Name: ______________________________ Date: ________________ # ____

Section 4-1 Quadratic Functions and Transformations

Learning Goal: To understand how to identify and graph quadratic functions.

Essential Questions: What are the advantages of a quadratic function in vertex form?
What are the advantages of a quadratic function in standard form?
How is any quadratic function related to the parent function of $y = x^2$?
How are the real solutions of a quadratic equation related to the graph of the related quadratic function?

Warm Up:

Solve.

1. $\frac{x+2}{4} = \frac{2x-1}{3}$

2. $3-(4x-2)=6x$

3. Simplify the expression: $3[2(x - 3) + 2] + 5(x - 3)$

4. Solve the inequality: $2 < 10 - 4d < 6$

Vocabulary:

<u>Quadratic Function</u> – Is an equation that can be written in the form,

$$f(x) = ax^2 + bx + c, \text{ where } a \neq 0.$$

<u>Parabola</u> – a graph of a quadratic function; a "U" shaped graph.

<u>Parent Function of a quadratic</u> – $f(x) = x^2$

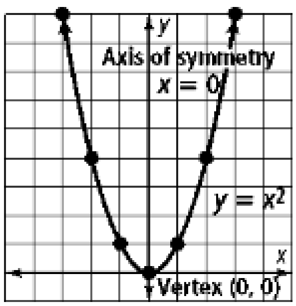
<u>Vertex form of a quadratic</u> - $f(x) = a(x-h)^2 + k, \text{ where } a \neq 0.$

<u>Axis of Symmetry</u> – is a line that divides the parabola into two mirror images.

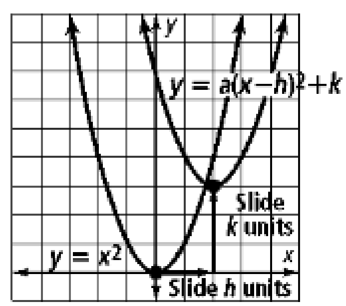
<u>Equation of the axis of symmetry</u> - x = h

<u>Vertex of the parabola</u> – is the point (h, k). *(**note**: the intersection of the parabola and its axis of symmetry)*

Ex: $f(x) = x^2$



Ex: $f(x) = a(x-h)^2 + k,$



In both the parent function and vertex form, the "a" tells you information about the parabola.

If "a" is positive (a > 0) the parabola opens up and the y-coordinate of the vertex is the minimum value.

If "a" is negative (a < 0) the parabola opens down the y-coordinate of the vertex is the maximum value.

Reflection: a *and* –a (opens up or down)

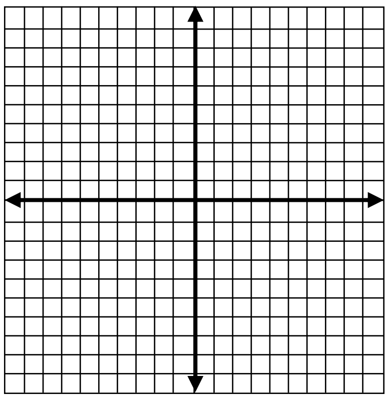
Stretch: a > 1 (moves the y value higher as if the parabola were stretched up)

Compression: 0 < a < 1 (the parabola is shrinking)

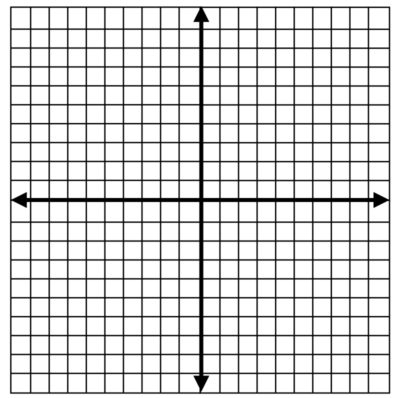
You Try:

Graph each function. How is the each graph a translation of $f(x) = x^2$?

