Introduction to Graphing Quadratic Functions

A quadratic function is a function that can be written in the form

$$y = ax^2 + bx + c$$

where $a \neq 0$

Given the quadratic functions in standard form, determine the values of a, b, and c.

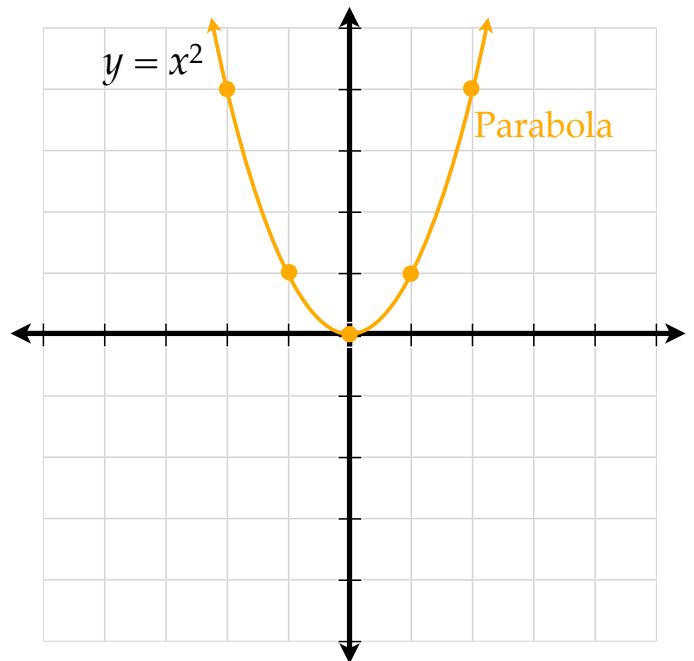$$y = -4x^2 + x + 2 \qquad y = x^2 - 2x + 1 \qquad y = -x^2 - 9 \qquad y = 2x^2 + 4x$$

The Quadratic Parent Function

$$y = x^2$$

$$a = 1; b = 0; c = 0$$

x	y
-2	4
-1	1
0	0
1	1
2	4

$y = x^2$

Parabola

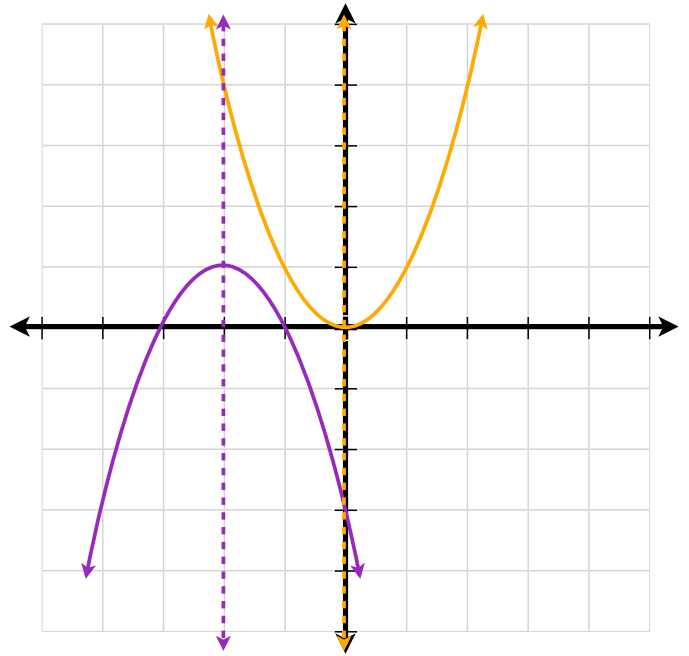Parabolas can be formed in many positions

