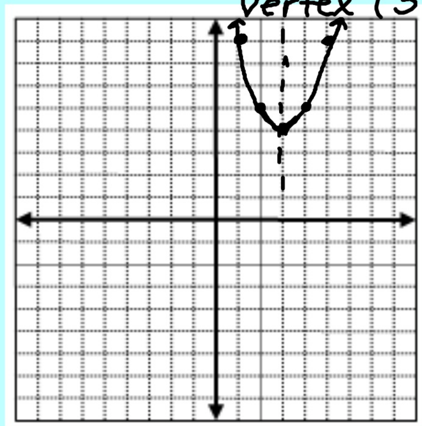
Algebra II Section 5.3 Transforming Parabolas

"a", the coefficient of x^2 determines the width and the opening (up or down) of the parabola.

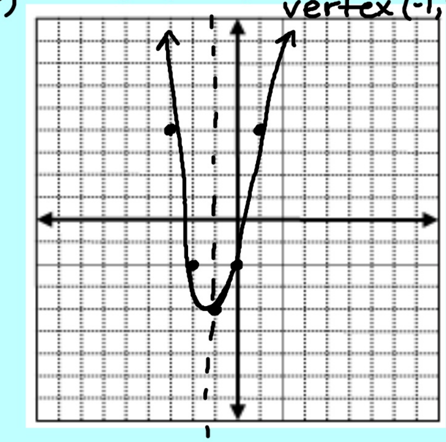
To review:
$a > 1$ makes the graph more narrow
$a < 1$ makes the graph wider
$-a$ makes the graph open down

Vertex Form of a Parabola is: $y = a(x - h)^2 + k$
Notice the similarity to $y = |x - h| + k$?

Graph $y = (x-3)^2 + 4$ vertex $(3, 4)$

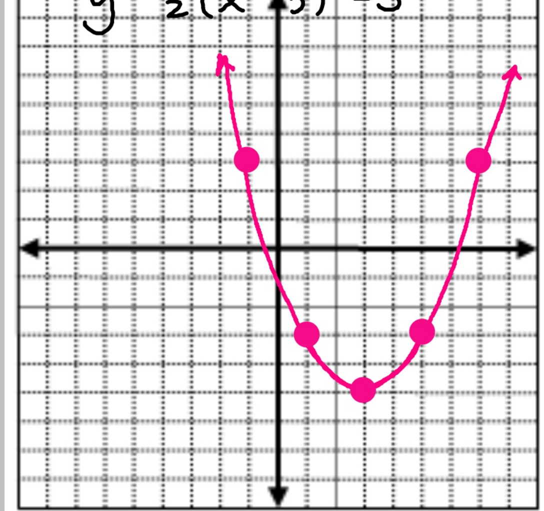


Graph $y = 2(x + 1)^2 - 4$. vertex $(-1, -4)$



Write the equation of the parabola below.

$y = \frac{1}{2}(x-3)^2 - 5$



1. Find the vertex $(3, -5)$

$y = a(x - 3)^2 - 5$

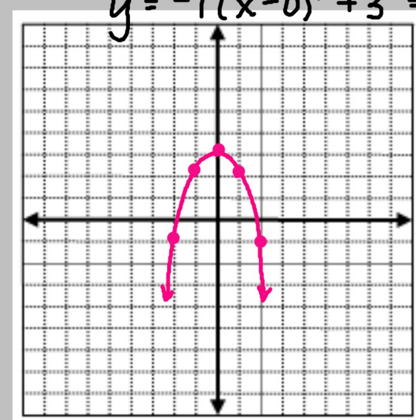
2. Find another point $(1, -3)$

3. Solve for a.

$-3 = a(1-3)^2 - 5$
$-3 = a(-2)^2 - 5$
$-3 = 4a - 5$
$+5 \qquad +5$
$\frac{2}{4} = \frac{4a}{4}$ $\quad a = \frac{1}{2}$

Write the equation of the parabola below.

$y = -1(x-0)^2 + 3 = -x^2 + 3$



vertex $(0, 3)$
$y = a(x-h)^2 + k$
$y = a(x-0)^2 + 3$
point $(1, 2)$

$2 = a(1-0)^2 + 3$
$2 = a(1)^2 + 3$
$2 = a + 3$
$-3 \qquad -3$
$-1 = a$

Write $y = 2x^2 + 10x + 7$ in vertex form.

1. Find the x-coordinate of the vertex using $x = \frac{-b}{2a}$

$$x = \frac{-b}{2a} = \frac{-10}{2(2)} = \frac{-10}{4} = -2.5$$

$$x = -2.5$$

2. Find the y-coordinate of the vertex by substituting x in the standard form equation.

$$y = 2(-2.5)^2 + 10(-2.5) + 7$$

$$y = 2(6.25) + 10(-2.5) + 7$$

$$y = 12.5 - 25 + 7$$

$$y = -5.5$$

3. Write vertex form. Remember "a". $y = 2(x+2.5)^2 - 5.5$

Write $y = -3x^2 + 12x + 5$ in vertex form. $y = -3(x-2)^2 + 17$

$$x = \frac{-b}{2a}$$

$$x = \frac{-12}{2(-3)} = \frac{-12}{-6} = 2$$

$$y = -3(2)^2 + 12(2) + 5$$

$$y = -3 \cdot 4 + 12 \cdot 2 + 5$$

$$y = -12 + 24 + 5$$

$$y = 17$$

Identify the vertex and y-intercept.

$y = 3(x - 2)^2 - 4$ $(2, -4)$

Standard form:

$$y = 3(x^2 - 4x + 4) - 4$$

$$y = 3x^2 - 12x + 12 - 4$$

$$y = 3x^2 - 12x + 8$$

y-intercept $= 8$

$$x = 0$$

$$y = 3(0-2)^2 - 4$$

$$y = 3(-2)^2 - 4$$

$$y = 3 \cdot 4 - 4$$

$$y = 12 - 4$$

$$y = 8$$

$(0, 8)$