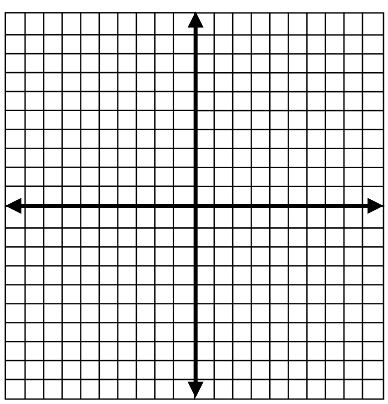
1. $f(x) = x^2 - 3$



2. $g(x) = \left(x+1\right)^2$



3. $h(x) = -\frac{1}{4}x^2$

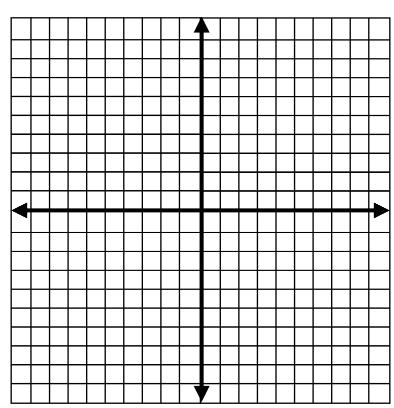


1-3-5 method for graphing a quadratic equation:

1. Identify the " a" of the equation
2. Multiply the "a" by 1,3,5 always put your solution over 1
3. Graph: start at the vertex and move top number up/down and bottom number left/right.

Example: f(x) = $2x^2$ - 4

1. a = 2
2. 2 (1, 3, 5) 2, 6, 10
   $\frac{2}{1}, \frac{6}{1}, \frac{10}{1}$
3. Vertex is (h, k) or (0, -4)



Interpreting Vertex Form:

For $y = 3(x-4)^2 - 2$, what are the vertex, the axis of symmetry, the maximum or minimum value, the domain and range?

1. Compare: $y = 3(x-4)^2 - 2$
   $y = a(x-h)^2 + k$

2. The vertex is (h, k) = (4, -2).

3. The axis of symmetry is x = h, or x = 4.

4. Since a > 0, the parabola opens upward. k = -2 is the minimum value.

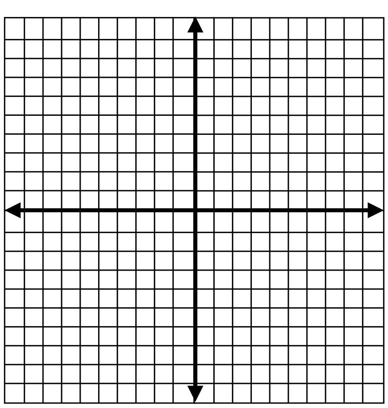
5. Domain: All real numbers. There is no restriction on the value of x.
   Range: All real numbers ≥ -2, since the minimum value of the function is -2.

You Try:

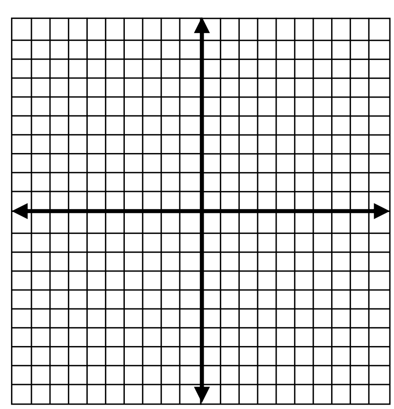
4. For, $y = 2(x + 3)^2 + 2$ what are the vertex, the axis of symmetry, the maximum or minimum value, the domain and range?

Graph each function. How is the each graph a translation of $y = a(x-h)^2 + k$?

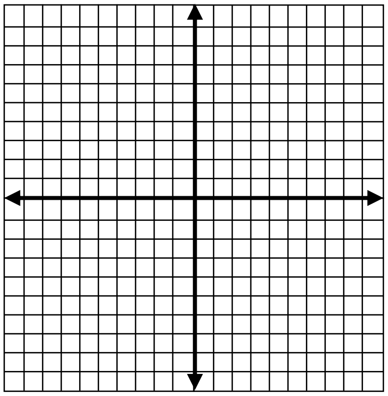
5. $y = (x + 4)^2 - 2$



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



7. $y = \frac{1}{2}(x + 6)^2 - 2$



8. Write an equation in vertex form for a quadratic with maximum y=7; axis of symmetry of x = -3, and is stretched. Then state the vertex, domain and range of the function.

Closure: How can you use a quadratic function written in vertex form to describe the graph of the parabola?

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Assignment: section 4.1 # 8,9,15,18,23,24,26,31,32,35,37,38,39,40,49(15 problems)