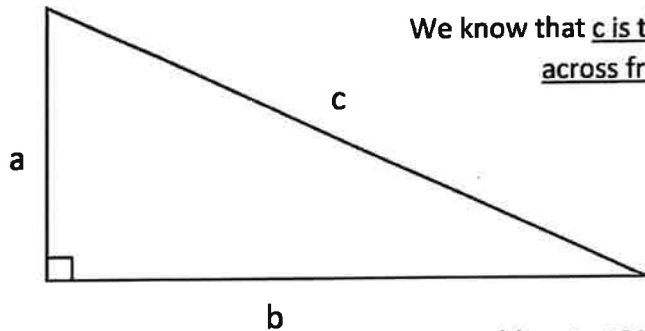


Section 7.1 – Right Angle Triangle Trigonometry

EVERYTHING YOU NEED TO KNOW ABOUT RIGHT ANGLE TRIANGLES AND THEIR ANGLES

Consider the Right Triangle...



We know that c is the longest side and that it is across from the 90° angle.

- The angles inside a triangle add up to 180°, so if we know two of them we can find the third
- We know that if we have two side lengths we can use the Pythagorean Theorem:

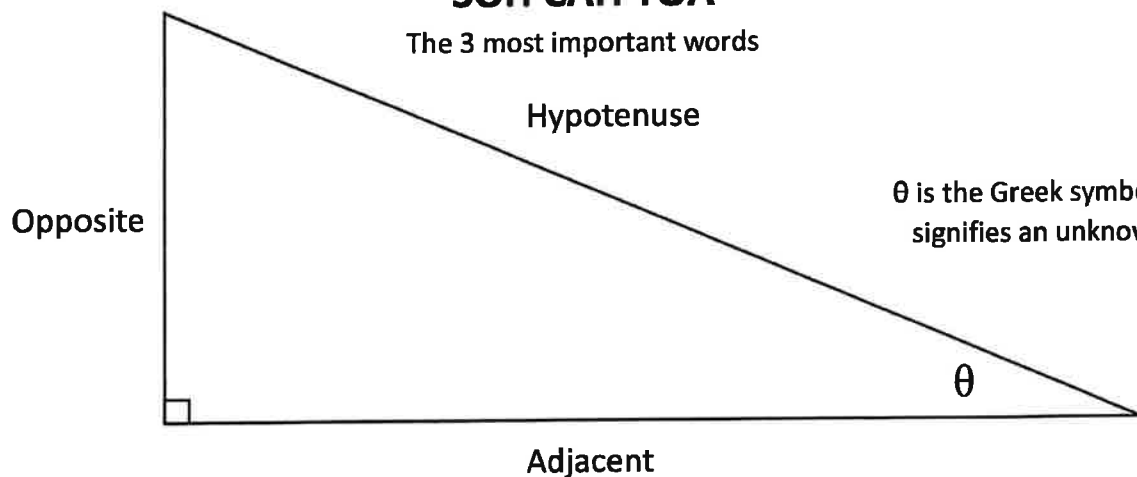
$$a^2 + b^2 = c^2 \quad \text{to find the third.}$$

What happens if we can't use the two methods above to get our information?

We need to use our TRIGONOMETRIC RATIOS

SOH CAH TOA

The 3 most important words



θ is the Greek symbol theta. It signifies an unknown angle.

The way we name the sides of the triangle depend on which angle we need or are using.

- The **HYPOTENUSE** is always labelled **HYPOTENUSE**
- The side across from the angle is the '**OPPOSITE**'
- The side that helps create the angle with the hypotenuse is the '**ADJACENT**' side

So our TRIGONOMETRIC RATIOS are:

Tangent

Sine

Cosine

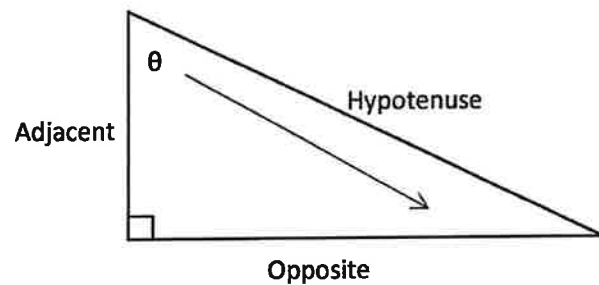
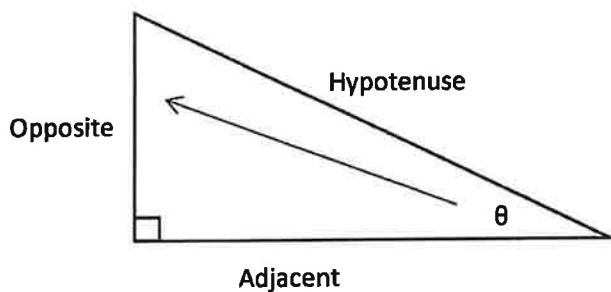
Depending on the side lengths and the angle we have or want, we use one of the 3 different ratios.