Pieces of parabolas

Axis of Symmetry

Line that divides the parabola into two symmetric halves

$x = 0$

$x = -2$

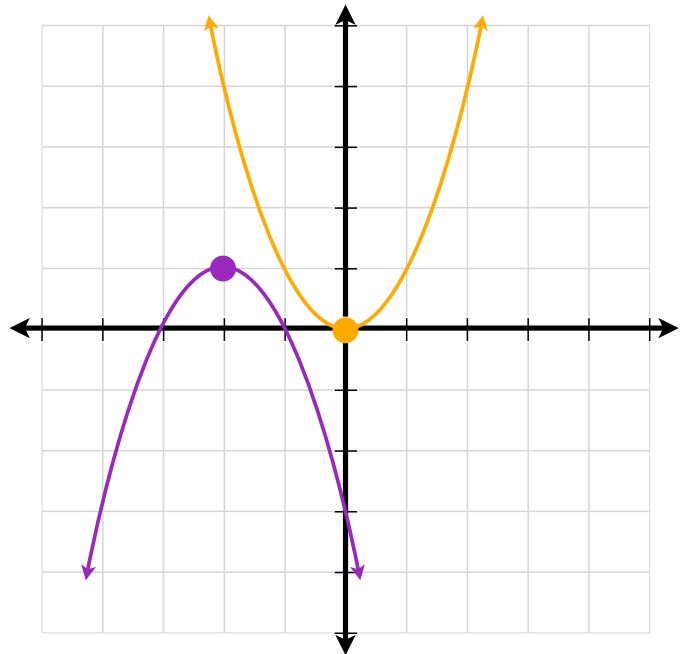Parabolas can be formed in many positions

Pieces of parabolas

Vertex

If parabola opens up, minimum point
If parabola opens down, maximum point

vertex - minimum (0,0)
vertex - maximum at (-2,1)

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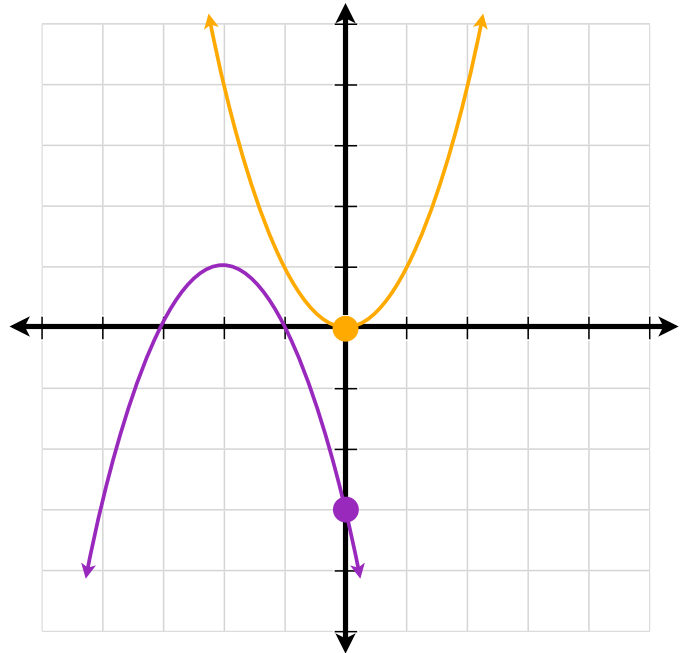
Parabolas can be formed in many positions

Pieces of parabolas

y-intercept

Where the parabola intersects the *y*-axis

y-intercept - (0,0)
y-intercept - (0,-3)

Parabolas can be formed in many positions

Pieces of parabolas

x-intercept(s)
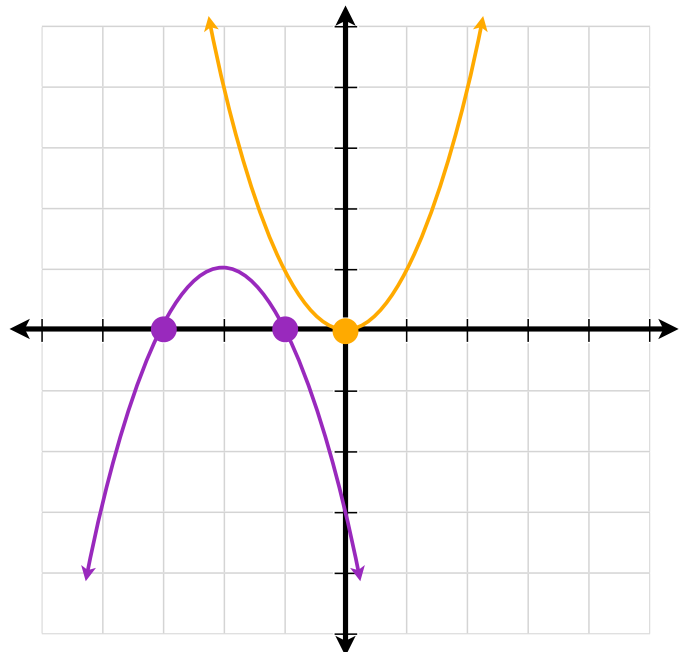
Where the parabola intersects the *x*-axis
Also called roots or zeros of the parabola

x-intercept - (0,0)
x-intercept - (-3,0) and (-1,0)

