PC 11

Unit 3: Quadratic Function

Review: Functions and Relations

A relation is a relationship between input values (=independent values = values from **the domain =** usually "x" values) and the output values (= dependent values = values from **the range** = usually "y" values).

- The input value and its associated output value(s) form an ordered pair (or several ordered pairs) that can be plotted in a coordinate system (= Cartesian System).

A relation can be described in many different ways:

A function is a special type of a relation that has exactly one output value for one input value. A function is a relation whose graph passes the vertical line test (VTS).

- In other words, every function is a relation but not every relation is a function.

Examples:

So far, you have learned about linear functions (remember grade 10?).

- Linear functions can be expressed in different ways. Regardless the type of the linear equation, every present variable does not have an exponent greater than one.
- In other words, a linear function is a polynomial function of degree one.
- Examples:

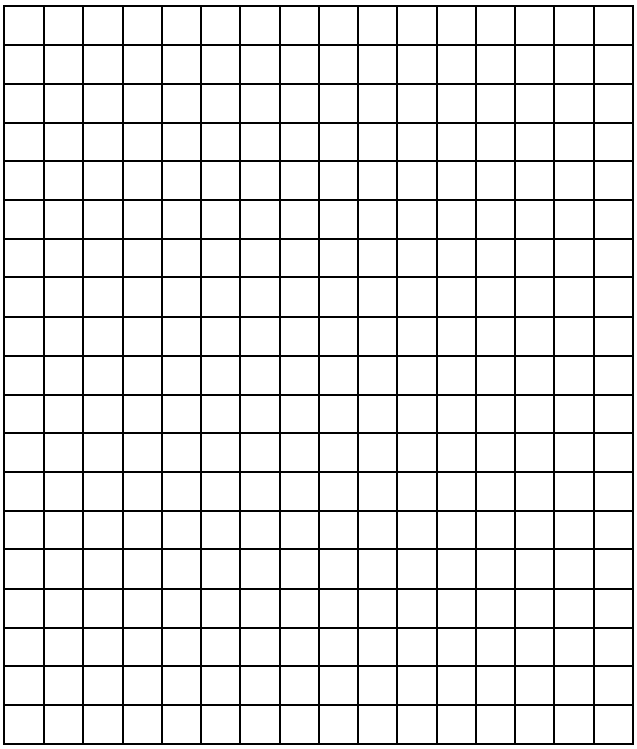
In PC11, you are going to learn about quadratic functions.

- Quadratic functions can be expressed in different ways. Regardless the type of the quadratic equation, every present variable does not have an exponent greater than two, and there has to be at least one variable that has an exponent of two.
- In other words, a quadratic function is a polynomial function of degree two.
- Examples:

Graphing the Quadratic Function

- The graph of every quadratic function is called the **<u>parabola.</u>**
- A parabola has several important features:

The original parabola is given by the equation: $y = x^2$ or $f(x) = x^2$.



Vertex (its coordinates):

Direction of opening:

Axis of symmetry:

y-intercept (every parabola has one):

- A y-intercept is a point and it has to be described as such = as an ordered pair: (0,#)

x-intercept(s) (not always present):

- An x-intercept is a point and it has to be described as such = as an ordered pair: (#,0)
- If a parabola does not have x-intercepts, this fact must be clearly communicated in a statement: "There are no x-intercept." ("N/A").

Transformations of a Quadratic Function

- The original graph can undergo several transformations.
- Transformations of a graph an be grouped in to two categories based on the coordinate that is affected by the transformation:
  - Vertical transformations = transformations that change the y-coordinate of the original point.
  - Horizontal transformations = transformations that change the x-coordinate of the original point.
- Transformations of a graph can be grouped in to three categories based on their type (or a math operation that describes the transformation):

  - Reflections: (only vertical reflection for a parabola = R in x-axis, because a reflection in the y-axis gives an identical graph).

  - Translations:

- Stretches: (only a vertical for a parabola, because we can use algebra to express a horizontal stretch as a vertical stretch which is much easier).
    - Expansion
    - Compression

Vertex Form of the Quadratic Equation

Describing and Graphing Transformations of a Parabola