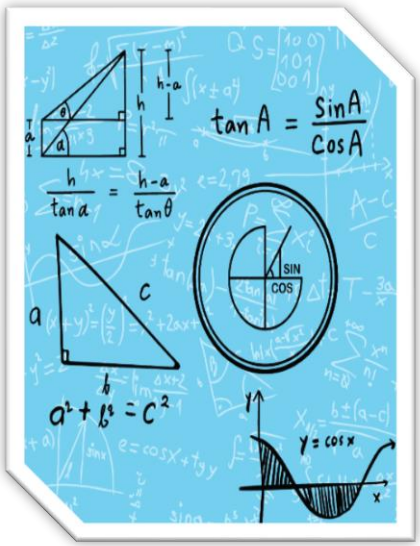

TOPIC: TRIGONOMETRY

SUBJECT: MATHS

LEVEL/AGE: 15 years old

FOREKNOWLEDGE: Trigonometric numbers of 30, 45 and 60 degree angles

LENGTH: 6 PAGES (DURATION: 110 MINUTES)

LEARNING OUTCOMES

At the end of this lesson, the pupils will know:

- Ways of finding the missing side in a right-angled triangle that do not involve calculation.
- How to label sides in a triangle and select the correct ratio to use out of sine, cosine and tangent.
- How to calculate a side in a right-angled triangle, given a side and an angle.
- How to use trigonometry in right-angled triangles to solve worded problems.

RESOURCES

Pythagoras' theorem slides

Canva (to create pictures)

Slide: *"The practical use of trigonometry : The Egyptian pyramids"* (Chin) on Prezi.com

TEACHING METHODS

Lecture, presentations (slides), group work.

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ACTIVITIES

INTRODUCTION (7 minutes)

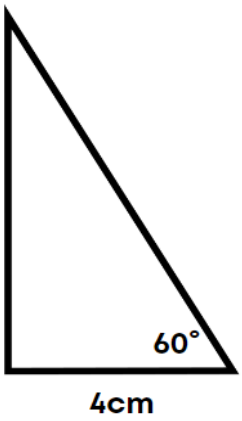
Why is trigonometry important?

The teacher will explain that one of the uses of trigonometry is to measure heights, such as sides of triangles or heights of buildings. Even in ancient times, when humans lacked the technology and tools of the modern era, they managed to build magnificent structures using primitive math, geometry and trigonometry. Such an example is the pyramids. The ancient Egyptians, by using a primitive form of trigonometry, managed to make every triangular side of the pyramid identical, which made the structure stable and solid. Relevant slides: 'The practical use of trigonometry : The Egyptian pyramids" (Chin) on Prezi.com

THEORY PART (45 minutes)

Finding a side without using calculation

Suppose we have a triangle which is right-angled; the shortest side is 4cm long and the angle between this side and the hypotenuse is 60°. How could we work out the length of the hypotenuse?



You might have thought about using Pythagoras' theorem, but of course Pythagoras' theorem is only useful if we already know two side lengths.You may also have considered doing a scale drawing. This would be a good way of working out the length of the hypotenuse, but it will be limited by how accurate your drawing and measuring is.

Trigonometry offers us a way to find a missing side in a right-angled triangle when only the length of one side and the size of one angle (other than the right angle) is known.

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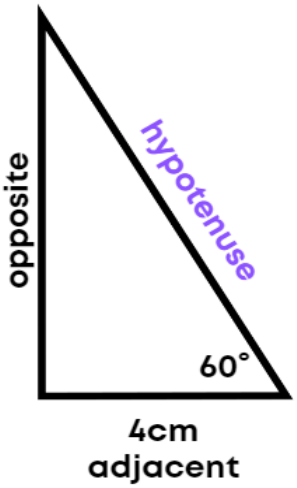
We'll begin with the triangle from the last activity and calculate the length of the hypotenuse. We already have an idea of what our answer should be.

The first job is to label the sides: **hypotenuse**, **opposite** and **adjacent**.



The **hypotenuse** is always the longest side (and opposite the right angle); let's label that first.

To label the other two, we must imagine we are looking from the angle that is 60°. The **adjacent** side is the side which is not the hypotenuse but connects with the known angle.

The **opposite** side is the remaining side; the one that does not connect with the known angle and is, therefore, opposite to it.

S stands for sine, which is abbreviated to sin.

C stands for cosine, which is abbreviated to cos.