Parabola can have 0, 1, or 2 *x*-intercept(s)

How does a affect the graph of $y = ax^2$

$y = x^2$ $y = 2x^2$ $y = 3x^2$

$a = 1$ $a = 2$ $a = 3$

x	y
-2	4
-1	1
0	0
1	1
2	4

x	y
-2	8
-1	2
0	0
1	2
2	8

x	y
-2	12
-1	3
0	0
1	3
2	12

$y = x^2$
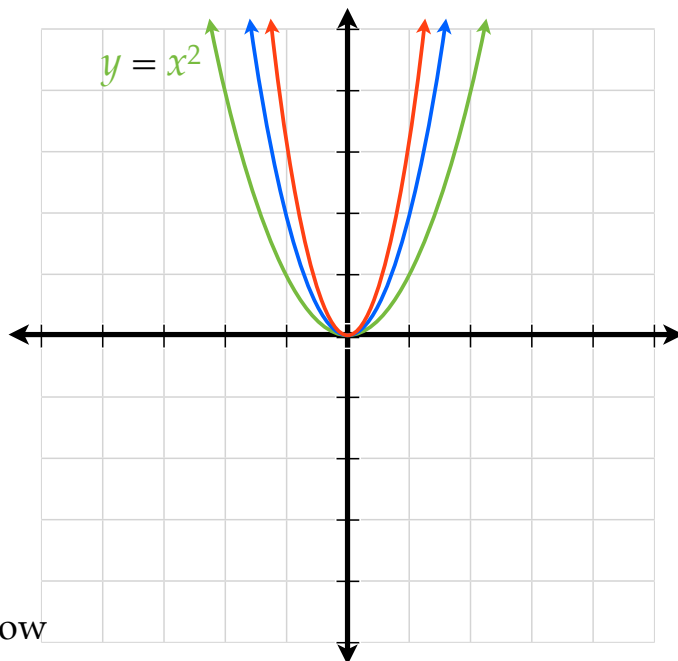
As a increases, the parabola gets more narrow

How does a affect the graph of $y = ax^2$

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

$a = 1$ $a = \frac{1}{2}$ $a = \frac{1}{4}$

x	y
-2	4
-1	1
0	0
1	1
2	4

x	y
-2	2
-1	$\frac{1}{2}$
0	0
1	$\frac{1}{2}$
2	2

x	y
-2	1
-1	$\frac{1}{4}$
0	0
1	$\frac{1}{4}$
2	1

$y = x^2$
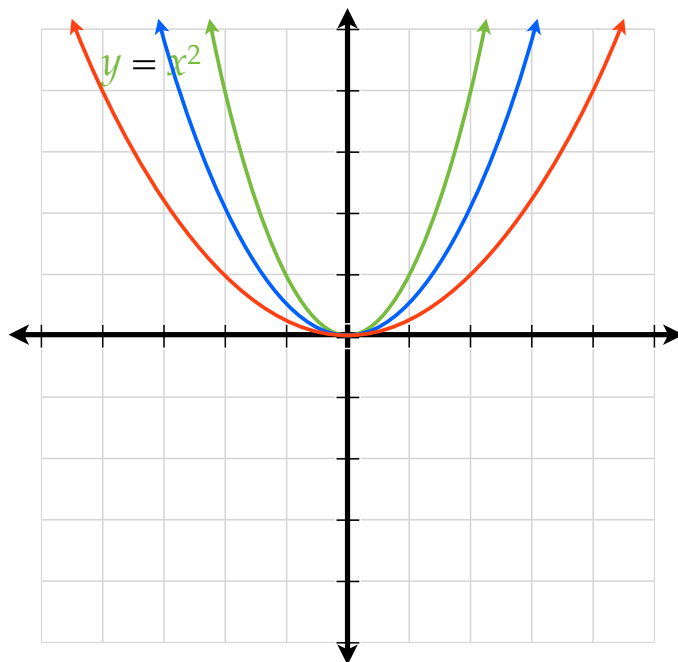
As a decreases (between 0 and 1), the parabola gets more wide

