Week 11/12
Term 2
2024

HAWKER COLLEGE
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**Learning Brief**
**SMM1**

# Quadratic Formula

when $ax^2 + bx + c = 0$

$$x = \frac{-b \pm \sqrt{(b)^2 - 4ac}}{2a}$$

## Goals

This fortnight's focus:

- Quadratic functions, their graphs and features
- Quadratic skills (factorising, quadratic formula, completing the square, equations reducible to quadratics)
- Solving quadratic equations
- Sketching quadratic functions
- Function recognition, domain and range

## Theoretical Components

You will need to have a good working knowledge of domain and range, functions, and relations for the assignment this term.

Quadratics: You need to know about dilation, vertical translation, horizontal translation, vertex, axis of symmetry, reflection, roots, intercepts

Forms: Base form $y = kx^2$

General form $y = ax^2 + bx + c$

Vertex (h,k) form $y = a(x - h)^2 + k$

Fully factorised form $y = (ax - m)(fx - n)$

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 from a graph. **Turning point** or vertex is at $x = \frac{-b}{2a}$

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

More functions and their graphs:

http://www.intmath.com/functions-and-graphs/4-graph-of-function.php

http://tutorial.math.lamar.edu/Classes/CalcI/CommonGraphs.aspx

http://tutorial.math.lamar.edu/Classes/Alg/GraphFunctions.aspx

## Practical Components

Do the following questions:
Organise your solutions neatly in your exercise book. Chapter 2 of Maths Quest 11 Mathematical Methods (pdf – Google Classroom)
**2F Solving quadratic equations – completing the square** As many as you think you need
**2G Quadratic formula**
Q1 a, h; Q2(all); Qs 8,10,13
**2H Discriminant**
Q1 a, e, i; Q5(all)
**2I Graphs of Quadratic Function as power function (turning point form)**
Q4 a, e; Qs 6 and 7
**2J Graphs (using your algebraic manipulation skills)** Qs 1-9 (a, e); Qs 10 - 13
**2K Using technology to solve quadratics equations** (Use Desmos or Quadratic Calculator to solve)
**2L Simultaneous quadratic and linear equations**
Q1 j, l, n, p; Qs 3,4.5,7,8

## Investigation

See next page. Consider working in pairs, sharing the tasks, and then coming together in your double lesson to swap notes, explain to each other and finish the investigation by the end of Week 12. This will hopefully achieve/encourage group collaboration and communication skills when sharing with your partner.

## Other

**Fun fact:** Satellite dishes are parabolic in shape to ensure that incoming signals can be reflected to the receiver no matter the direction it comes from.
**Quadratic Calculator**:https://www.calculatorsoup.com/calculators/algebra/quadratic-formula-calculator.php

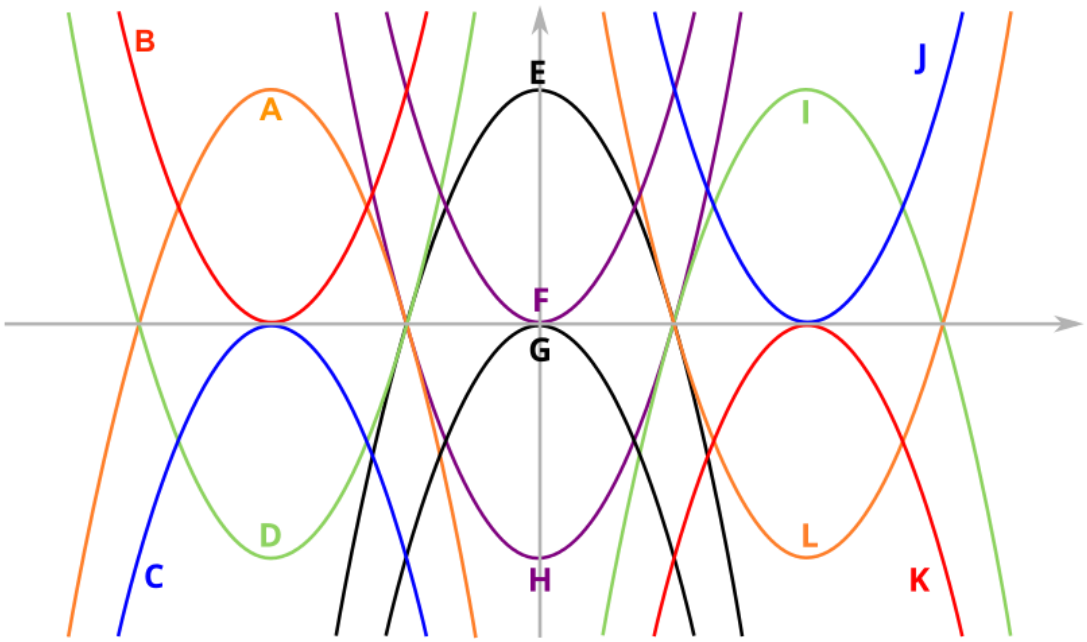
## Week 11 and 12 Investigation

**PART A: (i)**

Use DESMOS or other graphing tools to investigate the effect that the value of *k* has on the shape and position of the graph $y = x^2$ in the following situations.

| | $k > 0$ | $k < 0$ | $0 < k < 1$ | $k > 1$ |
|---|---|---|---|---|
| $y = kx^2$ | -- | | | |
| $y = x^2 + k$ | | | -- | -- |
| $y = (x + k)^2$ | | | -- | -- |
| $y = (kx)^2$ | -- | | | |
| $y = x^2 + kx$ | | | -- | -- |
| Any other observations? | | | | |

**PART A: (ii)**




Given that two of the parabolas have equations:

$$y = x^2 - 12x + 27 \text{ and } y = -x^2 + 12x - 36$$

Find the equations of the other parabolas:

| | | | |
|---|---|---|---|
| **A** | | **G** | |
| **B** | | **H** | |
| **C** | | **I** | |
| **D** | | **J** | |
| **E** | | **K** | |
| **F** | $y = x^2$ | **L** | |

**PART B:**

We are also investigating function families:

- Linear
- Quadratic
- Square Root
- Cubic
- Hyperbolas (reciprocal functions)
- Semi-Circles
- Absolute Value
- Exponential
- Logarithmic
- Hybrid / Piecewise

Your task is to sketch an example of EACH of the above functions and identify and describe what it is about these functions that make them identifiable as the function named. (Linear function is so named because linear means 'line' and the linear functions are always straight lines.)
What are their main features? How are their equations recognisable algebraically? Give the equation of the example you have chosen? State the domain and range?

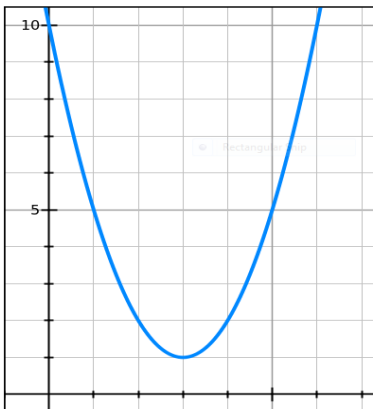
A good place to start looking for examples:http://www.intmath.com/functions-and-graphs/4-graph-of-function.php

For example:
The word "quadratic" comes from quadratum, the Latin word for square.
Quadratic example: $y = (x - 3)^2$ +1

Domain: $x$ can be any real number
$(-\infty < x < \infty)$

Range: $y$ can be any real number,

where $y \geq 1$




**Sketching tools:** https://www.desmos.com/calculator

http://graphsketch.com/

http://www.intmath.com/functions-and-graphs/graphs-using-jsxgraph.php

**Calculator:**

https://www.calculatorsoup.com/calculators/algebra/quadratic-formula-calculator.php