Quadratic Functions

Wednesday, February 20, 2019 12:58 PM

We are used to the **general form** of a quadratic function: $f(x) = ax^2 + bx + c$

E.g. $f(x) = 3x^2 - 2x + 7$

It is much easier to analyze the graph of a quadratic function if it is in standard form (vertex form)

The standard form of a quadratic function is

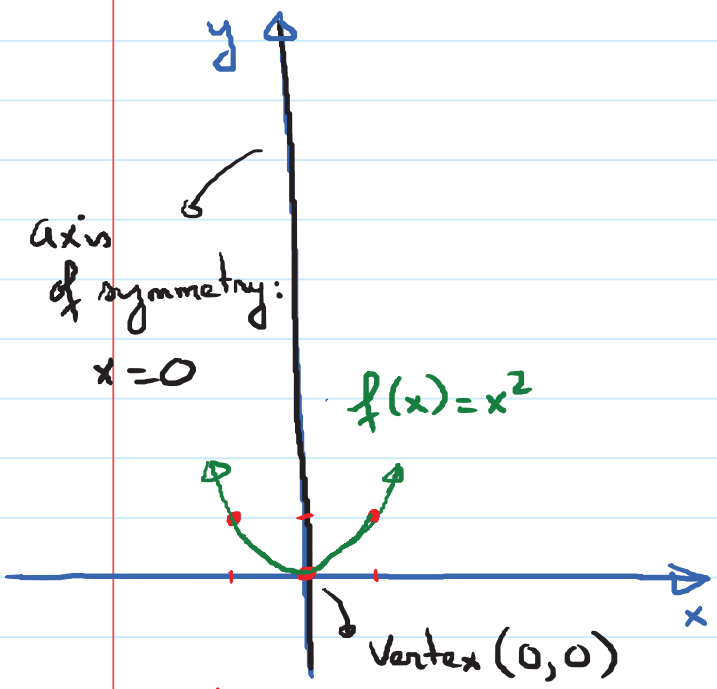
$$f(x) = a(x-h)^2 + k$$

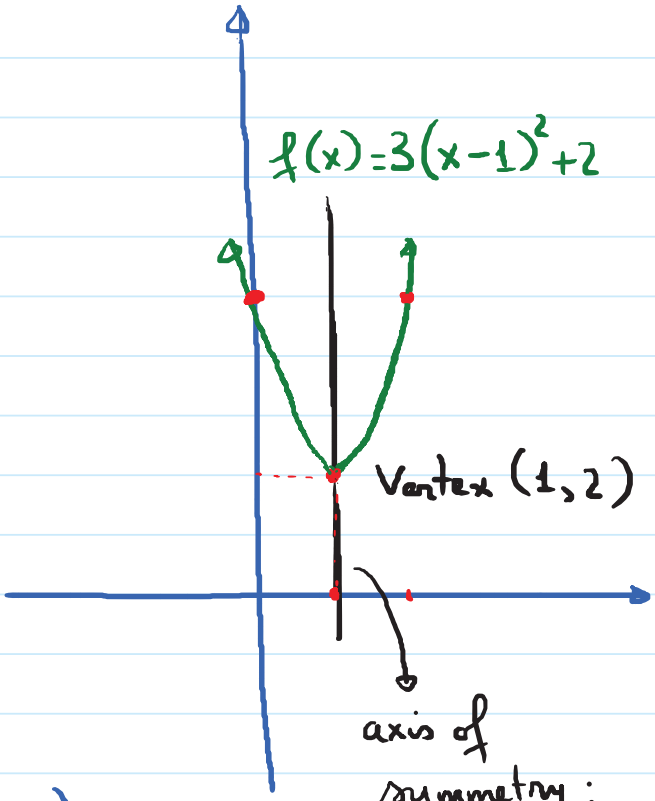
E.g. $f(x) = 3(x-1)^2 + 2$

(A quadratic function in standard form (vertex form))

Parent function: $g(x) = x^2$

$g(x) = x^2$ → Shift Right 1 unit → Stretch vertically by a factor of 3 → Shift up 1 unit → $f(x) = 3(x-1)^2 + 2$





Vertex of g

(0,0) → (1,0) → (1,0)

