**9-3 Study Guide and Intervention**

***Transformations of Quadratic Functions***

**Translations** A **translation** is a change in the position of a figure either up, down, left, right, or diagonal.   
Adding or subtracting constants in the equations of functions translates the graphs of the functions.

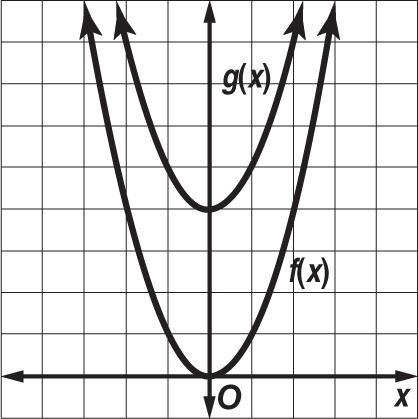
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| --- |
| The graph of ***g***(***x***) = + ***k*** translates the graph of ***f***(***x***) = vertically.  If ***k*** > 0, the graph of ***f***(***x***) = is translated ***k*** units up.  If ***k*** < 0, the graph of ***f***(***x***) = is translated units down. |

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| The graph of ***g***(***x***) = is the graph of ***f***(***x***) = translated horizontally.  If ***h*** > 0, the graph of ***f***(***x***) = is translated ***h*** units to the right.  If ***h*** < 0, the graph of ***f***(***x***) = is translated units to the left. |

**Example: Describe how the graph of each function is related to the graph of *f*(*x*) = .le**

**a. *g*(*x*) = + 4**

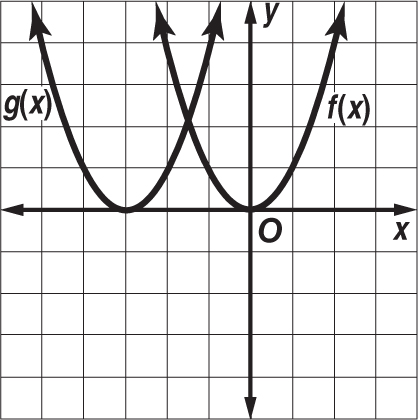
The value of *k* is 4, and 4 > 0. Therefore, the graph of *g*(*x*) = + 4 is a translation of the graph of *f*(*x*) **=**  up 4 units



**b. *g*(*x*) =**

The value of *h* is –3, and –3 < 0. Thus, the graph of

*g*(*x*) = is a translation of the graph of *f*(*x*) = to the left 3 units.



**Exercises**

**Describe how the graph of each function is related to the graph of *f*(*x*) = *x*2.**

**1.** *g*(*x*) = + 1 **2.** *g*(*x*) = **3.** *g*(*x*) =

**4.** *g*(*x*) = 20 + **5.** *g*(*x*) = **6.** *g*(*x*) = – +

**7.** *g*(*x*) = + **8.** *g*(*x*) = – 0.3 **9.** *g*(*x*) =

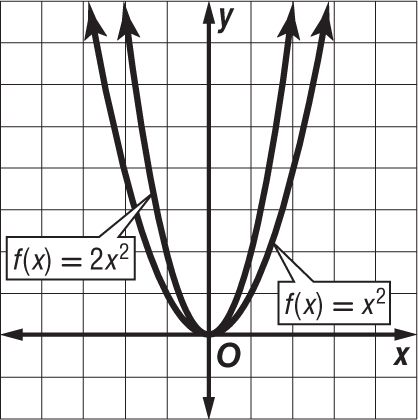
**9-3 Study Guide and Intervention** *(continued)*

***Transformations of Quadratic Functions***

**Dilations and Reflections** A **dilation** is a transformation that makes the graph narrower or wider than the parent graph. A **reflection** flips a figure over the *x*- or *y*-axis.

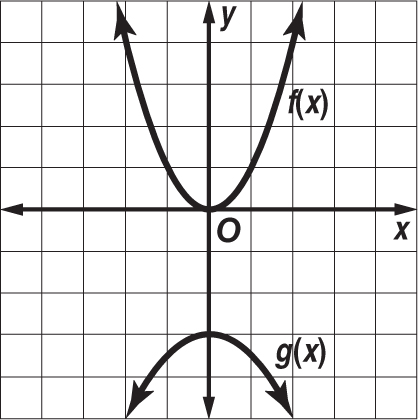
|  |
| --- |
| 18-f-1.jpg  The graph of ***f***(***x***) = ***ax*2**stretches or compresses the graph of ***f***(***x***) = ***x*2**.  If > 1, the graph of ***f***(***x***) = ***x*2**is stretched vertically.  If 0 < < 1, the graph of ***f***(***x***) = ***x*2**is compressed vertically. |
| 18-f-2.jpg  The graph of the function –***f***(***x***) flips the graph of ***f***(***x***) = ***x*2** across the *x*-axis.  The graph of the function ***f***(–***x***) flips the graph of ***f***(***x***) = ***x*2** across the *y*-axis. |

**Example: Describe how the graph of each function is related to the graph of *f*(*x*) = .**

**a. *g*(*x*) = 2**

The function can be written as *f*(*x*) = *a* where *a* = 2. Because > 1, the graph of *y* = 2 is the graph of *y* = that is stretched vertically.

**b. *g*(*x*) = – – 3**

The negative sign causes a reflection across the *x*-axis. Then a dilation occurs in which *a* = and a translation in which *k* = –3. So the graph of *g*(*x*) = – – 3 is reflected across the *x*-axis, dilated wider than the graph of *f*(*x*) = , and translated down 3 units.

**Exercises**

**Describe how the graph of each function is related to the graph of *f*(*x*) = .**

**1.** *g*(*x*) = –5 **2.** *g*(*x*) = – **3.** *g*(*x*) = – – 1