

MA3 NOTES - TRIGONOMETRY

Remember - If you get stuck you can look at the worked examples from the text book, watch the movies I've suggested through the notes, come and talk to me or any of the maths staff, message me on the cLc or tweet me on @erin_hc. The text book questions are the minimum recommended and cover a range of types of questions, you should choose to do more if you find this topic difficult, or you could choose to do less if you are confident.

WEEK 1

PYTHAGORAS IN 2 AND 3 DIMENSIONS



Not much is known about the life of Pythagoras due to the code of secrecy that society he led, which was half religious and half scientific, followed. Most students have heard the name Pythagoras before because it is linked to a famous theorem, the Pythagorean Theorem. Incidentally, it is rumoured that Pythagoras himself may not have even come up with the theorem and that it may have been one of his students/followers and what's more, that he may have murdered them to claim the discovery himself!

Picture from :<http://www-groups.dcs.st-and.ac.uk/history/PictDisplay/Pythagoras.html%20>

WATCH

The Pythagorean Theorem is explained neatly in the following videos.

<http://www.mathsisfun.com/pythagoras.html>

Khan Academy (some people like his instructions)

https://www.khanacademy.org/math/geometry/right_triangles_topic/pyth_theor/v/the-pythagorean-theorem

This one is pretty good too... <http://www.youtube.com/watch?v=uaj0XcLtN5c>

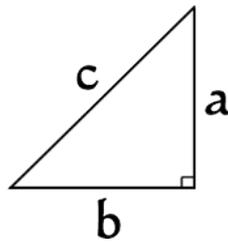
I quite like the videos from Patrick, <http://www.youtube.com/watch?v=WziqDlzHYxU>, and he does some worked examples in this one.

Every good topic has a rap! <http://www.youtube.com/watch?v=DRRVu-RHQWE>

And a little Donald Duck from one of my favourite movies, (A strenuous link but a bit of fun none the less.)

<http://www.youtube.com/watch?v=xyQBVMCVZws>

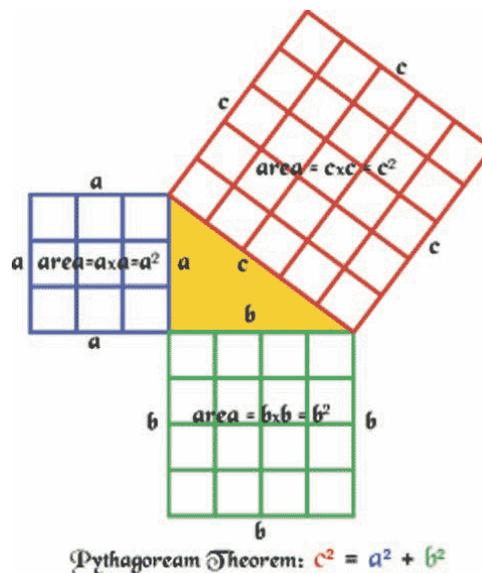
Basically though you need to know that this diagram



Is linked to this formula

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

Because of the proofs described by these squares... (and explained in some of the movies)



and of course you will need to know how to use it to solve problems, mostly worded ones.

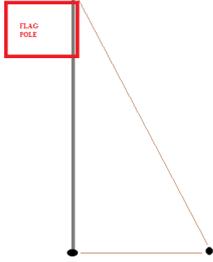
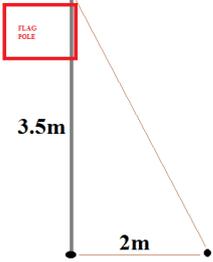
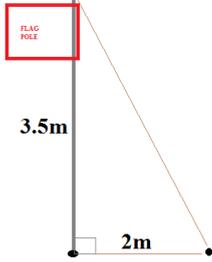
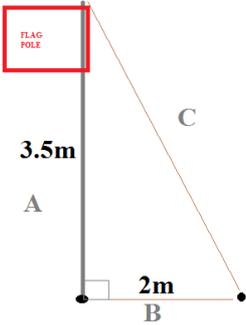
EXAMPLE 1

Finding the length of a hypotenuse, knowing the other sides.

The height of a flag pole is 3.5m. A rope is to be fixed from the top of the flag pole to the ground, a spot 2m away from the base. What is the minimum length of the rope that could be used, (allow an extra 60cm for the rope to be tied at either end.)

Video solution -> go here!

Paper solution on the next page.

<p>Step 1. Draw a picture</p> 	<p>Step 2. Mark on the measurements we know.</p> 	<p>Step 3. Is it a right triangle - don't forget to mark the 90 degree angle.</p> 
<p>Step 4. Identify your a, b and c and write the rule.</p>  $a^2 + b^2 = c^2$		
<p>Step 5. Fill in what you know</p>		$3.5^2 + 2^2 = c^2$
<p>Step 6. Solve for the unknown, (using your CAS is easiest)</p> <p>Type into the screen, highlight the whole equation, interactive, advanced, solve. Your text box has an example of this in worked example 8 from chapter 8C (Further Maths Book)</p>	<p>Or do some number crunching</p>	$3.5^2 + 2^2 = c^2$ $12.25 + 4 = c^2$ $16.25 = c^2$ $\sqrt{16.25} = c$ $c = 4.03$ <p>So the length of c is 4.03m, we remember we need to add 60cm, so the total length of the rope should be 4.63m (at the minimum).</p>
<p>Step 7.</p>	<p>State your answer.</p>	<p>The total length of the rope should be <u>4.63m</u> (at the minimum).</p>

EXAMPLE 2

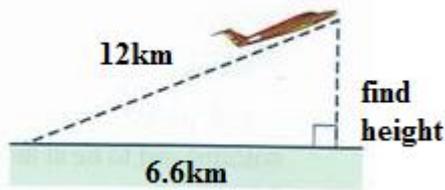
Solving for a side length if given the hypotenuse and one other side.