(1,2)

Vertex of f

(1,1) → (2,1) → (2,3) → (2,5)

(-1,1) → (0,1) → (0,3) → (0,5)

E.g. $f(x) = 2(x-3)^2 + 7$

Vertex = ? (3,7) ((0,0) is shifted 3 unit to the right of 7 unit up)

Axis of symmetry : x = 3

E.g. $f(x) = 3(x+5)^2 - 4$

Vertex ? $(-5, -4)$

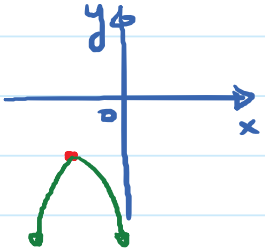
Axis of symmetry : $x = -5$

E.g. $f(x) = -3(x+5)^2 - 4$.

Vertex ? $(-5, -4)$

Axis of symmetry : $x = -5$

graph is flipped across x-axis



So, in general,

if a quadratic equation is given in standard form

$$f(x) = a(x-h)^2 + k$$

Then we know:

* Vertex : (h, k)
* Axis of symmetry : $x = h$
* $a > 0$: parabola opens up
* $a < 0$: parabola opens down.

E.g. Given $f(x) = -2\left(x + \frac{1}{2}\right)^2 + 1$.

Q1: Determine vertex, axis of symmetry, parabola opens up on down?

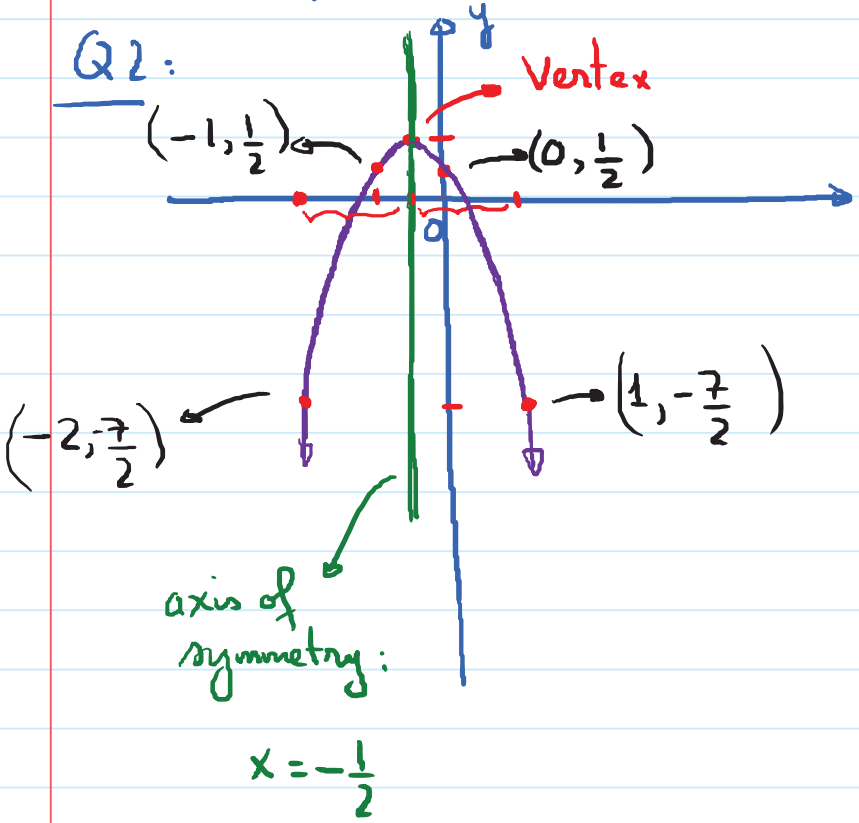
Q2: Find 2 pairs of symmetric points on both sides of the axis of symmetry and graph the parabola.

Q1: Vertex: $\left(-\frac{1}{2}, 1\right)$

Axis of symmetry: $x = -\frac{1}{2}$

opens down: $a = -2 < 0$

Q2:



x	$y = f(x)$	
0	$\frac{1}{2}$	
-1	$\frac{1}{2}$	by symmetry
1	$-\frac{7}{2}$	
-2	$-\frac{7}{2}$	by symmetry