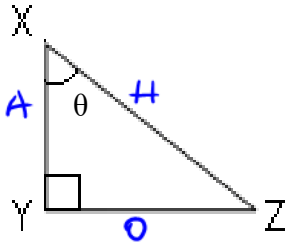
The hypotenuse is always the longest side, across from the right angle. The other two sides are named either '**side** adjacent or '**side** opposite depending on the location of **reference angle** θ (theta).

KEY WORDS
Trigonometry
Right
Hypotenuse
Adjacent
Opposite
Sine
Cosine
Tangent
Right
SOH
CAH
TOA

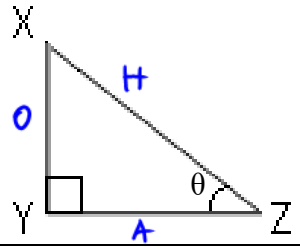




Ex1. In Δ***XYZ*** , label the hypotenuse (H), adjacent (A) side, and opposite (O) side for θ



Ex2. In Δ***XYZ*** , label the hypotenuse (H), adjacent (A) side, and opposite (O) side for θ.



PRIMARY TRIGONOMETRIC RATIOS

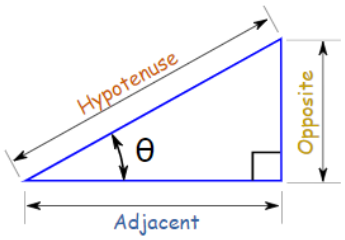
By definition, **ratio** is the comparison of two or more quantities with the same units. There are **three** primary trigonometric ratios: Sine, Cosine and tangent

Primary trig ratios help us calculate angles and lengths in construction, navy, landscaping, electricity, etc.

$\sin\theta = \frac{\text{Opposite}}{\text{Hypotenuse}}$

$\cos\theta = \frac{\text{Adjacent}}{\text{Hypotenuse}}$

$\tan\theta = \frac{\text{Opposite}}{\text{Adjacent}}$



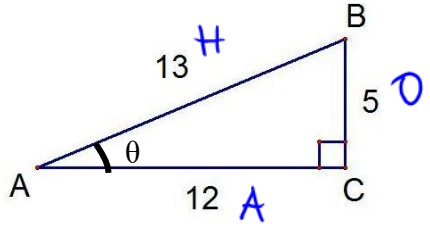
We can use the acronym SOH - CAH - TOA to help us remember the trigonometric ratios.

Example: Determine the primary trig ratios for the following triangle

sin θ^o= $^O/_H = {}^5/_{13}$

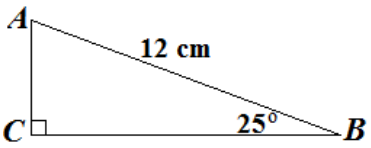
cos θ^o= $^A/_H = {}^{12}/_{13}$

tan θ^o= $^O/_A = {}^5/_{12}$

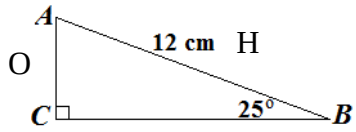


FINDING SIDE LENGTHS

Solved example 1: Find the length of side AC to the nearest tenth.



Step 1:
Label the sides of your triangle relative to the given angle



*Note: Do not label side BC.

3 Steps to Solving
Step 1: Label the sides of your triangle relative to the given angle
Step 2: Determine which trig ratio to use (sin, cos, tan)
Step 3: Set up the equation with the unknown side and solve.

Step 2:
Determine which trig ratio to use (sin, cos, tan)

Side lengths AB and AC give us the letters OH; therefore, we can calculate the sine ratio. Or simply choose the matching ratio from SOH CAH TOA. OH is only in SOH.

Step 3:
Set up the equation with the unknown side and solve.

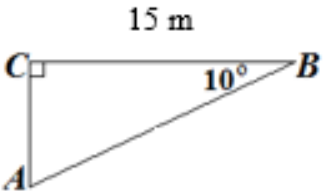
$\sin 25 = \frac{O}{12}$ * multiply both side with 12

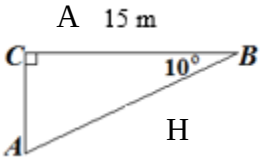
$12 \times \sin 25 = \frac{O}{12} \times 12$ * 12 on the right side will cancel

$5.1 = O$

∴ Side AC is approximately 5.1 cm.

Solved example 2: Find the length of side BC to the nearest tenth.





$\cos 10 = \frac{15}{H}$ * multiply both sides by H

$H \times \cos 10 = \frac{15}{H} \times H$ * H on the right side will cancel.

