

# Unit 1: Trigonometry

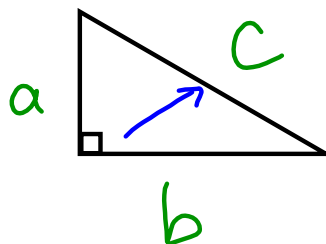
## Trigonometry Ratios in Right Angled Triangles

### Learning Goals

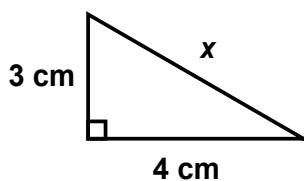
- review Pythagorean Theorem
- review SohCahToa

## Pythagorean Theorem

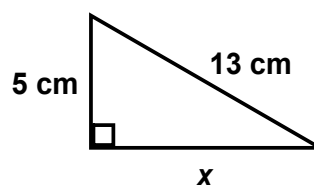
- used with right angled triangles
- used to find sides
- the formula is  $a^2 + b^2 = c^2$



Find the missing side.



$$\begin{aligned}
 a^2 + b^2 &= c^2 \\
 3^2 + 4^2 &= c^2 \\
 9 + 16 &= c^2 \\
 25 &= c^2 \\
 \boxed{5 = c}
 \end{aligned}$$



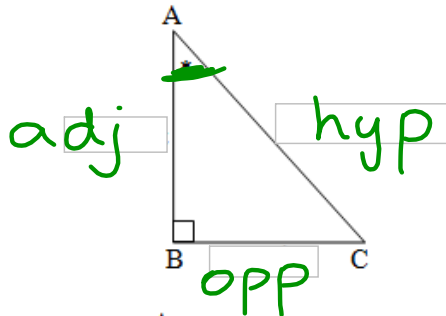
$$\begin{aligned}
 a^2 + b^2 &= c^2 \\
 a^2 &= c^2 - b^2 \\
 a^2 &= 13^2 - 5^2 \\
 a^2 &= 169 - 25 \\
 a^2 &= 144 \\
 \boxed{a = 12}
 \end{aligned}$$

Handout

**(1.1) Trigonometric Ratios in Right Triangles**

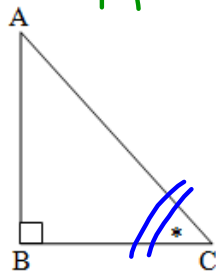
TRI GONO METRY  
Three angle measurement

In any right angled triangle, there is a  $90^\circ$  angle and 2 acute angles.



$\angle B = 90^\circ \therefore AC = \text{hyp}$

From  $\angle A$ , BC is opp  
AB is adj



$\angle B = 90^\circ \therefore AC = \text{hyp}$

From  $\angle C$ , AB is opp  
BC is adj

Primary Trigonometric Ratios

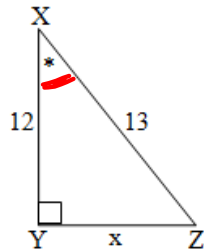
Sine of  $\angle A \longrightarrow \sin A = \frac{\text{opposite}}{\text{hypotenuse}} \longrightarrow \sin A = \frac{O}{H}$

Cosine of  $\angle A \longrightarrow \cos A = \frac{\text{adjacent}}{\text{hypotenuse}} \longrightarrow \cos A = \frac{A}{H}$

Tangent of  $\angle A \longrightarrow \tan A = \frac{\text{opposite}}{\text{adjacent}} \longrightarrow \tan A = \frac{O}{A}$

The easiest way to MEMORIZE these ratios is to use:

SOH, CAH, TOA

Finding trig ratios:Ex. What are the trig ratios of  $\angle X$ ?