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How does a affect the graph of $y = ax^2$

$y = x^2$ $y = -x^2$
$a = 1$ $a = -1$

x	y
-2	4
-1	1
0	0
1	1
2	4

x	y
-2	-4
-1	-1
0	0
1	-1
2	-4
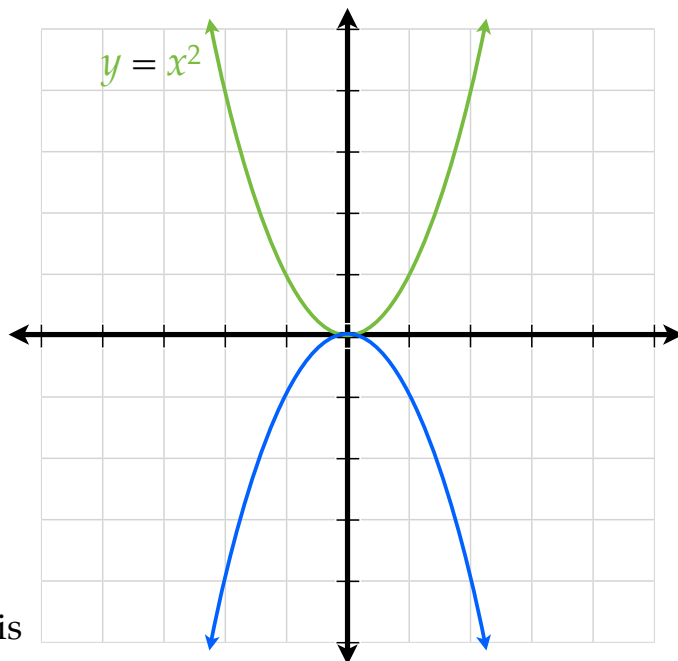
If a is negative, parabola reflects over x-axis

$y = x^2$

How does c affect the graph of $y = x^2 + c$

$y = x^2$ $y = x^2 + 1$ $y = x^2 - 3$
$c = 0$ $c = 1$ $c = -3$

x	y
-2	4
-1	1
0	0
1	1
2	4

x	y
-2	5
-1	2
0	1
1	2
2	5

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

$y = x^2$
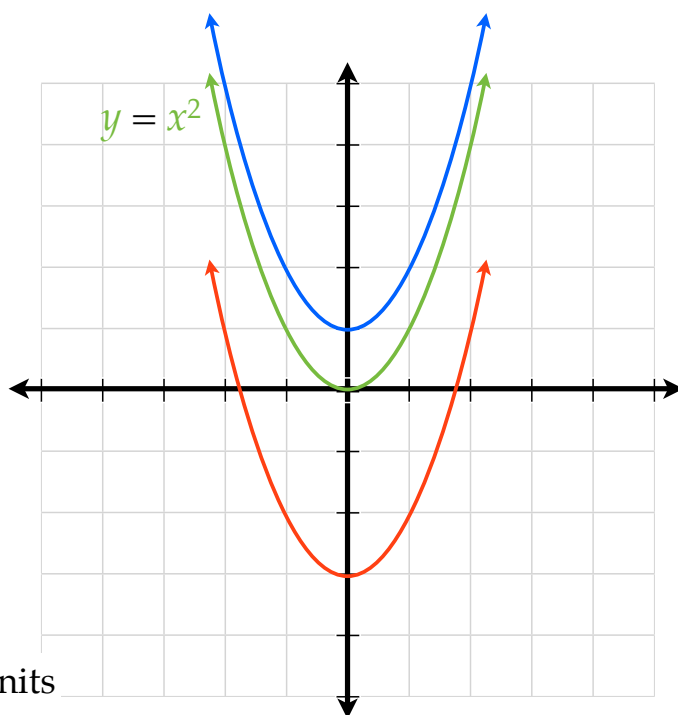
c causes the graph to move up and down c units

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$$y = ax^2 + bx + c$$

$$a = ? \quad b = ? \quad c = ?$$

a determines width of parabola
parabola opens up or down
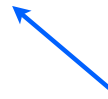
c determines vertical shift
of graph up or down