$ax^2 + bx + c = 0$

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3.1 Quadratic Functions in Vertex Form: Part I

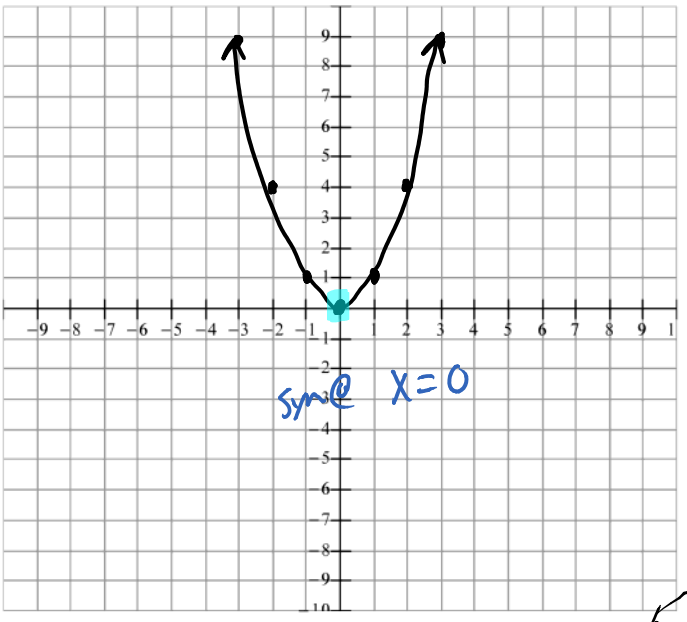
A quadratic function is a polynomial of the second degree.

e.g.

The graph of a quadratic is called a parabola

Ex. #1: Sketch the graph of the curve $y = x^2$ on the grid below.

x	y
0	0
1	1
-1	1
2	4
-2	4
3	9
-3	9



The vertex of the parabola is the lowest point of the graph (if the graph opens up), and the highest point of the graph (if the graph opens down).

The y-coordinate of the vertex is called the minimum if the parabola opens upward or the maximum if the parabola opens downward.

The parabola is Symmetric about a line called the axis of

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Investigating $y = x^2 + q$

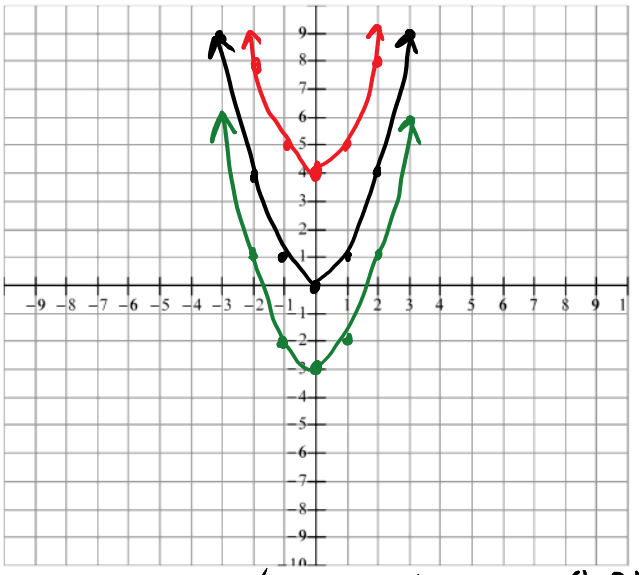
On the grid below graph the indicated curves.

$y = x^2$

$y = x^2 + 4$

$y = x^2 - 3$

x	y
0	4
-1	5
1	5
2	8
-2	8



x	y
0	-3
1	-2
-1	-2
2	1
-2	1
3	6
-3	6

What do you notice about the graphs? Same shape. Shift up/down

_____.

In general the graph of $y = x^2 + q$ is congruent to the graph of $y = x^2$.

- If $q > 0$ the graph is translated q units up
- If $q < 0$ the graph is translated q units down

Ex. #2: Sketch the graph of $y = x^2 - 7$ on the grid below and answer the following questions.

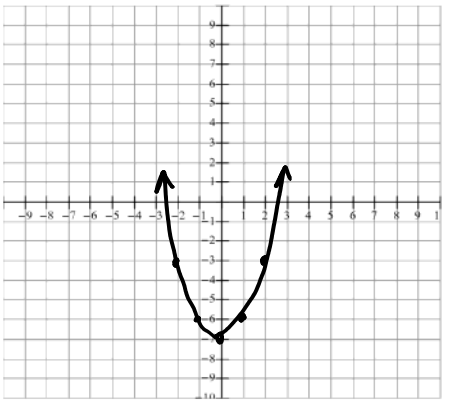
Vertex: $(0, -7)$

Max or Min: -7

Axis of Symmetry: $x = 0$

Domain: $\{x \mid x \in \mathbb{R}\}$ (x such that x belongs to the real numbers)

Range: $\{y \mid y \geq -7, y \in \mathbb{R}\}$



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Investigating y = (x – p)²

On the grid below graph the indicated curves.

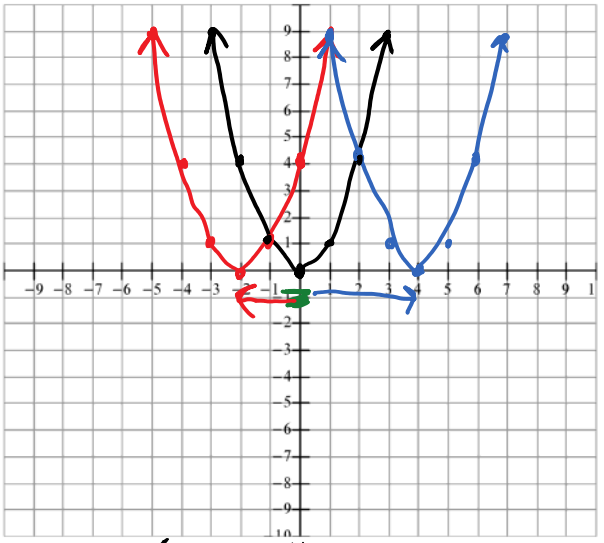
$y = x^2$

$y = (x + 2)^2$

$y = (x - 4)^2$

x	y
0	4
1	9
-1	1
-2	0
-3	1
-4	4

x	y
0	9
1	4
2	1
3	0
4	1
5	4



What do you notice about the graphs? Same Shape.
Shifted left / Right
$(x-p)^2 \rightarrow [x-(-2)]^2 \rightarrow (x+2)^2$.

In general the graph of $y = (x - p)^2$ is congruent. to the graph of $y = x^2$.

- If p > 0 the graph is translated p units right
- If p < 0 the graph is translated p units left.

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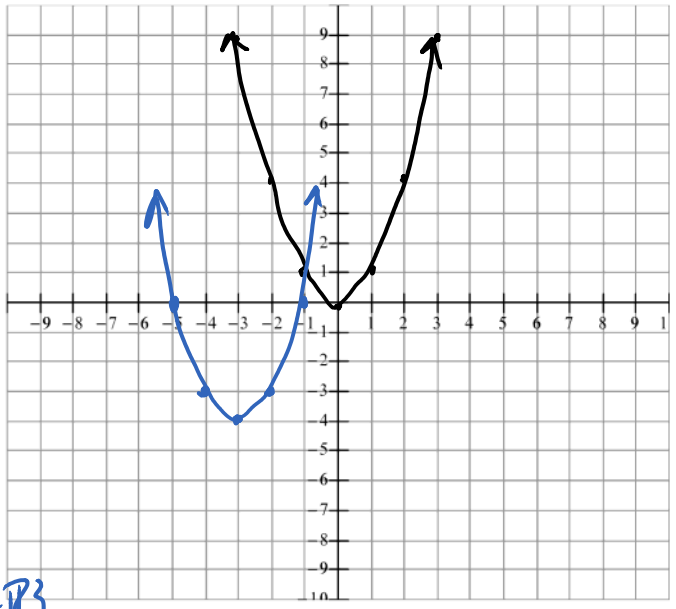
$y = -x^2$ $\quad \downarrow 4$ $\quad y = \frac{1}{x}$

$\leftarrow 3$

Ex. #3: Sketch the graph of the equation $y = (x + 3)^2 - 4$ by translating the graph of $y = x^2$.



Vertex: $(-3, -4)$

Max or Min: -4

Axis of Symmetry: $x = -3$

Domain: $\{x \mid x \in \mathbb{R}\}$

Range: $\{y \mid y \geq -4, y \in \mathbb{R}\}$

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#2, 3a, 7b, 8d.