1. Find the missing side

$$\begin{aligned} a^2 + b^2 &= c^2 \\ 12^2 + b^2 &= 13^2 \\ b^2 &= 13^2 - 12^2 \\ b &= 5 \end{aligned}$$

$$\begin{aligned} \sin X &= \frac{O}{H} \\ &= \frac{5}{13} \end{aligned}$$

$$\begin{aligned} \cos X &= \frac{A}{H} \\ &= \frac{12}{13} \end{aligned}$$

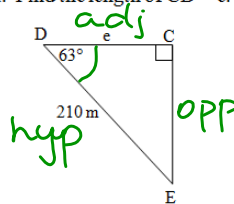
$$\begin{aligned} \tan X &= \frac{O}{A} \\ &= \frac{5}{12} \end{aligned}$$

Finding trig ratios using a calculator (usually to 4 decimal places)

$$\begin{aligned} \text{Ex. } \cos 36^\circ &= 0.809 \\ \sin 52^\circ &= 0.788 \\ \tan 8^\circ &= 0.1405 \end{aligned}$$

**Side Lengths**

Using trig ratios to find missing side lengths in a triangle.

Ex. Find the length of  $CD = e$ .

1. Name the sides.
2. Decide which formula you need.
3. Find the side.

SOH CAH TOA  
 x ✓    ? ✓    x ?  
 ↑

$$\cos x = \frac{\text{adj}}{\text{hyp}}$$

$$\cos 63^\circ = \frac{e}{210}$$

$$\begin{aligned} (\cos 63^\circ)(210) &= e \\ 95.3 &= e \end{aligned}$$

**Angles**Finding Angles using a calculator

Ex.  $\cos A = 0.3584$   $\cos^{-1}$

$\angle A = 69^\circ$

ex.  $\sin A = 0.5736$   $\sin^{-1}$

$\angle A = 35^\circ$

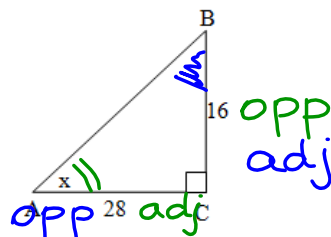
ex.  $\tan A = 4.7046$   $\tan^{-1}$

$\angle A = 78^\circ$

Angles are usually rounded to a given accuracy. If none is given, you can round to the nearest whole number.

Finding Angles in a Triangle

Ex. Determine the measure of  $\angle A$  and  $\angle B$ .



Find A

$$\tan \theta = \frac{\text{opp}}{\text{adj}}$$

$$\tan \theta = \frac{16}{28}$$

$$\tan \theta = 0.571$$

$$\tan^{-1}$$

$$\theta = 30^\circ$$

Find B

$$\tan \theta = \frac{\text{opp}}{\text{adj}}$$

$$\tan \theta = \frac{28}{16}$$

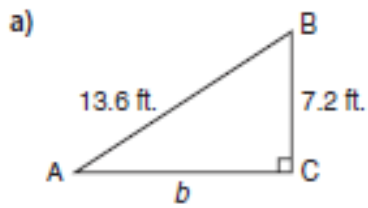
$$\tan \theta = 1.75$$

$$\tan^{-1}$$

$$\theta = 60^\circ$$

## On the Boards...

1. Use the Pythagorean Theorem to find the missing sides.

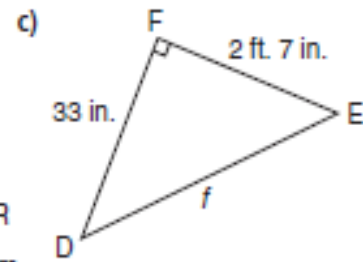
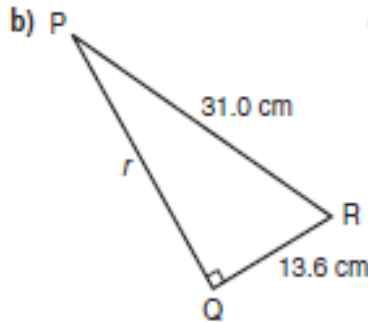


$$a^2 + b^2 = c^2$$

$$7.2^2 + b^2 = 13.6^2$$

$$b^2 = 133.12$$

$$b = 11.53$$



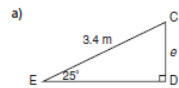
1 foot = 12 inches

$$33^2 + 31^2 = f^2$$

$$2050 = f^2$$

$$45.3 = f$$

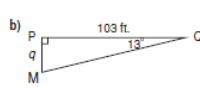
2. Calculate the length of each of the indicated sides.