$H \times \cos 10 = 15$ * Divide both sides by cos10 to leave H by itself on left side

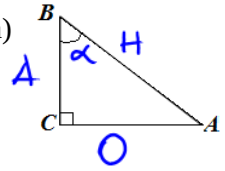
$H \times \cos 10 \div \cos 10 = 15 \div \cos 10$

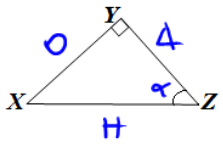
$H = 15 \div \cos 10$

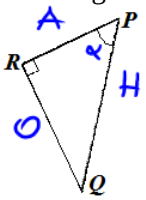
∴ Side AB is approximately 15.2 m.

Practice

1. Identify the opposite, adjacent, and hypotenuse sides associated with the indicated angle.

a) 

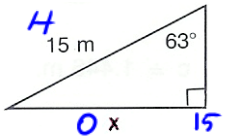
b) 

c) 

2. Using your calculator, evaluate the following ratios. Round your answers to three decimal places.

a) $\sin 30° = 0.5$ b) $\cos 45° = 0.7071$ c) $\tan 60° = 1.7321$

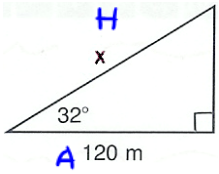
3. Find the length of the unknown side, rounded to one decimal.

a) 

$\sin 63 = \frac{x}{15}$

$15 \cdot \sin 63 = \frac{x}{15} \cdot 15$

$13.4 \doteq x$

b) 

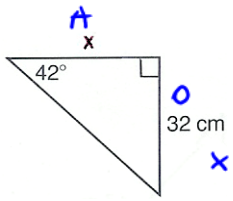
$\cos 32 = \frac{120}{x}$

$x \cdot \cos 32 = \frac{120}{x} \cdot x$

$x \cdot \cos 32 = 120$

$x \cdot \cos 32 \div \cos 32 = 120 \div \cos 32$

$x \doteq 141.5$

c) 

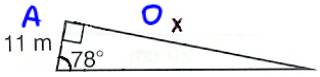
$\tan 42 = \frac{32}{x}$

$x \cdot \tan 42 = \frac{32}{x} \cdot x$

$x \cdot \tan 42 = 32$

$x \cdot \tan 42 \div \tan 42 = 32 \div \tan 42$

$x \doteq 35.5$

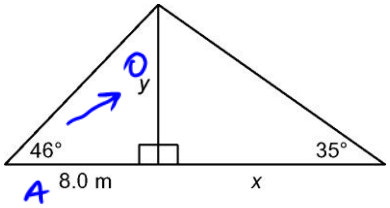
d) 

$\tan 79 = \frac{x}{11}$

$11 \cdot \tan 78 = \frac{x}{11} \cdot 11$

$51.8 \doteq x$

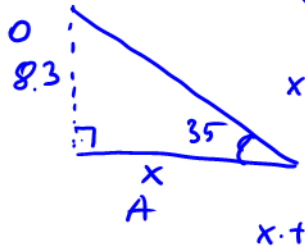
4. Find the measures of sides x and y to the nearest tenth of a metre.



$\tan 46 = \frac{y}{8}$

$8 \cdot \tan 46 = \frac{y}{8} \cdot 8$

$y \doteq 8.3$



$\tan 35 = \frac{8.3}{x}$

$x \cdot \tan 35 = \frac{8.3}{x} \cdot x$

$x \cdot \tan 35 = 8.3$

$x \cdot \tan 35 \div \tan 35 = 8.3 \div \tan 35$

$x \doteq 11.9$

5. Based on the following diagram use the values given to find the missing side indicated.

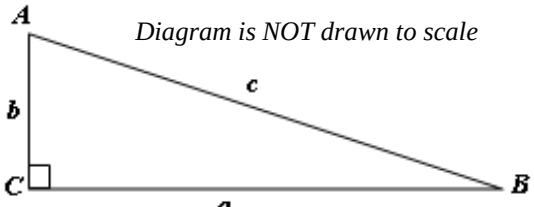
a) $\angle A = 55°, c = 25m, \rightarrow$ find a

b) $\angle A = 65°, c = 32cm, \rightarrow$ find b

c) $\angle B = 15°, c = 42m, \rightarrow$ find b

d) $\angle B = 35°, c = 55cm, \rightarrow$ find a

Diagram is NOT drawn to scale



a) $\sin 55 = \frac{a}{25}$

$a = \sin 55 \times 25$

$a \doteq 20.5$

b) $\cos 65 = \frac{b}{32}$

$b = \cos 65 \times 32$

$b \doteq 13.5$

$\cos 15 = \frac{b}{45}$

$b = \cos 15 \cdot 45$

$b \doteq 43.5$

$\sin 35 = \frac{a}{55}$

$a = \sin 35 \times 55$

$a \doteq 31.5$