**** Note: Make sure your calculator is in degree mode ****

To decide with ratio to use just remember...

SOH CAH TOA

The 3 most important words

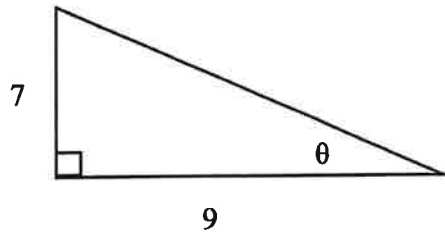


$$\text{Sine } \theta = \frac{\text{Opposite}}{\text{Hypotenuse}}$$

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

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

Example 1: What is the measure of the angle of inclination?



Solution 1: We have the opposite side and adjacent side so we use...

TANGENT (TOA) $\text{Tan } \theta = \frac{\text{Opposite}}{\text{Adjacent}} \Rightarrow \tan \theta = \frac{7}{9}$

So $\text{Tan } \theta = 0.7777$ This is the ratio so how do we get it as a degree?

We need to use the

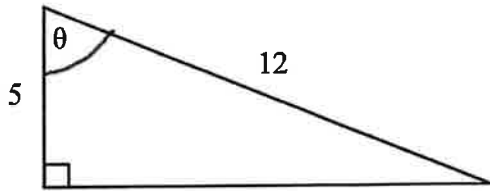
Tan^{-1}

button on your calculator

So... $\theta = \tan^{-1} (0.7777)$

$$\theta = 37.9^\circ$$

Example 2: What is the measure of angle θ ?



Solution 2: We have the hypotenuse and adjacent side so we use...

COSINE (CAH) $\cos \theta = \frac{\text{Adjacent}}{\text{Hypotenuse}} \Rightarrow \cos \theta = \frac{5}{12}$

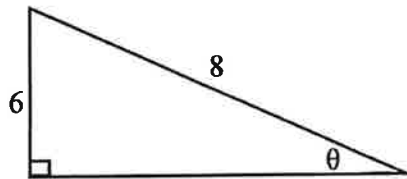
So $\cos \theta = 0.4166$ This is the ratio so how do we get it as a degree?

We need to use the \cos^{-1} ← button on your calculator

So... $\theta = \cos^{-1}(0.4166)$

$\theta = 65.4^\circ$

Example 3: What is the measure of angle θ ?



Solution 3: We have the hypotenuse and opposite side so we use...

SINE (SOH) $\sin \theta = \frac{\text{Opposite}}{\text{Hypotenuse}} \Rightarrow \sin \theta = \frac{6}{8}$

So $\sin \theta = 0.75$ This is the ratio so how do we get it as a degree?

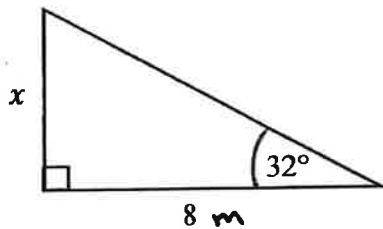
We need to use the \sin^{-1} ← button on your calculator

So... $\theta = \sin^{-1}(0.75)$

$\theta = 48.6^\circ$

So that is how you find the angles. **What about finding missing side lengths?**

Example 4: What is the height of the ramp off the ground?



Solution 4: We have the degree and the adjacent side and we want the opposite side so we use...

TAN (TOA) $\tan 32^\circ = \frac{x}{8}$

We want x so multiply both sides by 8 to get rid of the denominator.

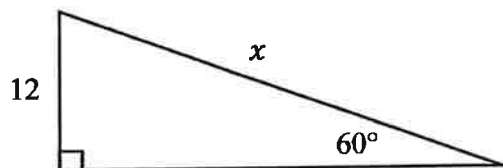
$$8 \cdot \tan 32^\circ = \frac{x}{8} (8)$$

The 8's cancel so..

$$x = 8 \tan 32^\circ$$

$$x = 5.0 \text{ m}$$

Example 5: If the building is 12m tall and I want to connect a zip-line at a 60° angle from the ground, how long will it be?



Solution 5: We have the degree and the opposite side and we want the hypotenuse so we use...

SINE (SOH) $\sin 60^\circ = \frac{12}{x}$

In this case since the unknown is in the denominator just switch x with the $\sin 60^\circ$

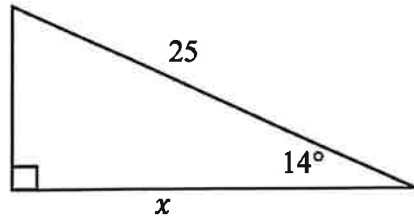
$$x \cdot \sin 60^\circ = \frac{12}{x} \cdot x$$

$$x \cdot \sin 60^\circ = 12$$

$$\frac{x \cdot \sin 60^\circ}{\cancel{\sin 60^\circ}} = \frac{12}{\cancel{\sin 60^\circ}}$$

$$x = 13.8 \text{ m}$$

Example 6: As the sun sets on a building, the shadow of the incline is 25m, how long along the ground is the shadow.



