Learning outcomes: Chapter 1

1. You should be able to recognise a function as being linear/quadratic

2. You should be able to sketch/plot simple linear and quadratic functions

3. Given the general form of a linear function – that is, $y = mx + c$ – you should:

- be able to identify the intercept and gradient of a linear function;
- know that this function gives a straight line graph, and you should be able to plot/sketch this graph;
- understand the role of the intercept and gradient – both graphically and in terms of a real–life scenario;
- be able to operate the linear function by substitution, remembering the rules of "BIDMAS".

4. You should be able to find the equation of a straight line:

- from a graph of the line;
- given the gradient and a point that the line passes through ("Gradient–point");
- given the co-ordinates of two points that the line passes through ("Point–point").
- In all situations, Gradient $= \dfrac{\text{Change in } y}{\text{Change in } x}$.

5. You should be able to:

- rearrange simple formulae and solve simple linear equations;
- formulate, and solve, a simple linear equation given a real–life scenario;
- solve a pair of linear equations simultaneously

6. You should know that, for a quadratic of the form $ax^2 + bx + c$, the *discriminant* is

$$D = b^2 - 4ac.$$

7. You should know that if

- D is a perfect square, then the quadratic can be factorised;
- $D > 0$, the quadratic will have two distinct roots;
- $D = 0$, the quadratic will have repeated roots;
- $D < 0$, the quadratic will have complex roots.

8. Given that a quadratic has a perfect square discriminant, you should be able to solve this quadratic via factorisation.

9. You should be able to use the quadratic formula

$$x = \frac{-b \pm \sqrt{D}}{2a}$$

to solve a quadratic equation with $D \geq 0$.

10. You should be able to form quadratic equations from simple scenarios, and solve these according to (8) or (9) above.

11. You should know that quadratics are *polynomials of order 2*, and that cubics and quartics are extensions of this to polynomials of order 3 and 4 (respectively).

12. You should be able to:

- formulate a real–life scenario as a linear programming problem, identifying the *decision variables*, *constraints* and *objective function*;
- summarise a linear programming problem graphically;
- solve very simple linear programming problem graphically and algebraically.

Prize question*

KJB Haulage receives an order to transport 1600 packages. They have large vans, which can take 200 packages each, and smaller vans, which can take 80 packages each. The cost of running each large van on the required journey is £40 and the cost of running each small van on the same journey is £20. There is a limited budget for the job which requires that not more than £340 be spent. It is additionally required that the number of small vans used must not exceed the number of large vans used. How many of each type of van should be used if costs are to be kept to a minimum? What will the associated costs be? Show *all* your working.

*** To be handed in to me in the lecture on Friday, 11th November 2016**