**Quadratic Functions in Standard Form**

A **quadratic function** is a function that is a degree 2 polynomial.

Ex :

**I – The Reference quadratic function :**

Table of values :

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *x* | -4 | -3 | -2 | -1 | 0 | 1 | 2 | 3 | 4 |
| *y* |  |  |  |  |  |  |  |  |  |

Graph :



Axis of symmetry :

Vertex :

Opening upwards

Domain :

Range :

This type of graph is called a **PARABOLA**.

**II – Quadratic Functions in Standard Form :**

Ex : 🡪 , ,

🡪 , ,

The graph of any quadratic function is a **parabola** which can open upwards or downwards:

To graph a quadratic function, you need to determine the coordinates of its vertex, the direction of opening and the “speed” of its opening (or “width of opening”).

* **Direction of opening** : The sign of coefficient *a* tells us if the parabola opens upwards or downwards.
* **Coordinates of the vertex** : The calculation gives the *x-*coordinate of the vertex   
  Then, you just need to replace *x* by that value to find the corresponding *y* value.

Example :

**Note** : The *y*-intercept is the value of *y* when .

In Standard form, it always is the value of coefficient .  
 Ex : for the *y*-intercept is 2.

To finish graphing the parabola, you can either create a table of values (by hand of with a graphing calculator) or use the reference function.

Example 1 : Using a table of values.

We already figured out that the parabola opens upwards, that its vertex is and its *y*-intercept is 2.

We also know that parabolas have a vertical axis of symmetry that goes through the vertex (here . Therefore, if we can find some points on one side of the vertex, we can position the “same” points on the other side easily. We will fill a table of values with *x* values only on one side of the vertex…

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *x* | 2 | 3 | 4 | 5 |
| *y* | -2 |  |  |  |

Domain :

Range :



We can notice that the parabola opens at the same “speed” as the reference function … that’s because they have the same coefficient.

Your turn :

Example 2 : Using the « speed of opening » of the reference function.

Opening

Vertex :

Opening 3 times faster than the reference function



Domain :

Range :

Your turn :

**Note** : In « real life » situations, domain might have to be restricted for all values to make sense…

**Hwk : p 174 # 1 – 12, 15, 23**