A Guide to Trigonometric Functions

Teaching Approach

Trigonometric functions can be taught in a very abstract manner, or they can be linked to trigonometric equations. Most teachers will combine both approaches to cater for the higher functioning and average learners.

The parent functions for the sine and cosine graphs are very similar. As a result, they should be taught at the same time with constant comparisons between the two. Give learners tricks to remember which graph is which. Once the changes in 'a' and 'q' have been introduced, they should be able to apply the changes to both graphs with very little difficulty.

The tangent function has a different shape to the sine and cosine functions. The parent graph has a period of 180^{o} and asymptotes that occur at the end of each period.

Use graph paper or trace paper when engaging learners in point by point plotting. It is always a good idea to use graph software to display the graphs to the class, if available.

Always encourage the learners to use the correct terminology. This encourages them to link meaningful words with what they have mastered or is still to master.

Get them talking about functions. Start your lesson out with a challenge that you will base on the previous lesson that they viewed and make it a timed task. Encourage and motivate them by having a small reward like a chocolate ready for the first person to finish the task correctly. Motivating efforts like these can have a huge impact on learners.

Video Summaries

Some videos have a 'PAUSE' moment, at which point the teacher or learner can choose to pause the video and try to answer the question posed or calculate the answer to the problem under discussion. Once the video starts again, the answer to the question or the right answer to the calculation is given

Mindset suggests a number of ways to use the video lessons. These include:

- Watch or show a lesson as an introduction to a lesson
- Watch of show a lesson after a lesson, as a summary or as a way of adding in some interesting real-life applications or practical aspects
- Design a worksheet or set of questions about one video lesson. Then ask learners to watch a video related to the lesson and to complete the worksheet or questions, either in groups or individually
- Worksheets and questions based on video lessons can be used as short assessments or exercises
- Ask learners to watch a particular video lesson for homework (in the school library or on the website, depending on how the material is available) as preparation for the next days lesson; if desired, learners can be given specific questions to answer in preparation for the next day's lesson

1. The Unit Circle

We use the unit circle to identify the sine function as $y = \sin\theta$. In this relationship, the sine ratio is dependent on the size of the angle.

2. Plotting the Basic Sine and Cosine Functions

In this lesson we sketch the graphs of the functions $y = \sin x$ and for $y = \cos x$ from a table of values. We can define these as the parent functions for the sine and cosine families of functions. We then compare characteristics of the sine and cosine parent graphs.

3. Plotting the Basic Tan Function

In this lesson we explore the tan function using the unit circle. We establish a functional relationship between the size of the angle and the tan ratio. Using a calculator, learners can generate a table of values which represent this function and plot the tan graph from the table.

4. The Effect of 'a' on the Sine and Cosine Functions

In this lesson we investigate the changes to the parent graphs brought about by changes to the *a* value in the formulae: $y = a\sin x + q$ and $y = a\cos x + q$. We describe the change as a 'stretch' by a factor of *a*.

5. The Effect of 'q' on the Basic Sine and Cosine Functions

In this lesson we investigate the effect changing the *q* value has on the parent sine and cosine graphs. We then generalize the effects of *q* and compare the effects of the *a* and *q* values.

6. **The Effect of 'a' and 'q' on the Tan Function**
   We investigate the effect changes to the *a* and *q* values have on the graph of $y = tan\, x$.

7. **Sketching Trigonometric Functions**
   This video deals with sketching the trigonometric graphs without using a table of values.

