Name:_____ Date:_____

Class/Home worksheet: Alg2H
Vertex form
(book chapter 9, page 404 and onward)

Writing quadratic expression as a function:

Standard form:

$f(x) = 2x^2 - 12x + 10$

$\boxed{ax^2 + bx + c}$

Useful for:

Findings roots.

Quadratic: $x_1 = 1$, $x_2 = 5$

Factored form:

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

$\boxed{a(x-x_1)(x-x_2)}$

Useful for:

x-intercepts.

Vertex form:

$f(x) = 2(x-3)^2 + (-8)$

$\boxed{a(x-h)^2 + k}$

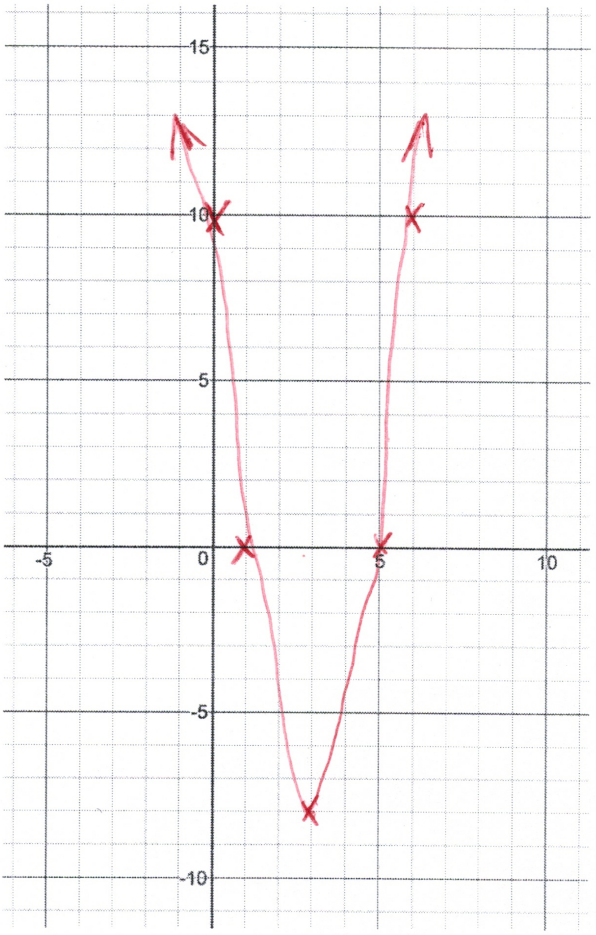
Useful for:

vertex (h, k)

h: 3 k: -8

Example:

Now graph.



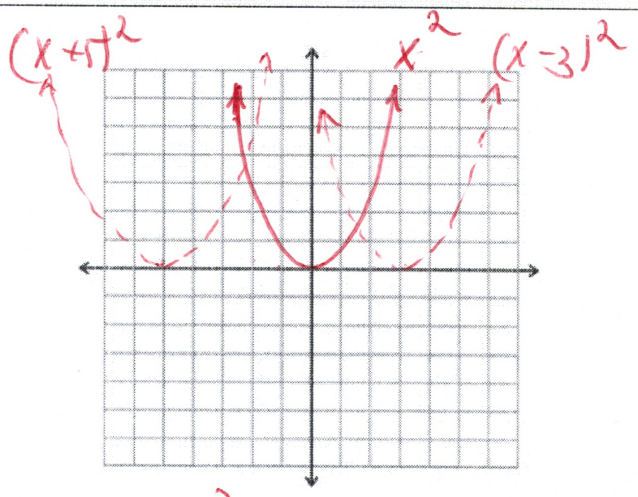
y-intercept: 10

Vertex form

$a(x-h)^2+k$ → vertex at (h,k)

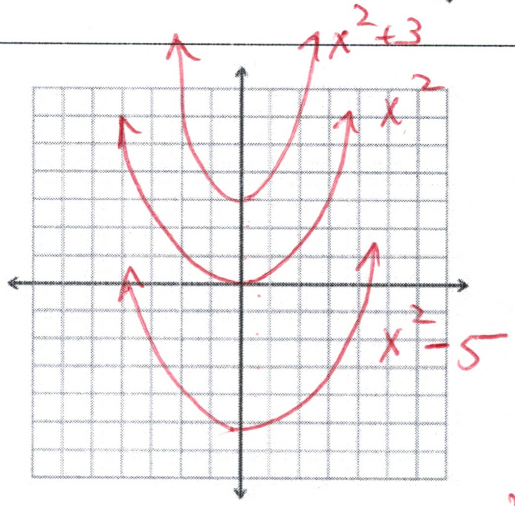
The rule of h

shift right ↔ left.



