Week 11
Term 2
2021

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MM1
Functions and graphs
Quadratic relationships

Goals

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

- examine examples of quadratically related variables
- recognise features of the graphs of $y = x^2$, $y = a(x-b)^2 + c$, and $y = a(x-b)(x-c)$, including their parabolic nature, turning points, axes of symmetry and intercepts
- solve quadratic equations using the quadratic formula and by completing the square
- find the equation of a quadratic given sufficient information
- find turning points and zeros of quadratics and understand the role of the discriminant
- recognise features of the graph of the general quadratic $y = ax^2 + bx + c$.

Theoretical Components

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

- Know about shape, dilation, vertical translation, horizontal translation, vertex (turning point), 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.

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 same thing.
Solving quadratics can be done by using

- Quadratic Formula
- Graphing and finding the x-intercepts
- Fully factorised form (gives the roots easily)
- Completing the square

Discriminant: the discriminant gives us important information about the solutions a quadratic may have. It tells us the number, the type of roots and the graphical implications for the quadratic.

Online reading:
https://www.mathsisfun.com/algebra/quadratic-equation-real-world.html
https://www.mathsisfun.com/algebra/quadratic-equation-graphing.html
Videos:
https://youtu.be/BGz3pkoGPag

Practical Components

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

Do the following questions:
Organise your solutions neatly in your exercise book.

You will require Chapter 2 of Maths Quest 11 Mathematical Methods (pdf – Google Classroom)

Ex 2G The quadratic formula
- Q's 1 (a,h), 2 (all)

Ex 2H The discriminant
- Q's 2 (b.e,h), 5 (a,d,g)

Ex 2I Graphs of quadratic functions as power functions (turning point form)
- Q's 6 (any 5), 7

Ex 2J Graphs of quadratic functions (intercept method)
- Q's 1 (a,b), 2 (a,j), 4 (all), 6 (a,d,g), 10, 11, 13

Investigation

See the following page

QFO
Quiz/Forum/Other

No mathspace this week.

Make a start on your assignment (due week 14).

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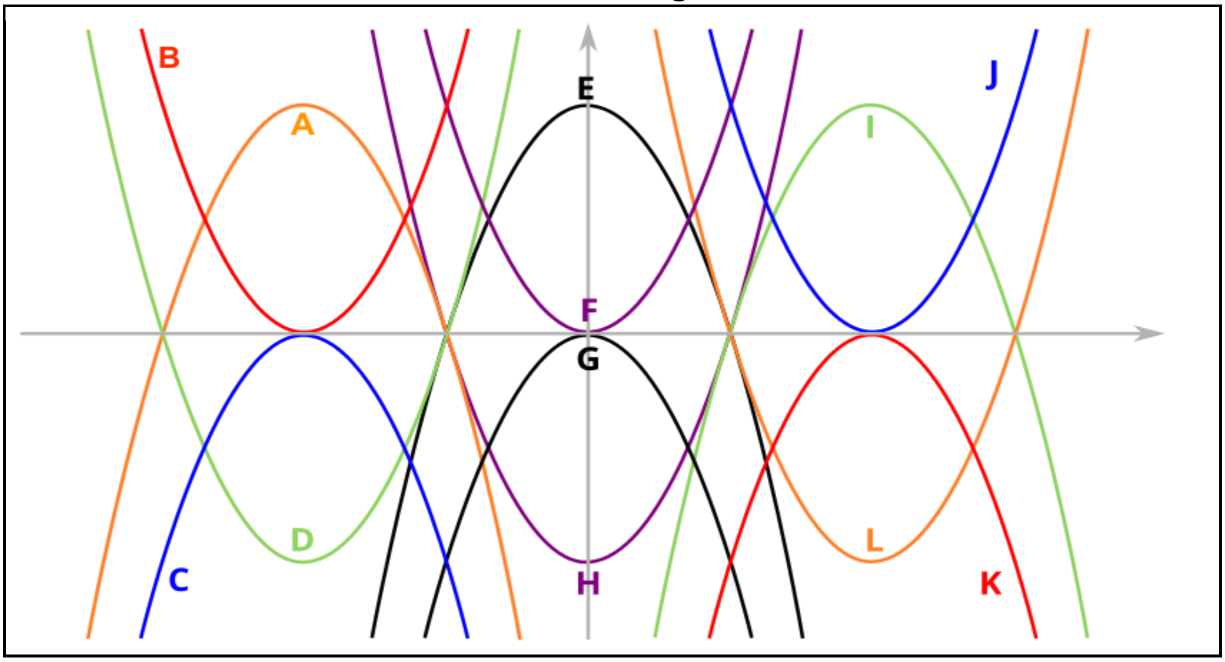
Week 11 Investigation



Given that two of the parabolas have equations

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

can you find the equations of the other parabolas?

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

Hints:

1. Can you factorise these equations? What does this tell you about the graphs of these two functions?

2. What is the difference between the graphs of $y = x^2 + bx + c$ and $y = -x^2 - bx - c$? Can you spot any graphs in the picture that might satisfy such a relation?

3. If you know that a graph has equation $y = ax^2 + bx + c$, what is the equation of its reflection in the y-axis?

You may write the equations in general form, factorised form or turning point form. However, **be consistent.**