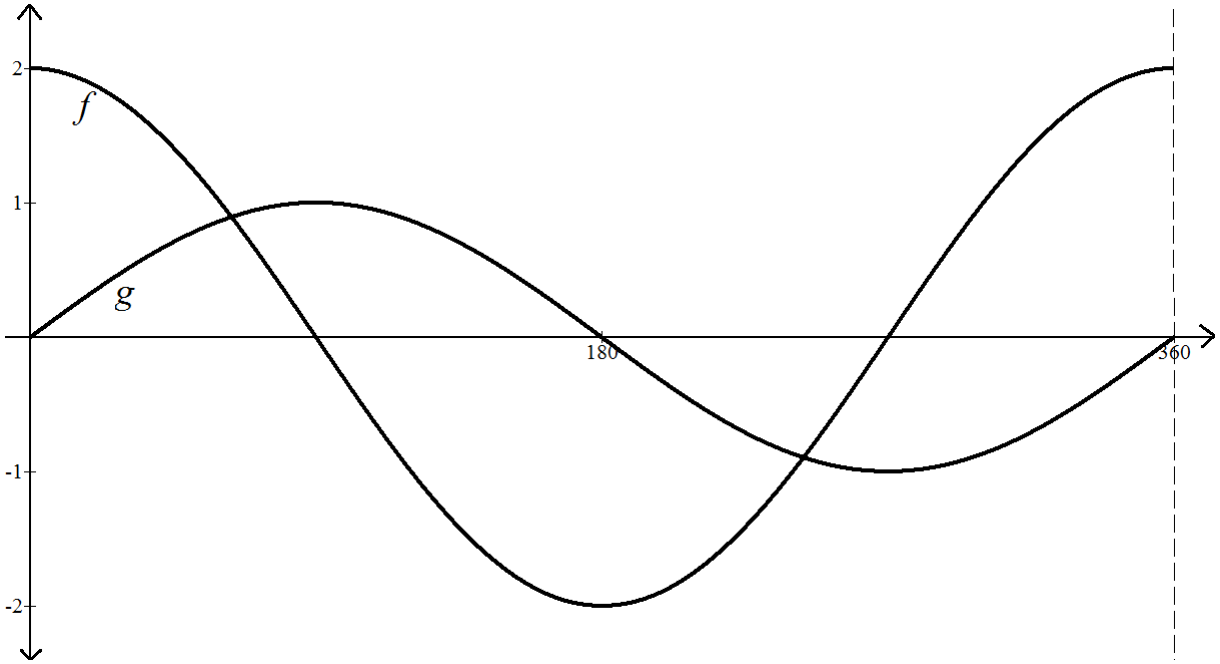
Resource Material

http://www.mathisfun.com/geometry/unit-circle.html	An explanation of the unit circle.
http://www.regentsprep.org/regents/math/algtrig/ATT5/unitcircle.htm	A note on the unit circle.
http://www.mathtutor.ac.uk/functions/trigonometricfunctions	An online course for trigonometric functions.
http://mrhomer.hubpages.com/hub/Trigonometry-graphs-of-sin-x-cos-x-and-tan-x	A note on trigonometric functions.
https://everythingmaths.co.za/grade-10/05-functions/05-functions-06.cnxmlplus	A textbook chapter on trigonometric functions.

Task

Question 1

Study the diagram and answer the questions:



1.1 Give the equation of the function represented by f.
1.2 Give the equation of the function represented by g.
1.3 What is the amplitude of f?
1.4 What is the period of g?
1.5 Compare f to its parent function and describe the changes that took place to produce graph f.
1.6 For what values of x does $f(x) - g(x) = 2$?

Question 2

2.1 Draw a sketch graph of $y = \tan x$ for $x \in [0°; 360°]$
2.2 On the same set of axes, sketch the graph of $y = \tan x - 2$

Question 3

Given $a = -\frac{1}{2}$ and $q = 4$, describe how the parent graph of each of these families of functions will be affected:

$$y = a\ cos\ x + q$$
$$y = a\ tan\ x + q$$

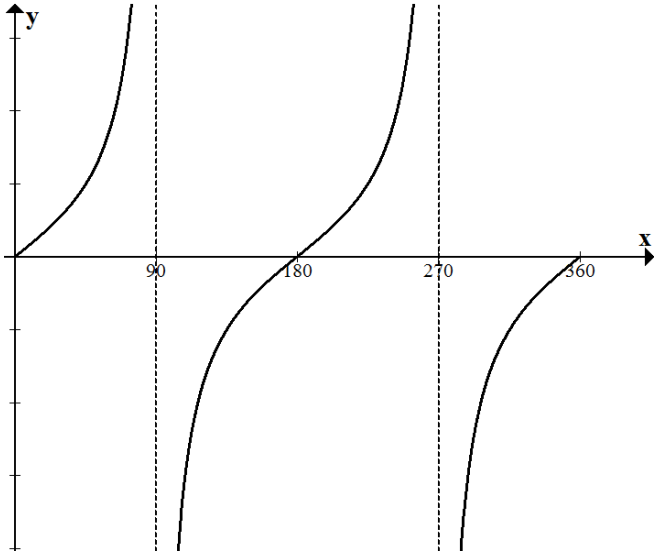
Task Answers

Question 1

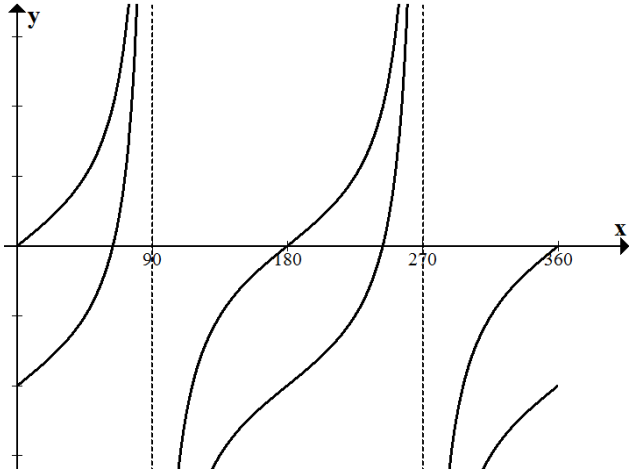
1.1 $f(x) = 2\ cos\ x$
1.2 $g(x) = sin\ x$
1.3 Amplitude = 2
1.4 Period = 360^o
1.5 Graph f is twice as tall as it's parent cosine graph. It's amplitude is twice as big.
1.6 $x = 0^o; 360^o$

Question 2

2.1 $y = \tan x$ for $x \in [0°; 360°]$



2.2 $y = \tan x - 2$



Question 3

$$y = a\ cos\ x + q$$

The cos function's amplitude will be halved and the function will be reflected over the x-axis. The function will be translated four units up.

$$y = a\ tan\ x + q$$

The tan function will be reflected about the x-axis and translated up by four units. It will look like the function has been squashed.

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