

Before You Watch

This topic is designed to refresh your memory of trigonometry and what it means. It uses algebra to represent the various sides and angles of the triangle. So, if you're not confident with the concept of algebra and how symbols represent certain values, watch [Introduction to Algebra](#) first, then come back.

The Video Content

Trigonometry is a branch of mathematics that studies relationships involving lengths and angles of triangles. It first came about when people were trying to figure out distances between stars, more than 2000 years ago. Astronomers noted that when the length of one side and the value of one angle is known, then all other angles and lengths can be determined.

The Greeks worked out what we now know as trigonometric ratios: sine, cosine and tangent, which you probably studied in high school. Remember SOH-CAH-TOA?

SOH-CAH-TOA is a trick to remember the ratios.

It is important to understand that a ratio is a relationship between two numbers. In this case the numbers are the length of the sides of the triangle.

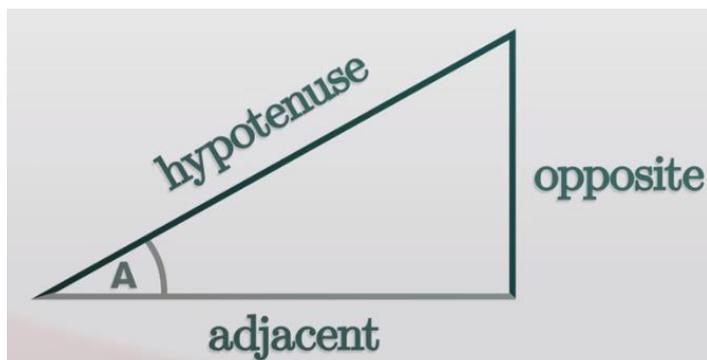
If we have a right triangle and a given angle A in it, we can label the sides of the triangle as follows:

- the longest side is always the **hypotenuse**
- the side that is next to the angle is called **adjacent** side
- the other side is called the **opposite** side.

The sine of A is the length of the opposite side divided by the length of the hypotenuse:

$$\sin A = \text{opposite} / \text{hypotenuse}$$

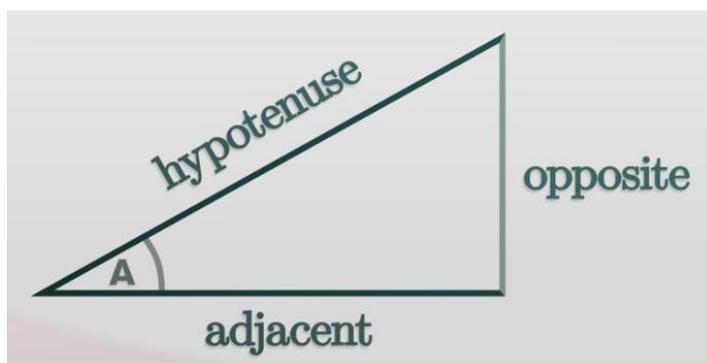
This is **SOH**.



The cosine of A is the length of the adjacent side divided by the length of the hypotenuse:

$$\cos A = \text{adjacent} / \text{hypotenuse}$$

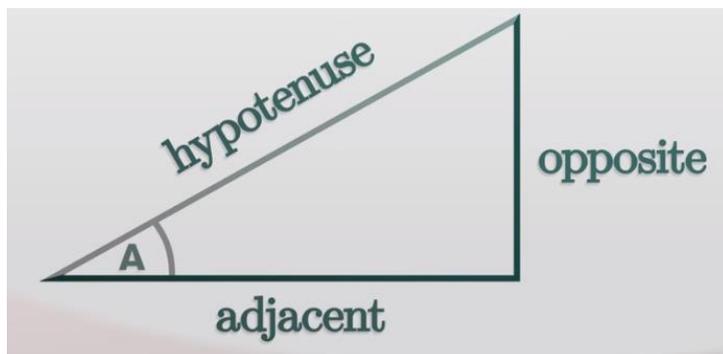
This is **CAH**.



The last one is the tangent of A. The tangent of A is the length of the opposite side divided by the length of the adjacent side:

$$\tan A = \text{opposite} / \text{adjacent}$$

This is **TOA**.



So that's SOH-CAH-TOA.

These ratios always remain constant, no matter how big or small the right triangle is, as long as the angle A doesn't change.

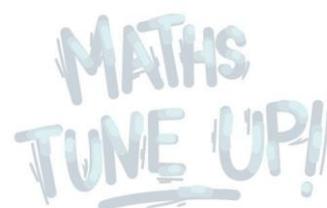
This property of triangles is incredibly useful and is even what allows your GPS to always find where you are and give you the quickest way to your destination.

Now What?

The next step in your trigonometry journey is to watch **Components of Vectors**. This video demonstrates a specific application of trigonometry used in science and engineering, as well as giving sample questions that you're likely to come across at university and beyond.

But When Am I Going To Use This?

Right-angled triangles are common in construction, surveying and the application discussed in the **Components of Vectors** video, where things like forces, or movements, are broken down into perpendicular components. However, trigonometry also extends to non-right angled triangles through applications like the sine rule and the cosine rule, and to calculating the areas of triangles.



Moving beyond triangles, trigonometry is critical to the study of waves, such as radio waves. This is very important in fields such as wireless communication and quantum physics: for instance, mobile phone technology would be impossible without a method of breaking down a signal into a series of sines and cosines known as Fourier Analysis. Your GPS device also uses trigonometry to help you navigate using satellites.

Other Links

Maths is Fun has a great page summarising the trigonometric ratios and includes several different applets to help you visualise and understand the basics. It also has other pages dealing with more advanced trigonometry subjects to develop your understanding.

- <https://www.mathsisfun.com/algebra/trigonometry.html>

The **Mathspace** page on trigonometry is well laid out with a variety of instructive videos, applets and quizzes. It also has apps for iPad, iPhone, Android and Windows Phone. It does require you to create a login, however, using these resources is free.

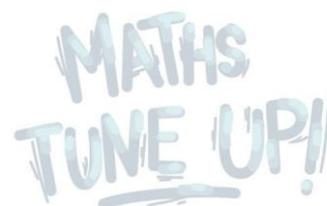
- <https://mathspace.co/learn/world-of-maths/trigonometry/trigonometric-ratios-6831/special-ratios-258/>

GeoGebra is a mathematics app that works on a wide variety of platforms, including tablets, and in a web browser. It is used to create great tools for teaching and learning. The link here is an example of a GeoGebra 'program' that helps demonstrate how trigonometric ratios stay constant, no matter how the triangle shrinks and expands.

- <http://www.geogebra.org/student/b77950#material/11887>

The following link is to a simple animation which demonstrates the creation of the graph of the sine function using the unit circle. The source code for the creation of the animation is also attached. For people with a natural orientation towards computer programming (which is a huge application of mathematics) this may help you understand the nature of trigonometry.

- <http://www.humblesoftware.com/demos/trig>



The **Khan Academy** has a comprehensive set of video tutorials covering a large range of mathematical and other concepts, as well as questions to test your knowledge. This link takes you to the chapter covering basic trigonometry, and continues onto more advanced trigonometric concepts.

<https://www.khanacademy.org/math/trigonometry/basic-trigonometry>

Patrick JMT (Just Maths Tutorials) has a comprehensive set of video tutorials covering a large range of mathematical concepts. This video covers the trigonometric ratios and solves a variety of problems using these ratios.

- <http://patrickjmt.com/right-triangles-and-trigonometry/>