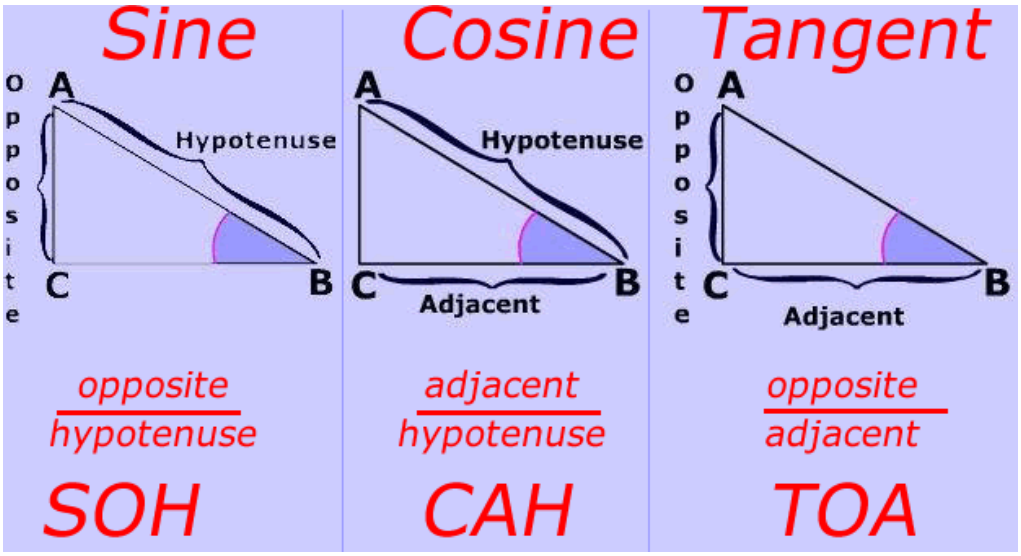
T stands for tangent, which is abbreviated to tan.

O stands for opposite.

H stands for hypotenuse.

A stands for adjacent.

We write it like this:



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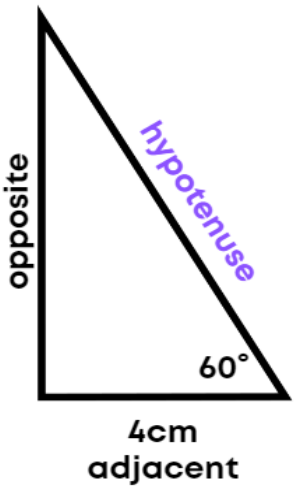
We can sum up the above in the following formulas:

$$\boldsymbol{S = \frac{O}{H}\ or\ H = \frac{O}{S}\ or\ O = H \cdot S}\ (1)$$

$$\boldsymbol{C = \frac{A}{H}\ or\ H = \frac{A}{C}\ or\ A = H \cdot C}\ (2)$$

$$\boldsymbol{T = \frac{O}{A}\ or\ A = \frac{O}{T}\ or\ O = A \cdot T}\ (3)$$



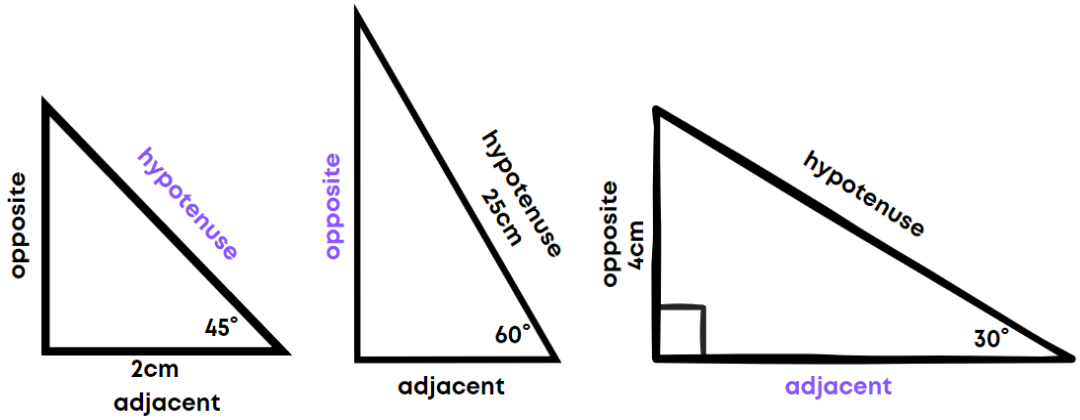
So, going back to our triangle, we want to calculate the hypotenuse.

We know the angle and the length of its adjacent side. The trigonometric number that connects these sides is the cosine of the angle. This means that we will use the second formula to calculate the length of the hypotenuse.

$$H = \frac{A}{C} = \frac{4}{cos60} = \frac{4}{\frac{1}{2}} = 8cm$$

HANDS-ON PART (30 minutes)

The students will work in pairs to calculate the missing sides (purple) of the following triangles. Then, three of the pairs will present one solution each to the classroom.



