

2 Functions

Teaching support and guidance

Concepts

- Change
- Space
- Relationships
- Representation

Outcomes

Students will understand that creating different representations of functions to model the relationships between variables, visually and symbolically as graphs, represents different ways of communicating mathematical ideas.

Conceptual Understandings

- Different representations of functions, symbolically and visually as graphs, equations and tables, provides different ways of communicating mathematical relationships.
- The change in parameters of a function or equation corresponds to geometrical features of a graph and can represent physical quantities in spatial dimensions.
- Patterns can be identified in behaviours that can give us insight into appropriate strategies to model or solve systems.

Inquiry Questions

- Factual: How do we represent and use relationships in mathematics?
- Conceptual: How can a function not exist?
- Debatable: What is the best way to represent mathematical relationships?

Factual: How do we represent and use relationships in mathematics?

Debatable: What is the best way to represent mathematical relationships?

Concepts: Representation, Change, Space

Standard Level

PowerPoint: Composite functions (S2.5)

Using the PowerPoint, discuss with students the applications of composite and inverse functions, and where, potentially, they could exist in real life.

The focus should be on the connection between numbers. The output from one function becomes the input to another. Emphasize the notation:

$$f(g(x))$$

When substituting a value for x we can see that it goes through the function g and then the output from this function becomes the input for f .

Therefore, the function $g(x)$ has changed from being the output to the input.

Links: Function notation (S2.5)

The following websites offer discussion points on the history of function notation:

- <https://mathbitsnotebook.com/Algebra1/Functions/FNNotationEvaluation.html>
- <http://pat-thompson.net/PDFversions/2014MusgraveThompsonPME.pdf>
- [http://pat-thompson.net/PDFversions/2013WhyF\(x\).pdf](http://pat-thompson.net/PDFversions/2013WhyF(x).pdf)

Activity: Function transformations (S2.6)

While teaching S2.6, and before teaching S2.11, as a starter activity have the students attempt the exploration piece on transforming functions. It would be powerful for them to work in small groups to refine their explanations of what has happened to the function.

The task is designed as an investigative piece and students can attempt it individually, as a homework activity (in a flipped classroom context), or during class time. It is important that students communicate their own discoveries of what happens to the functions. When consolidating the task, it is important to introduce transformation language where relevant.

As a supplement to the task, students may find the website

- www.desmos.com

helpful as they model the functions.

Higher Level

Activity: Inverse and composite functions test (H2.14)

This test covers the main topics related to inverse and composite functions while incorporating some nice application/problem-solving style questions.

Conceptual: How can a function not exist?

Concept: Relationships

Standard Level

PowerPoint: Vertical and horizontal asymptotes (S2.4, S2.8)

This PowerPoint introduces the concept of an asymptote and discusses the idea of regions where functions do not exist. There are several rules involved in calculating asymptotes and (where relevant) revision cards can be created with the applicable rules.

The links that are referenced in the PowerPoint are:

- www.purplemath.com/modules/asymtote.htm
- www.purplemath.com/modules/asymtote2.htm

Higher Level

Link: Polynomial division (H2.12)

Before they attempt any further questions related to asymptotes, it is imperative that students can perform polynomial division. The link below demonstrates the most common technique for this:

- www.purplemath.com/modules/polydiv2.htm

PowerPoint: Oblique asymptotes (H2.13)

This PowerPoint builds on the knowledge from the SL PowerPoint and introduces the idea of oblique asymptotes. As mentioned, calculating oblique asymptotes requires the ability to perform polynomial division. There is an opportunity to develop the use of revision cards during this topic. The website link mentioned in the PowerPoint is:

- www.purplemath.com/modules/asymtote3.htm

Opportunities for students to manipulate functions and observe asymptotes are offered on the graphing website:

- www.desmos.com