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

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

$= 4$

$4(2)$

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.

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

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

$h(x) = 2(x-2)^2 + 1$ $\quad (4)(2)$

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

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

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.

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

$-1 \quad -1$

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

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

None

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

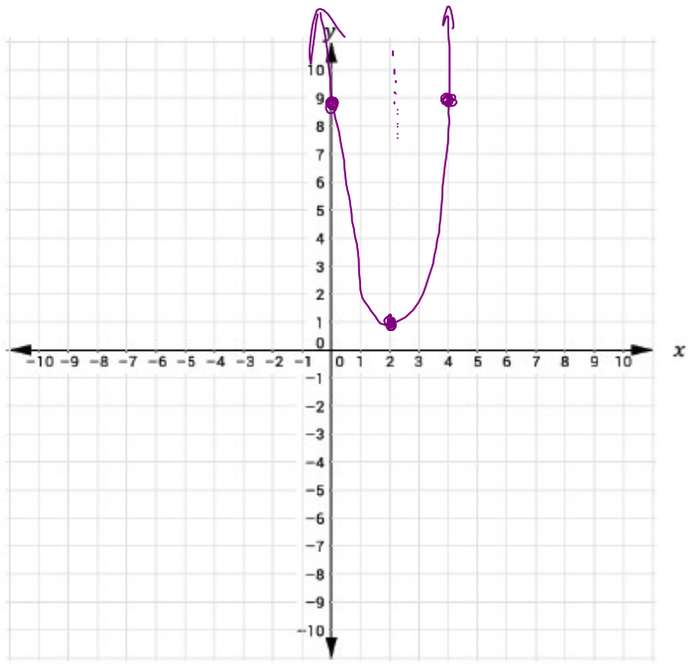
$h(x) = 2(0-2)^2 + 1$

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

$= 2(4) + 1$

$h(x) = 9$ $(0, 9)$

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



Try it!

1. Consider the following function.

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

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

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

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

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

Vertex form of the quadratic equation:

$(\frac{4}{2})^2 = (2)^2 = 4$

$4(3) = 12$

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

upward

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.

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

$-4 \quad\quad -4$

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

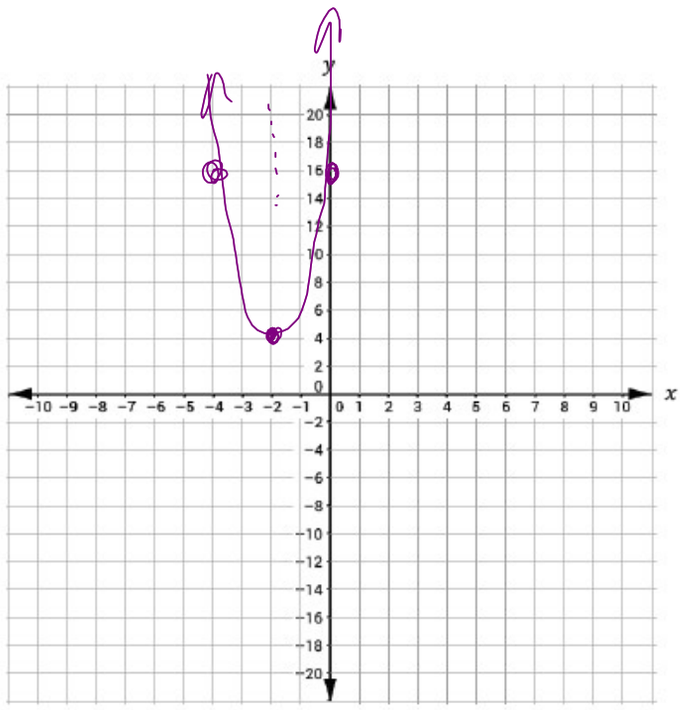
None

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

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

$3(2)^2+4 = 3(4)+4=16$

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.

- [x] The graphs of $f(x)$ and $g(x)$ share the same axis of symmetry.
- [x] 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 $g(x)$.

$(-\frac{2}{2})^2$ $(0,2)$ $(-1)^2$ $(1, 2.2)$ $x=1$

$5x-10x+2$

$(5x^2-10x\quad)+2$

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

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

$(1,-3)$

$0=5(x-1)^2-3$

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

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

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

$11=(x-1)^2$

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

$(0,2)$

$-\frac{1}{5}(-1)^2+2.2=-0.2(1)+2.2=2$