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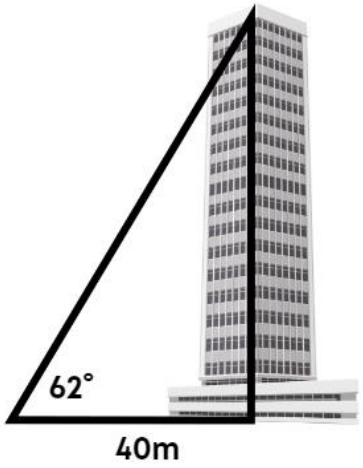
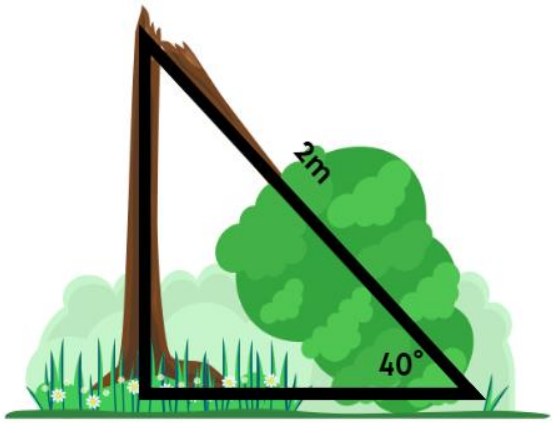
EXERCISE PART (20 minutes)

For this section the students will be provided with the table with the trigonometric numbers for every angle.

What is the height of the skyscraper?



What was the tree's height before it broke?



CONCLUSION (5 minutes)

This lesson teaches students to use trigonometry to find the length of a side in a right-angled triangle. Through the lesson, we discover the importance of trigonometry since we are able to calculate the length of a side, given only the length of another side and one angle (besides the right one), something we can't do with classic geometry or using Pythagoras' theorem.

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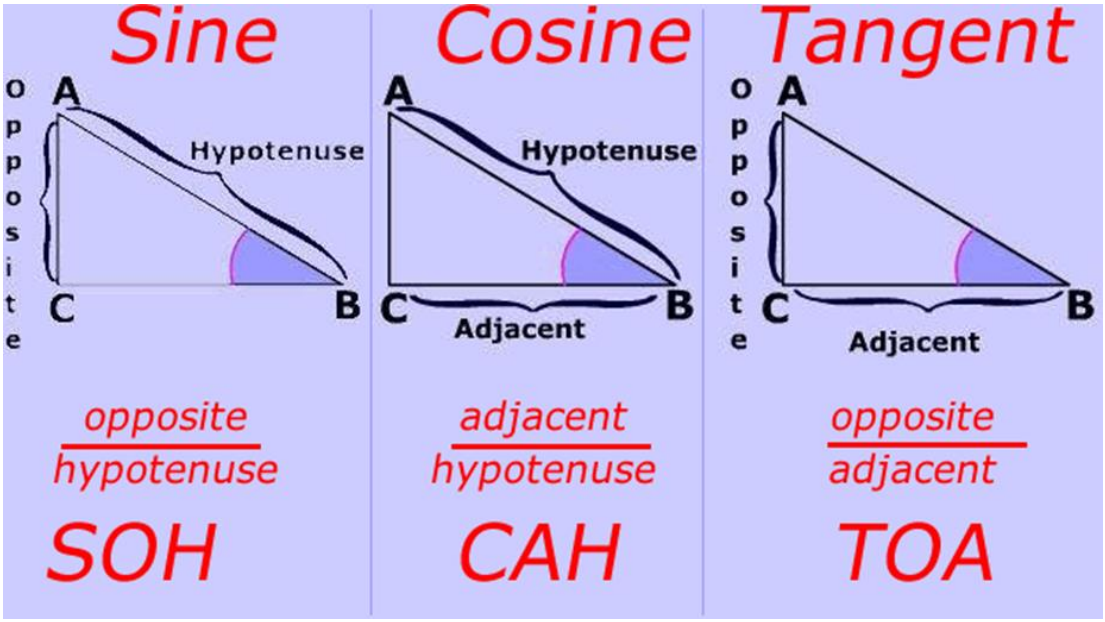
SYNTHESIS/SUMMARY (5 minutes)



$$S = \frac{O}{H} \; or \; H = \frac{O}{S} \; or \; O = H \cdot S \; (1)$$

$$C = \frac{A}{H} \; or \; H = \frac{A}{C} \; or \; A = H \cdot C \; (2)$$

$$T = \frac{O}{A} \; or \; A = \frac{O}{T} \; or \; O = A \cdot T \; (3)$$

BIBLIOGRAPHY & RESOURCES

Chin, c. (n.d.). *The practical use of trigonometry : the egyptian pyramids*. Prezi.com. Https://prezi.com/zjzzoin60tle/the-practical-use-of-trigonometry-the-egyptian-pyramids/

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