A plane travels 12km on its take off path from the ground to its cruising height. During this time it has travelled a horizontal distance of 6.6km. What is the cruising height of the plane.

Video solution -> go here!

Paper solution.

Step 1. Draw a diagram and mark on values we know.



Step 2. Write the rule

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

Step 3. Fill in values we know.

$$6.6^2 + b^2 = 12^2$$

Step 4. Solve for unknown.

$$43.56 + b^2 = 144$$

By hand or using your CAS.

$$b^2 = 144 - 43.56$$

$$b^2 = 100.44$$

$$b = \sqrt{100.44}$$

$$b = 10.021km$$

Step 5. State your answer

So the plane cruises at 10021m above the ground.

CONSOLIDATION AND PRACTICE

Maths Quest Further Maths 8A Pythagoras' Theorem Q1 any 2, 2, 3, Q5 any 3, 7, 9

Maths Quest Standard General 10A Pythagoras' Theorem in 2D Q5, 6, 9

PYTHAGOREAN TRIADS

These are just lists of sets of three numbers that make the Pythagorean formula true, eg 3,4, 5 is a triad because $3^2 + 4^2 = 5^2$. To test if numbers are a triad, see if the sum of the squares of the smaller 2 numbers, (in my example the 3 and 4), add up to the square of the largest number.

CONSOLIDATION AND PRACTICE

Maths Quest Further Maths

8B Pythagoras' Triads

Q1, 4, 5

PYTHAGORAS IN 3D

This just means apply the Pythagoras' theorem in situations that involve 3 dimensional perspectives. You can see some wire models of 3D Pythagoras in the Learning Commons and room 19. These might help if you have trouble visualising. The process for solving problems for Pythagoras in 3D is the same as in 2D - the trick is getting your diagram correct.

WATCH

The Pythagorean Theorem in 3D is explained neatly in the following video.

<http://www.youtube.com/watch?v=P4QH8BDUVUM&feature=youtu.be>

CONSOLIDATION AND PRACTICE

Maths Quest Further Maths

8 C Pythagoras in 3D

Q1, 2, 4, 7, 10, 12

Maths Quest Standard General

10B Pythagoras' Theorem in 3D

Q2, 4, 6

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WEEK 2

TRIGONOMETRIC RATIOS

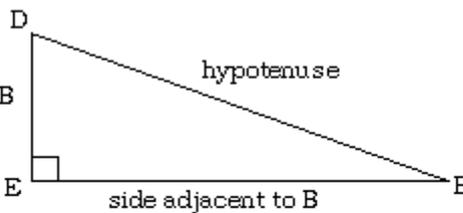
A ratio is a word that describes a proportional relationship.

A trigonometric ratio is ratio that describes the proportional relationship that exists between sides and angles of right angled triangles.

This week is a revision of these ratios, and by the end of the week you should be able to solve trigonometric ratio problems that are given to you in a diagram, numbers or words. Your solutions should also be including labelled diagrams.

The ratios you need to know!

The Basic Trigonometric Ratios



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

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

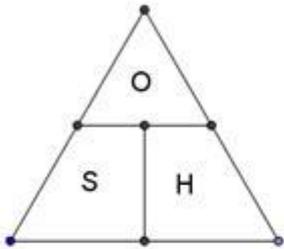
$$\tan B = \frac{\text{opp}}{\text{adj}} = \frac{\sin B}{\cos B}$$

Abbreviations
for side lengths:

opp : opposite
adj : adjacent
hyp : hypotenuse

You will probably remember the as the SOHCAHTOA rule.

SOH-CAH-TOA

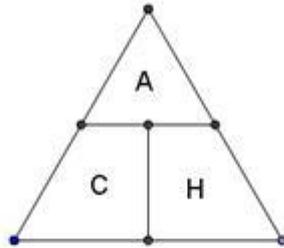


Angle = Inverse Sin(O/H)

$$O = H \cdot \sin(\text{angle})$$

$$H = O / \sin(\text{angle})$$

Sin is short for Sine
Use when no A

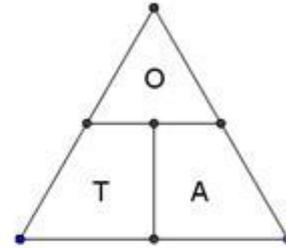


Angle = Inverse Cos(A/H)

$$A = H \cdot \cos(\text{angle})$$

$$H = A / \cos(\text{angle})$$

Cos is short for Cosine
Use when no O



Angle = Inverse Tan (O/A)

$$O = A \cdot \tan(\text{angle})$$

$$A = O / \tan(\text{angle})$$

Tan is short for Tangent
Use when no H

WATCH

These videos (whilst not the most exciting) do go over the basics of SOHCAHTOA including how to label diagrams correctly.

Trig Ratios Part 1 - http://youtu.be/NCyY_GwzU5M

Trig Ratios Part 2 - <http://youtu.be/2sBLQ58nIOM> (with some worked examples)

VCE Revision - <http://youtu.be/5tp74g4N8EY> (the best of the three – if you only watch one watch this one!)

CONSOLIDATION AND PRACTICE

Maths Quest Further Maths 8D: Q1 any 3, Q2, Q3, Q4c, Q5c, Q6c, Q7, any 2 from Q8-12, any 2 from Q13-17

Maths Quest Standard General 7A : Q2 any 3, Q4, Q5, Q13, Q14, Q18