

Goals

This fortnight we are going to:

- Understand the concepts of relations and functions
- Understand the inter-connectivity of the written, graphical and algebraic forms of relation
- Develop mathematical models with various functions
- Use algebraic methods and graphing software to identify the key features of linear functions
- Functions and relations
- Odd and even functions
- Domain and range
- Further develop curve recognition, domain and range, using technology to sketch functions

Theoretical Components

Resources

Make notes on the following chapters and websites:

Chapter 1 and 4 of Maths Quest 11 Mathematical Methods (pdf – Google Classroom)

- <http://www.mathsisfun.com/algebra/linear-equations.html>
- <http://www.mathsisfun.com/gradient.html>
- http://www.mathsisfun.com/data/straight_line_graph.html
- <http://www.mathsisfun.com/algebra/line-equation-point-slope.html>
- <https://www.mathsisfun.com/sets/function.html>
- <https://www.mathsisfun.com/sets/domain-range-codomain.html>

Knowledge Checklist:

- Know about gradients
- Be able to sketch linear functions quickly, easily and with accuracy
- Find the equation of a line given certain information
- Use modelling techniques -applications using linear functions
- Define the domain and range of a function
- Use the vertical line test for functions

Formulas

- General form for linear equations
 $y = mx + c$
where m is the gradient and c is the y -intercept (when $x=0$)
- Gradient
 $m = \frac{\text{rise}}{\text{run}}$ or $m = \frac{y_2 - y_1}{x_2 - x_1}$
- Perpendicular lines
 $m_1 \times m_2 = -1$
- Parallel lines
 $m_1 = m_2$
- Finding the equation of a straight line
 $y - y_1 = m(x - x_1)$

Practical Components

Make notes on the following chapters and websites:

Maths Quest 11 Mathematical Methods

- 1A Solving linear equations and inequations
- 1B Rearrangement and substitution
- 1C Gradient of a straight line
- 1D Sketching linear functions
- 1F Finding the equation of a straight line
- 1G Distance between two points and midpoint of a segment
- 1H Linear modelling
- 4C Domain and range
- 4D Types of relations (including functions)

Do the following questions:

Organise your solutions neatly in your exercise book.

- 1A: 2a, h; 3
- 1B: 3, 5
- 1C: 1a, 2c, 7, 8
- 1D: 8e, 9c, f; 14, 15
- 1F: 5a, b; 8, 10, 12-15
- 1G: 1, 5
- 1H: All even numbered questions
- 4C: 1b, g; 2d, h; 3c, 4, 7, 8, 10
- 4D: 1a, d, g, j; 2a, d, g, j; 4

Investigation

See the next page.

Week 7 and 8 Investigation

Part A

Here are the equations of 12 straight lines.

$y = 4x + 4$	$4y = x + 3$	$y = 8x - 3$	$y + 4x + 6 = 0$
$3y = 2x - 8$	$y + 6x = 11$	$y + 8x = 6$	$2y + 8 = 3x$
$2y + x = 4$	$2y = 8x + 3$	$y = 6x - 4$	$y + x + 8 = 0$

1. Rewrite each equation in the form $y = mx + c$

2. These 12 straight lines can be divided up into pairs/group, each pair matching one of the following descriptions. Sort them into the correct pairs and complete the final description.

- These lines are parallel.
- These lines are perpendicular.
- These lines have the same y-intercept.
- These lines have the same x-intercept.
- These lines both go through the point (1,5).
- These lines ...

Part B

Read the following on Odd and Even Functions and complete the questions on the following page.

Even and Odd Functions

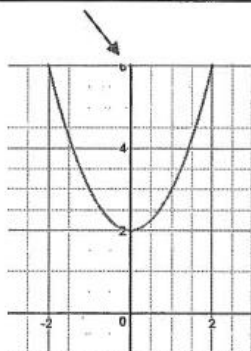
A **Function** can be classified as **Even**, **Odd** or **Neither**. This classification can be determined *graphically* or *algebraically*.

Graphical Interpretation -

Even Functions:

Have a graph that is symmetric with respect to the **Y-Axis**.

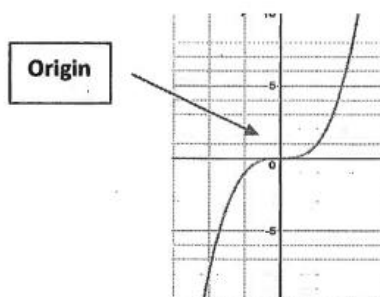
Y-Axis – acts like a mirror



Odd Functions:

Have a graph that is symmetric with respect to the **Origin**.

Origin – If you spin the picture upside down about the Origin, the graph looks the same!



Algebraic Test – Substitute $(-x)$ in for x everywhere in the function and analyze the results of $f(-x)$, by comparing it to the original function $f(x)$.

Even Function: $y = f(x)$ is **Even** when, for each x in the domain of $f(x)$, $f(-x) = f(x)$

Odd Function: $y = f(x)$ is **Odd** when, for each x in the domain of $f(x)$, $f(-x) = -f(x)$

Examples:

a. $f(x) = x^2 + 4$

$$f(-x) = (-x)^2 + 4$$

$$f(-x) = x^2 + 4$$

$$f(-x) = f(x)$$



Even Function!

b. $f(x) = x^3 - 2x$

$$f(-x) = (-x)^3 - 2(-x)$$

$$f(-x) = -x^3 + 2x$$

$$f(-x) = -(x^3 - 2x) = -f(x)$$



Odd Function!

c. $f(x) = x^2 - 3x + 4$

$$f(x) = (-x)^2 - 3(-x) + 4$$

$$f(-x) = x^2 + 3x + 4$$

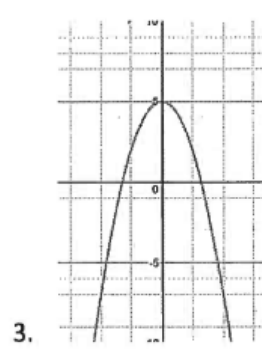
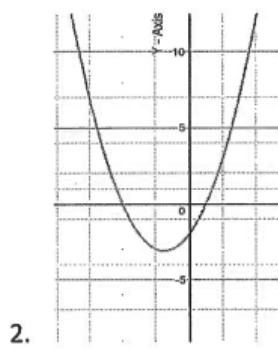
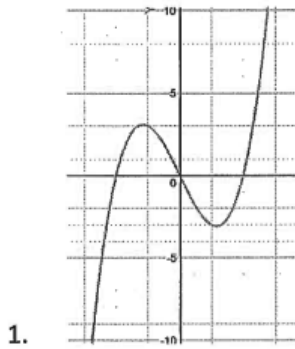
$$f(-x) \neq f(x) \neq -f(x)$$



Neither!

Even and Odd Functions - Practice Problems

A. Graphically determine whether the following functions are Even, Odd, or Neither



B. Algebraically determine whether the following functions are Even, Odd, or Neither

1. $f(x) = x^3 - x^2 + 4x + 2$
2. $f(x) = -x^2 + 10$
3. $f(x) = x^3 + 4x$
4. $f(x) = -x^3 + 5x - 2$
5. $f(x) = \sqrt{x^4 - x^2} + 4$
6. $f(x) = |x + 4|$
7. $f(x) = |x| + 4$
8. $f(x) = x^4 - 2x^2 + 4$
9. $f(x) = \sqrt[3]{x}$
10. $f(x) = x\sqrt{x^2 - 1}$