The rule of k

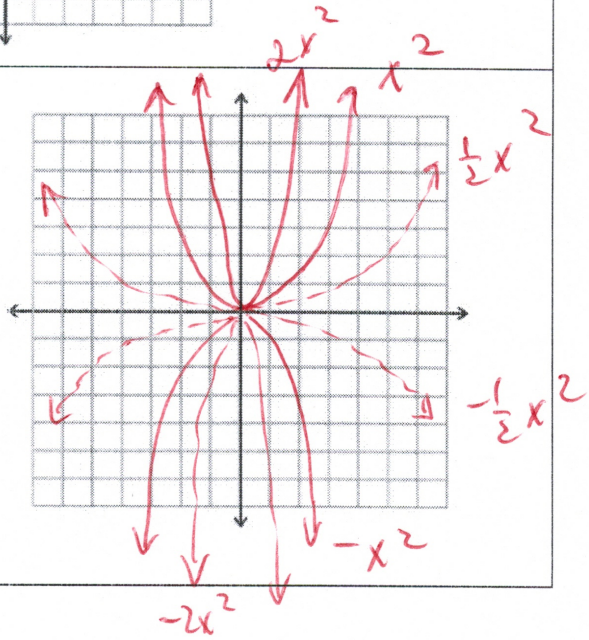
shift up-down



The rule of a

"shrink" or "stretch" vertically.

- Flip if sign



Question:

Given the function

$$f(x) = (2x + 2)(x - 3)$$

1. Write in standard form

FOIL $\quad 2x^2 - 4x - 6$

2. Solve $f(x) = 0$ for x (using the quadratic equation)

$$x_{1,2} = \frac{4 \pm \sqrt{16 - 4 \cdot 2 \cdot (-6)}}{2 \cdot 2} = \frac{4 \pm \sqrt{16 + 48}}{4} = \frac{4 \pm \sqrt{64}}{4} = \frac{4 \pm 8}{4} = 1 \pm 2 =$$

$$= \begin{cases} x_1 = 3 \\ x_2 = -1 \end{cases}$$

3. Write in Vertex form. What is the vertex?

$$2(x^2 - 2x - 3) = 2(x^2 - 2x + 1 - 1 - 3) = 2(x-1)^2 - 8$$

4. What is the Y-intercept? $x = 0 \rightarrow -6$

5. What is the X-intercept? 3 and -1

6. Write in factored form

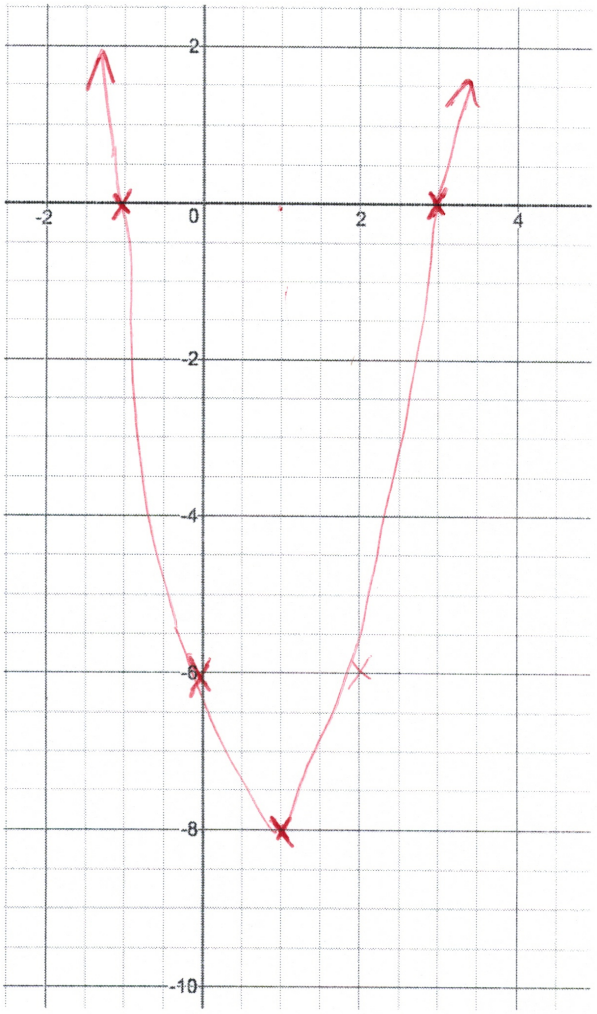
$$2(x-3)(x+1)$$

7. Plot the function.

x-intercepts

vertex

y-intercept



General process of moving from one form to another

Standard form: ax^2+bx+c

Factored form $a(x-x_1)\cdot(x-x_2)$

Vertex form $a(x-h)^2+k$

① standard → factored:
- ⓐ Find roots of $ax^2+bx+c=0 \rightarrow x_1, x_2$.
- ⓑ Write as $a(x-x_1)(x-x_2)$

② Factored → standard: Foil

③ standard → vertex
- ⓐ $h=\frac{-b}{2a}$
- ⓑ $k=$ (plug in (h) in the equation).

④ vertex → standard: Multiply.

⑤ vertex → factored: a is same. { use zeros from graph. or Find zeros of quad. eqn.

⑥ factored → vertex: { Throug graph OR Through Standrad

Using the following function:

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

Standard form: FOIL $2x^2+2x-4$

Vertex form: $2(x+\frac{1}{2})^2 - 4\frac{1}{2}$

$h = -(-\frac{1}{2})$

$f(-\frac{1}{2}) = 2(-1\frac{1}{2})(1\frac{1}{2}) = -3 \cdot 1\frac{1}{2} = -4\frac{1}{2}$

Y-intercept: $x=0 \Rightarrow -4$

X-intercept: $x=1$ or $x=-2$

Vertex: $(-\frac{1}{2}, -4\frac{1}{2})$

Plot (free hand), and compare: