Study Guide and Intervention

Transforming and Analyzing Quadratic Functions

Example Describe the transformation. What transformations of the quadratic parent function, $f(x) = x^2$, will result in the graph of the quadratic function $g(x) = 2(x + 3)^2$?

Solution Step 1 Rewrite the equation of g(x) in general form to determine the values of the parameters a, b, c, and d. $g(x) = 2(x + 3)^2$

 $g(x) = 2(x + 3)^{-2}$ $g(x) = 2(x - (-3))^{2}$ Therefore, a = 2, b = 1, c = -3, and d = 0

Step 2 Use the values of the parameters to describe the transformations of the quadratic parent function f(x) that are necessary to produce g(x).

a = 2, so |a| > 1. The range values (y-coordinates) of the quadratic parent function are multiplied by a factor of $\frac{2}{2}$ in order to vertically stretch the graph

b = 1, so there is no change.

c = -3, so c < 0. The graph of the quadratic parent function will translate $\left|\frac{-3}{-1}\right| = 3$ units to the left

d = 0, so there is no change

Exercises

For questions 1-4, describe the transformation of the quadratic parent function, $f(x) = x^2$ that will result in the graph of the quadratic function given.

1. $h(x) = \frac{-1}{4}(x)^2 + 5$ **2.** $h(x) = (\frac{1}{2}x)^2 - 1$

3. $h(x) = \frac{1}{3}(2x-5)^2 - 4$

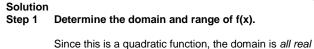
4. $h(x) = -2(3x + 10)^2 + 3$



Study Guide and Intervention Transforming and Analyzing Quadratic Functions (cont.)

Example Identify the domain, range, x-intercept, y-intercept and vertex of the quadratic function described by the equation shown below. Write the domain and range as inequalities, as intervals, and in set builder notation.

 $f(x) = (4x - 1)^2 - 2$



Since this is a quadratic function, the domain is all real numbers; the range is found using the equation. Since a is positive, the graph opens up. Since d = -2, the range contains all real values that are greater than or equal to -2.

As an inequality

Domain: $-\infty < x < \infty$, Range: $-2 \le y < \infty$

As an interval

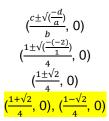
Domain: (-∞, ∞) Range: [-2, ∞)

Set builder notation

Domain: $\{x | x \in \mathbb{R}\}$ Range: $\{y | y \ge -2\}$



x-intercepts are located at
$$\left(\frac{c\pm\sqrt{(-d)}}{b}, 0\right)$$



Step 3 Determine the y-intercept of f(x).

y-intercepts is located at $(0, ac^2 + d)$

 $\begin{array}{c} (0, \ ac^2 + d) \\ (0, \ 1^*1^2 - 2) \\ (0, \ 1 - 2) \\ \hline (0, \ -1) \end{array}$

Step 4 Determine the vertex of the parabola

The vertex is located at $\left(\frac{c}{b}, d\right)$



Exercises

For questions 5-10, identify the domain, range, x-intercept, y-intercept and vertex of the quadratic function described by the equation shown below. Write the domain and range as inequalities, as intervals, and in set builder notation.

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

6. $f(x) = 2(x + 1)^2 - 8$
7. $f(x) = (x - 2)^2 - 9$

8.
$$f(x) = -3(4x)^2 + 7$$

9. $f(x) = \frac{-1}{2}(-10x + 4)^2 + 6$
10. $f(x) = 6(2x - 10)^2 - 3$