Week 9/10
Term 2
2019

HAWKER COLLEGE
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MM1: Functions and Graphs

Goals

By the end of this brief, you should be able to:

- understand the concepts of relations and functions
- understand the inter-connectivity of the written, graphical and algebraic forms of relations
- develop mathematical models with various functions
- use algebraic methods and graphing software to identify the key features of linear and quadratic functions.

This brief's focus:

- quadratic functions, their graphs and features
- describing functions and relations
- learn to use your ClassPad calculator

Theoretical Components

This brief is about becoming familiar with **quadratic functions** so you can sketch them fluently and accurately. You need to:

- Know about dilation, vertical translation, horizontal translation, vertex, axis of symmetry, reflection, roots, intercepts
- Be able to sketch quadratic functions quickly, easily and with accuracy (from the base form, h,k form and fully factorised form)
- Find the equation form of a quadratic knowing certain criteria of from a graph.

Forms:
Base form $y = x^2$
General form $y = ax^2 + bx + c$
Vertex (h,k) form $y = a(x - h)^2 + k$
Fully factorised form $y = (ax - m)(bx - n)$
Turning point or vertex is at $x = \frac{-b}{2a}$

http://www.mathsisfun.com/algebra/quadratic-equation-graphing.html

http://www.mathsisfun.com/algebra/quadratic-equation-real-world.html

http://www.mathsisfun.com/algebra/quadratic-equation.html

What are functions and relations?
What is the vertical line test?
Is there a quick way to determine if a rule is a function?
Define the domain and range of a function.

http://www.purplemath.com/modules/fcns.html

http://www.mathsisfun.com/sets/function.html

http://www.mathsisfun.com/sets/domain-range-codomain.html

Remind yourself of linear functions:
http://www.mathsisfun.com/algebra/linear-equations.html

Practical Components

Factorising Quadratics
There are a number of methods, some you may have learnt in high school. Refresh these by referring to your text (Ex 2C)
A method that may be new to you is called completing the square (Ex 2D)
Solving equations, (graphically means finding where the graph crosses the x-axis). This means that the solution to a function, the x-intercepts, the roots and the zeros are all descriptions of the exact same thing. Solving quadratics can be done by using:

- CAS Classpad (Ex 2K) - Optional
- Quadratic Formula (Ex 2G)
- Graphing and finding the x-intercepts
- Fully factorised form (gives the roots easily)
- Completing the square (Ex 2E, Ex 2F)

Please attempt (at least) the following questions:
2C Factorising quadratic expressions
Q7 (all), Q9.
2D Factorising by completing the square
Q2(a, c, e, g, i)
2E Solving quadratic equations
Q2(a, d, g, h), 3(a, d, g, j), 8, 10, 12
2F Solving quadratic equations – completing the squre
Q2 (all), Q8 (all)
2G Quadratic formula
Q1 a, h Q2(all),8,10,13

Investigation

see the following page.

QFO

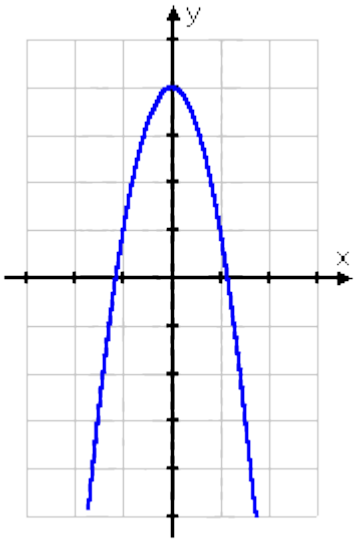
Week 10 Quiz on mathspace.

Week 9&10 Investigation

Read the following example:

Determine algebraically whether $f(x) = -3x^2 + 4$ is even, odd, or neither.

If I graph this, I will see that this is "symmetric about the *y*-axis"; in other words, whatever the graph is doing on one side of the *y*-axis is mirrored on the other side:



This mirroring about the axis is a hallmark of even functions.

Note also that all the exponents are even (the exponent on the constant term being zero: $4x^0 = 4 \times 1 = 4$).

But the question asks me to make the determination *algebraically*, which means that I need to do it with algebra, not with graphs.

So I'll plug $-x$ in for x, and simplify:

$$\begin{aligned} f(-x) &= -3(-x)^2 + 4 \\ &= -3(x^2) + 4 \\ &= -3x^2 + 4 \end{aligned}$$

My final expression is the same thing I'd started with, which means that **$f(x)$ is even**.

Your task is to:

1. Find definitions for the following and express in your words:
odd functions even functions neither odd nor even function
http://www.mathsisfun.com/algebra/functions-odd-even.html

2. Using the method in the example above determine algebraically whether $f(x) = 2x^3 - 10x + 1$ is even, odd, or neither. Show your working out steps to get full marks.