



## Pythagoras' Theorem

Once upon a time there lived a clever chap called Pythagoras. He came up with a clever theorem...

### Pythagoras' Theorem is Used on Right-Angled Triangles

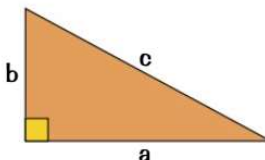
Pythagoras' theorem only works for **RIGHT-ANGLED TRIANGLES**.

It uses **two sides** to find the **third side**.

The formula for Pythagoras' theorem is:

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

short sides      long side



The trouble is, the formula can be quite difficult to use. **Instead**, it's a lot better to just **remember** these **three simple steps**, which work every time:

#### 1) SQUARE THEM

**SQUARE THE TWO NUMBERS** that you are given, (use the **x** button if you've got your calculator.)

#### 2) ADD or SUBTRACT

To find the **longest side**, **ADD** the two squared numbers.  $a^2 + b^2 = c^2$   
To find a **shorter side**, **SUBTRACT** the smaller from the larger.  $c^2 - b^2 = a^2$

#### 3) SQUARE ROOT

Once you've got your answer, take the **SQUARE ROOT** (use the **√** button on your calculator).

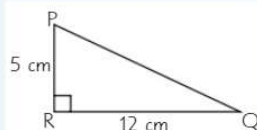
$$c = \sqrt{a^2 + b^2}$$

$$a = \sqrt{c^2 - b^2}$$

### EXAMPLES:

1. Find the length of side PQ in this triangle.

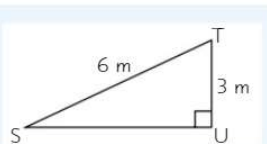
- Square** them:  $a^2 = 5^2 = 25$ ,  $b^2 = 12^2 = 144$
- You want to find the **longest side**, so **ADD**:  $a^2 + b^2 = c^2$   
 $25 + 144 = 169$
- Square root**:  $c = \sqrt{169} = 13 \text{ cm}$



Always check the answer's **sensible** — **13 cm** is longer than the other two sides, but not too much longer, so it seems OK.

2. Find the length of SU to 1 decimal place.

- Square** them:  $b^2 = 3^2 = 9$ ,  $c^2 = 6^2 = 36$
- You want to find a **shorter side**, so **SUBTRACT**:  $c^2 - b^2 = a^2$   
 $36 - 9 = 27$
- Square root**:  $a = \sqrt{27} = 5.196...$   
 $= 5.2 \text{ m (to 1 d.p.)}$



Check the answer is **sensible** — yes, it's a bit shorter than the longest side.

## Trigonometry — Sin, Cos, Tan

**Trigonometry** — it's clever stuff. The three trig formulas are used on right-angled triangles to:

a) find an unknown side if you know a side and an angle, or b) find an angle if you know two lengths.

### The 3 Trigonometry Formulas



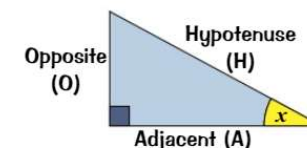
There are three basic **trig formulas** — each one links **two sides and an angle** of a **right-angled triangle**.

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

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

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

- The **Hypotenuse** is the **LONGEST SIDE**.
- The **Opposite** is the side **OPPOSITE** the angle **being used** ( $x$ ).
- The **Adjacent** is the (other) side **NEXT TO** the angle **being used**.



### Formula Triangles Make Things Easier



A great way to tackle trig questions is to convert the formulas into **formula triangles**.

Then you can use the **same method every time**, no matter which side or angle is being asked for.

There's more about formula triangles on p.69 if you need to jog your memory.

1) **Label** the three sides **O, A and H** (Opposite, Adjacent and Hypotenuse).

2) Write down '**SOH CAH TOA**'.

3) Decide which **two sides** are **involved**: O,H A,H or O,A and choose **SOH**, **CAH** or **TOA** accordingly.

4) Turn the one you choose into a **FORMULA TRIANGLE**:



In the formula triangles, S represents sin x, C is cos x, and T is tan x.

5) **Cover up** the thing you want to find with your finger, and write down whatever is left showing.

6) **Stick in the numbers** and work it out using the **sin**, **cos** and **tan** buttons on your **calculator**.

If you're finding an **angle**, you'll need to add an extra step to find the **inverse**. See next page.



# How do we use Knowledge Organisers in Mathematics?

## How can you use knowledge organisers at home to help us?

- **Retrieval Practice:** Read over a section of the knowledge organiser, cover it up and then write down everything you can remember. Repeat until you remember everything.
- **Flash Cards:** Using the Knowledge Organisers to help on one side of a piece of paper write a question, on the other side write an answer. Ask someone to test you by asking a question and seeing if you know the answer.
- **Mind Maps:** Turn the information from the knowledge organiser into a mind map. Then reread the mind map and on a piece of paper half the size try and recreate the key phrases of the mind map from memory.
- **Sketch it:** Draw an image to represent each fact; this can be done in isolation or as part of the mind map/flash card.
- **Teach it:** Teach someone the information on your knowledge organiser, let them ask you questions and see if you know the answers.

## How will we use knowledge organisers in Mathematics?

*Knowledge organisers will be used before I complete a Learning Check or Common Assessment. I will spend part of the lesson looking over each of the key topics of the half term before completing the Learning Check or Common Assessment.*

*I will also use these at home to complete my own independent learning and revision of these key topics.*

**GLUE HERE**