Section 5 – Topic 4
Graphing Quadratic Functions in Vertex Form – Part 2

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

If an equation is in standard form, we can always complete the square to rewrite it in vertex form.

Consider the function $h(x) = 2x^2 - 8x + 9$. Complete the square to write $h(x)$ in vertex form.

$h(x) = (2x^2 - 8x \quad) + 9$

$h(x) = 2(x^2 - 4x + 4) + 9 - 8$

$h(x) = 2(x-2)^2 + 1$

$\left(-\frac{4}{2}\right)^2 = (-2)^2 = 4$

$c(a) =$

$4(2) = 8$

Vertex form of the quadratic equation: $y = 2(x-2)^2 + 1$

Opening: If $a > 0$, quadratic opens upward. If $a < 0$, quadratic opens downward. up

Vertex: (h, k) $(2, 1)$

Axis of Symmetry: Use the x –coordinate of the vertex to find the axis of symmetry. $x = 2$

x-intercepts: Substitute 0 for y and solve for x.

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

$-1 \quad -1$

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

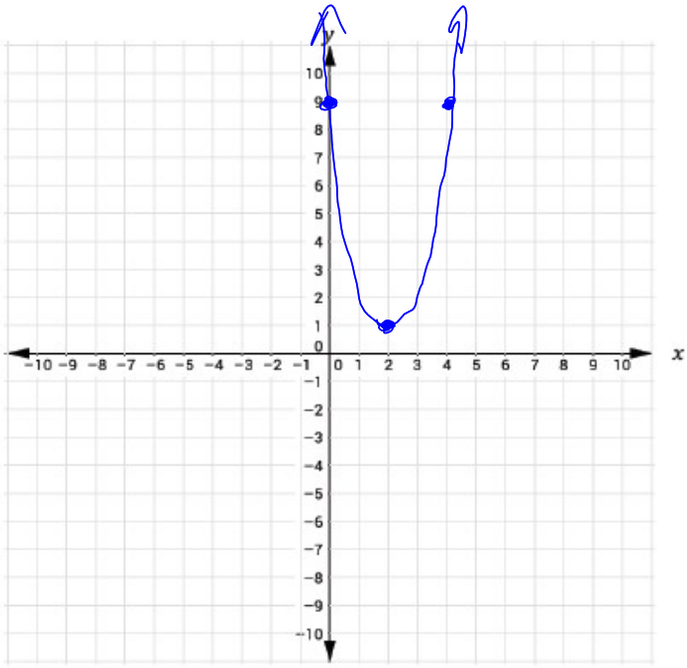
$-\frac{1}{2} = (x-2)^2$

none

y-intercepts: Substitute 0 for x and solve for y. $2(0-2)^2 + 1$

$(0, 9)$ $2(2)^2 + 1 = 9$

Sketch the graph of $h(x) = 2x^2 - 8x + 9$.



Try it!

1. Consider the following function. $\left(\frac{4}{2}\right)^2 = (2)^2 = 4$

$4(3) = 12$ $\qquad f(x) = 3x^2 + 12x + 16$

a. Complete the square to write $f(x)$ in vertex form.

$f(x) = (3x^2 + 12x \quad) + 16$

$f(x) = 3(x^2 + 4x + 4) + 16 - 12$

$f(x) = 3(x+2)^2 + 4$

$0 = 3(x+2)^2 + 4$

$-4 \quad -4 = 3(x+2)^2$

Vertex form of the quadratic equation:

Opening: If $a > 0$, quadratic opens upward. If $a < 0$, quadratic opens downward. up

Vertex: (h, k)

$(-2, 4)$

Axis of Symmetry: Use the x –coordinate of the vertex to find the axis of symmetry.

$x = -2$

x-intercepts: Substitute 0 for y and solve for x.

none

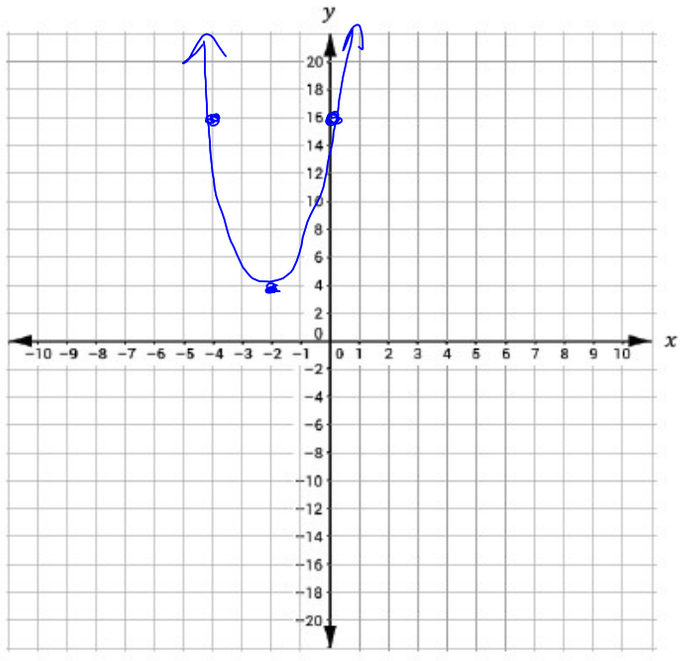
y-intercepts: Substitute 0 for x and solve for y.

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

$3(0+2)^2 + 4$

$3(4) + 4 = 16$

c. Sketch the graph of $f(x)$.



BEAT THE TEST!

1. Consider the functions $f(x) = 5x^2 - 10x + 2$ and $g(x) = -\frac{1}{5}(x-1)^2 + 2.2$.

Which of the following statements are true? Select all that apply.

- ☒ The graphs of $f(x)$ and $g(x)$ share the same axis of symmetry.
- ☒ The graphs of $f(x)$ and $g(x)$ share the same y –intercept.
- ☐ The graphs of $f(x)$ and $g(x)$ share the same x – intercepts.
- ☐ The graphs of $f(x)$ and $g(x)$ open in the same direction.
- ☐ The graph of $f(x)$ is wider than the graph of $g(x)$.

$f(x) = (5x^2 - 10x\ \ ) + 2$

$f(x) = 5(x^2 - 2x + 1) + 2 - 5$

$f(x) = 5(x-1)^2 - 3$

$-\frac{1}{5}(0-1)^2 + 2.2 \qquad 5(0-1)^2 - 3$

$-\frac{1}{5}(-1)^2 + 2.2 \qquad 5(-1)^2 - 3$

$-.2 + 2.2 = 2 \qquad 5 - 3 = 2$

$0 = -\frac{1}{5}(x-1)^2 + 2.2 \qquad 3 = 5(x-1)^2$

$(-2.2 = -\frac{1}{5}(x-1)^2) - 5 \qquad \frac{3}{5} = (x-1)^2$

$11 = (x-1)^2$