Solution 6: We have the degree and the hypotenuse and we want the adjacent side so we use...

COSINE (CAH) $\cos 14^\circ = \frac{x}{25}$

We want x so multiply both sides by 25 to get rid of the denominator.

$$25 \cdot \cos 14^\circ = \frac{x}{25} (25)$$

The 25's cancel so..

$$x = 25 \cos 14^\circ$$

$$x = 24.3 \text{ m}$$

****Once you have the second side you can use Pythagorean Theorem to get the last side****

Section 7.1 – Practice Questions

Make sure your calculator is in **DEGREE MODE!**

1. Using your calculator, find each ratio to 4 decimal places.

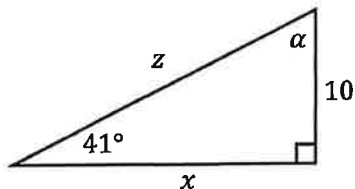
a) $\sin 35^\circ =$	b) $\cos 0^\circ =$
c) $\tan 81^\circ =$	d) $\cos 42^\circ =$
e) $\cos 77^\circ =$	f) $\tan 9^\circ =$
g) $\sin 0^\circ =$	h) $\cos 30^\circ =$
i) $\tan 0^\circ =$	j) $\sin 60^\circ =$

2. Using your calculator, find the measure of the angle to 1 decimal place.

a) $\sin \theta = 0.6348$	$\theta =$	b) $\cos \theta = 0.6348$	$\theta =$
c) $\tan \theta = 4.276$	$\theta =$	d) $\sin \theta = 0.3521$	$\theta =$
e) $\sin \theta = 0.1496$	$\theta =$	f) $\tan \theta = 0$	$\theta =$
g) $\tan \theta = 1$	$\theta =$	h) $\sin \theta = 0$	$\theta =$
i) $\cos \theta = 1$	$\theta =$	j) $\cos \theta = 0$	$\theta =$

3. Solve the following triangles to 1 decimal place.

a)

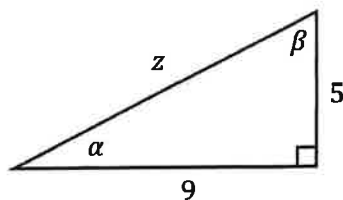


$$z =$$

$$x =$$

$$\alpha =$$

b)



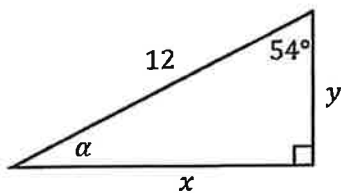
$$z =$$

$$\beta =$$

$$\alpha =$$

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c)

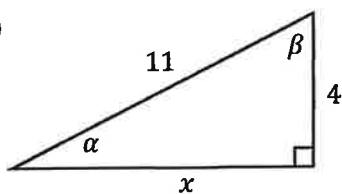


$y =$

$x =$

$\alpha =$

d)

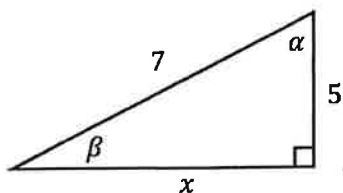


$\beta =$

$x =$

$\alpha =$

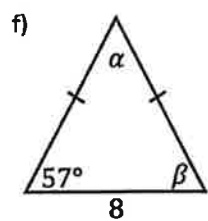
e)



$\beta =$

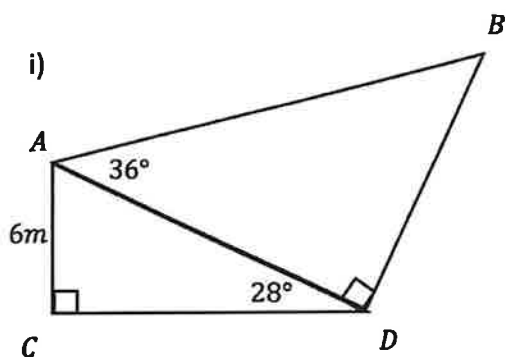
$x =$

$\alpha =$

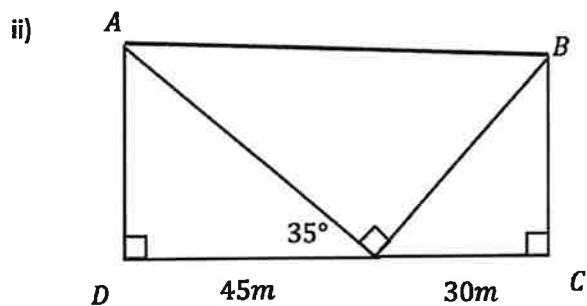


$\alpha =$
 $\beta =$

4. Find the length of AB



$AB =$



$AB =$