$$\sin 25^\circ = \frac{e}{3.4}$$

$$(\sin 25^\circ)(3.4) = e$$

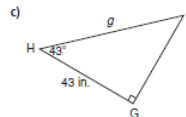
$$1.43 = e$$



$$\tan 13^\circ = \frac{q}{103}$$

$$(\tan 13^\circ)(103) = \frac{q}{103}(103)$$

$$23.8 = q$$



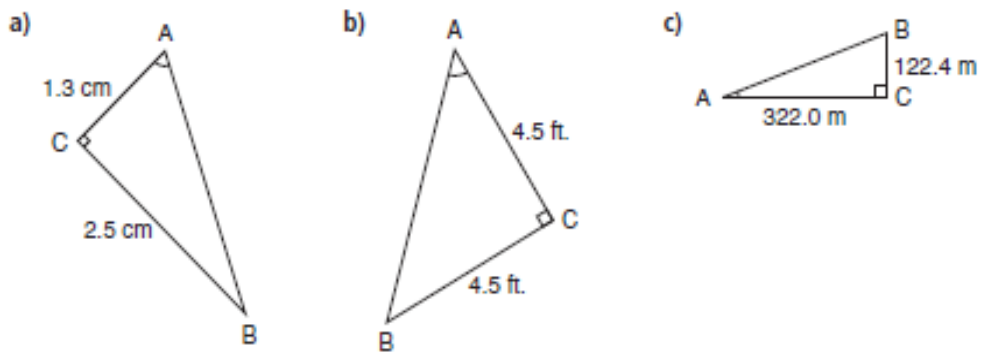
$$\therefore \frac{\cos 43^\circ}{1} = \frac{43}{g}$$

cross multiply

$$\frac{(\cancel{\cos 43^\circ})(g)}{\cancel{\cos 43^\circ}} = \frac{43}{\cos 43^\circ}$$

$$g = 58.8$$

3. Determine the measure of angle A.



$$\tan A = \frac{2.5}{1.3}$$

$$A = 45^\circ$$

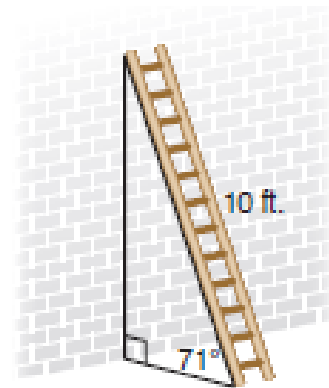
$$A = 21^\circ$$

$$\tan A = 1.92$$

$$A = 63^\circ$$

4. A ladder 10 feet long is leaning against a wall at a  $71^\circ$  angle.

- a) How far from the wall is the foot of the ladder?  
b) How high up the wall does the ladder reach?



$$a.) \cos 71^\circ = \frac{a}{10}$$

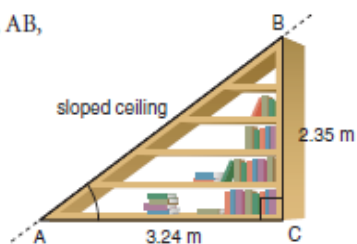
$$3.26 = a$$

$$b.) \sin 71^\circ = \frac{b}{10}$$

$$9.46 = b$$

5. A carpenter is building a bookshelf against the sloped ceiling of an attic.

- a) Determine the length of the sloped ceiling, AB, used to build the bookshelf.
- b) Determine the measure of  $\angle A$ .  
Is  $\angle A$  an angle of inclination or an angle of depression? Why?
- c) Describe another method to solve part b.  
Which method do you prefer? Why?



$$\begin{aligned} a.) \quad 2.35^2 + 3.24^2 &= c^2 \\ 16.02 &= c^2 \\ 4 &= c \end{aligned}$$

$$b.) \quad \tan A = \frac{2.35}{3.24}$$

$$\begin{aligned} \tan A &= 0.73 \\ A &= 36^\circ \end{aligned}$$

## Seatwork

pg 8 # 12 and 14