 Further trigonometry

Teaching ideas

Students have difficulty visualising 3D problems and should be encouraged to deconstruct the problem into related 2D triangles and draw the 2D triangles, marking them up with all known and derivable facts, and links between the triangles (syllabus element – 3D Problems)

A block of cheese, plasticine or the corner of a photocopy paper cardboard box lid cut up is a useful visualisation tool.

After students have learned the formulas, look at the image "Proof without words 01" - can you explain it? How would you construct this image? Would it work for any angle A or B? What is needed for this to work? What if the line of distance 1 was an arbitrary distance d? (Syllabus element – The Compound Angle Formulae)

Students should be encouraged to derive the double angle formula by themselves (syllabus element – The Double Angle Formulae).

Students should extend the formula to derive the triple angle formulas, but clearly told it is not a syllabus requirement to remember them.

Explore the reason for doing the t-transformation: it allows us to transform a trigonometric expression/equation into an algebraic one (syllabus element – The t-transformation).

The t-transform turns a problem in different trig functions into a single "common denominator"  which is then easier to solve.

Highlight danger of missing out on a possible solution for 180 degrees. Why is this a problem? How do we recognise when this will occur? Typically when the quadratic equation turns into a linear equation, or when we have the form:

Prior to doing algebraic work, explore graphically what happens when we add  to  using GeoGebra:

* Set up sliders for,  and 
* Plot 
* Plot 
* Prediction: What will happen when we add them?
* Do we expect the result to be periodic? Why? And what period?
* How do the values of A and B affect the result?
* View the result: display 
* Play with the sliders to confirm understanding
* What happens when A or B are negative?

(Syllabus element – The Auxiliary Angle Transformation)

Explore using the algebraic approach methods to express  in any form of  or  as a sum or a difference of angles.



Difficulty for some students: Understanding which parts of the identity are variables and which parts are constants. Recommended to show the constants (A, B, R, α) using a different colour from the variable x.

This content will be required knowledge for Simple Harmonic Motion later in the course.

The order of presentation of the trig functions makes a big difference.

Recommended sequence (in order of difficulty)–

  
then   
then finally 

(Syllabus element – The General Solution)

Two approaches to develop the solution: using graphs of the functions or using rotations of the unit circle.

Explore the general solution geometrically by looking at rotation in the circle. As we rotate around the circle, when do we get solutions? How would we write this algebraically?

Introduce the concept of the general solution as the next level in a sequence: 1st stage is to solve  in one rotation of the circle; 2nd stage is to solve domain eg – . The final step is to say "I want every solution", using integer multiples.

Alert: Students need to be shown the many different ways to write a general solution, including the use of . The introduction of multiple choice questions in the HSC means students may need to recognise solutions in a variety of forms.