

## Lesson 1 Properties of a Quadratic Function

A quadratic function is any function that can be written in the form  $y = ax^2 + bx + c$ , where  $a, b$  and  $c$  are real numbers and  $a \neq 0$ . This is called the general form of a quadratic function.

Recall: quadratic eqn  $ax^2 + bx + c = 0$

**Shape of graph:** parabola opening up or down.

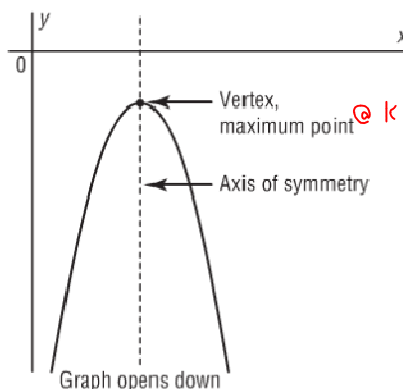
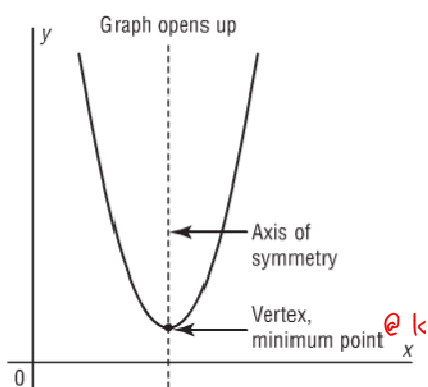
**Vertex:** highest or lowest point, known as the maximum/ minimum point

Coordinates are  $(h, k)$  when written in transformational form  $y = a(x - h)^2 + k$

**Axis of symmetry:** the vertical line through the vertex of a parabola, written as  $x = h$   
The parabola is symmetrical about this line.

Given  $y = ax^2$ ,  
if  $a$  is positive, the parabola opens up and its vertex is a minimum point.

if  $a$  is negative, the parabola opens down and its vertex is a maximum point.



**Domain:** all values of  $x$ ,  $(-\infty, \infty)$

**Range:**  $[k, \infty)$  or  $(-\infty, k]$   
*opens up*      *opens down*

Pre-Calculus 11 Quadratic Functions

The y-intercept of a quadratic function is the value of  $y$  when  $x = 0$ .

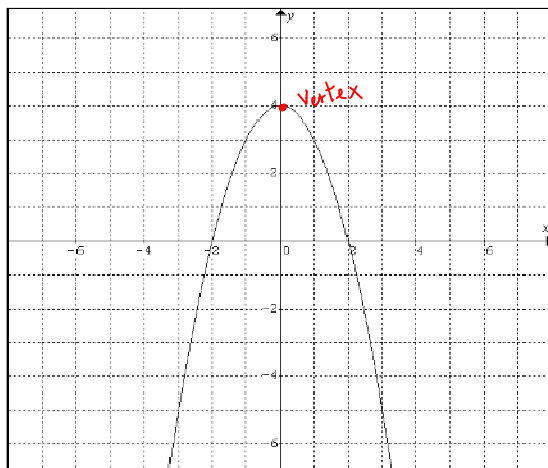
The x-intercepts of the graph of a quadratic function,  $y = ax^2 + bx + c$  are called the zeros of the function because they are the values of  $x$  when the function is 0; that is, when  $y = 0$ .

The zeros of the function are the roots of the related quadratic equation  $ax^2 + bx + c = 0$ .

graph  $\rightarrow$  x-int  
 function  $\rightarrow$  zeros  
 equation  $\rightarrow$  roots  
 } same values

**Example 1**

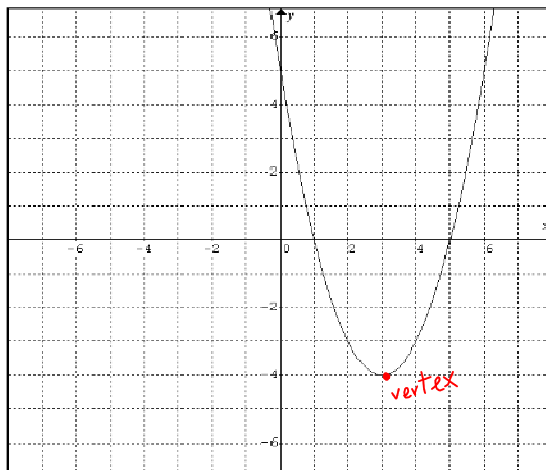
- a) Given the graph below, identify:
- i) the x- and y- intercepts
  - ii) the coordinates of the vertex
  - iii) the equation of the axis of symmetry
  - iv) the domain of the function
  - v) the range of the function
  - vi) the maximum/minimum value



- i.) x-int -2 and 2
- y-int <sup>K</sup> 4
- ii) (0, 4) <sub>h</sub> <sup>K</sup>
- iii)  $x = 0$
- iv)  $(-\infty, \infty)$
- v)  $(-\infty, 4]$  <sup>K</sup>
- vi) max @ 4 <sub>K</sub>

**Example 2**

- b) Given the graph below, identify:
- i) the  $x$ - and  $y$ - intercepts
  - ii) the coordinates of the vertex
  - iii) the equation of the axis of symmetry
  - iv) the domain of the function
  - v) the range of the function
  - vi) the maximum/minimum value



- i)  $x$ -int 1 and 5
- ii)  $y$ -int <sup>k</sup>5
- ii)  $V(3, -4)$
- iii)  $x = 3$
- iv)  $(-\infty, \infty)$
- v)  $[-4, \infty)$  <sup>k</sup>
- vi) min @ -4

**Example 3**

Determine the  $y$ -intercept of quadratic function,  $y = -2x^2 + 5x - 8$ .

sub  $x = 0$

$$y = -2x^2 + 5x - 8$$

$$y = -2(0)^2 + 5(0) - 8$$

$$y = -8$$

Assignment: Pg. 257; 4, 5, <sup>#</sup>handout