

Calculate Lengths & Angles using Trigonometry – SS2

Trigonometry is used to calculate the **lengths** and **angles** in **Right-Angled Triangles**. In any given triangle, first we say which angle we are **looking at**, then each of the words **hypotenuse**, **opposite**, and **adjacent** are used to mean one specific side of that triangle. Trigonometry then uses the **ratio of the lengths of the sides** of the triangle and compares these to the same ratios programmed into the calculator, **sin x**, **cos x**, and **tan x**.

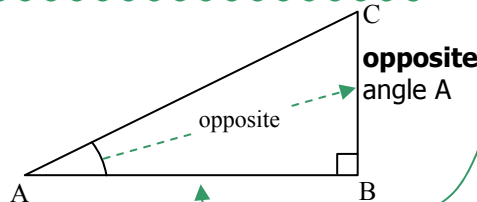
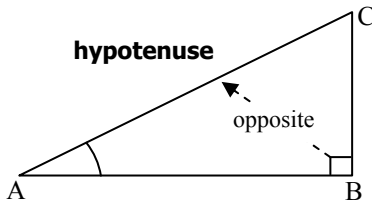
Always start by first identifying the **hypotenuse**, then the **opposite**, and *only then* the **adjacent**.

The **hypotenuse** is the longest side and is always 'opposite' the right angle. Draw an arrow from the right angle to be sure!

Decide which angle you are looking at, then the side opposite this is called the **opposite side**! Draw an arrow from the angle we are looking at to be sure!

This leaves side AB as the **adjacent** to angle A

The **adjacent** side always makes up one of the sides of the angle you are looking at, the other side being made by the hypotenuse.



Your Turn!!

- Draw any right-angled triangle XYZ with Y a right-angle. Mark angle X, x° . Using this angle as the angle you are looking at label up the sides of the triangle.
- Repeat a) but label Z, z° and using this angle as the angle you are looking at; label the sides of the triangle.

Observe... how the **opposite** and **adjacent** 'swap' when you change the angle you are looking at!!

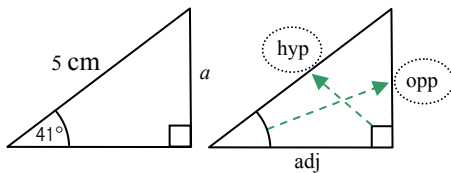
Memorise the trigonometric Ratios: $\sin x = \frac{\text{opp}}{\text{hyp}}$, $\cos x = \frac{\text{adj}}{\text{hyp}}$, $\tan x = \frac{\text{opp}}{\text{adj}}$

The phrase **SOH CAH TOA**, can help memorise these, where each letter stands for a word in the 3 equations

Your Turn!! c) For the $\triangle ABC$ above, $\sin A = \frac{BC}{AC}$. Similarly calculate $\cos A$ and $\tan A$.

Example 1 – finding a length

Find length a :



Strategy

- Label the hyp, opp and adj
- Decide which two are involved in the question
- Use the appropriate ratio from SOH CAH TOA

Solution

The **hypotenuse** and **opposite** are involved, therefore use the sine ratio:

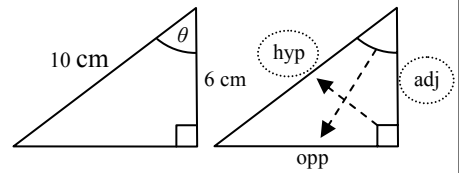
$$\sin x = \frac{\text{opp}}{\text{hyp}}$$

$$\sin 41^\circ = \frac{a}{5}$$

$$a = 5 \times \sin 41^\circ = 5 \times 0.656059029 = 3.28 \text{ cm (3 s.f.)}$$

Example 2 – finding an angle

Find angle θ :



Solution

The **hypotenuse** and **adjacent** are involved, therefore use cosine ratio:

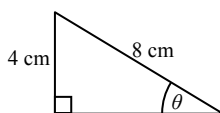
$$\cos \theta = \frac{\text{adj}}{\text{hyp}}$$

$$\cos \theta = \frac{6}{10} = 0.6$$

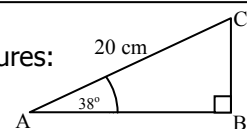
$$\text{So } \theta = \cos^{-1} 0.6 \\ \theta = 53.13010235 = 53.1^\circ \text{ (3 s.f.)}$$

Your Turn!!

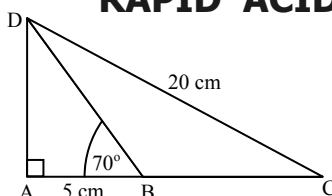
d) Find angle θ



e) Find the length AB to 3 significant figures:



RAPID 'ACID' TEST – Blank out the page above before answering these!



From the diagram, given that $CD = 20\text{cm}$, $AB = 5\text{cm}$, $\angle CAD = 90^\circ$ and $\angle ABD = 70^\circ$ find

- AD to 3 significant figures
- $\angle DCA$ to 3 significant figures