Name _____ Date _____

4.7 Transformations of Polynomial Functions

For use with Exploration 4.7

Essential Question How can you transform the graph of a polynomial function?

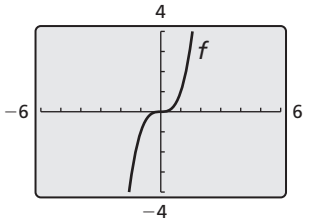
1 EXPLORATION: Transforming the Graph of the Cubic Function

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

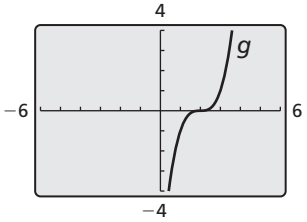
Work with a partner. The graph of the cubic function

$$f(x) = x^3$$

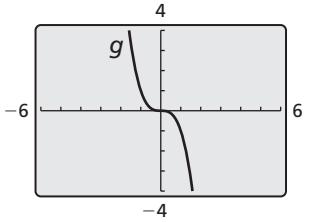
is shown. The graph of each cubic function g represents a transformation of the graph of f. Write a rule for g. Use a graphing calculator to verify your answers.



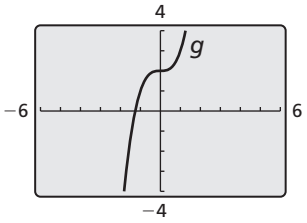
a.



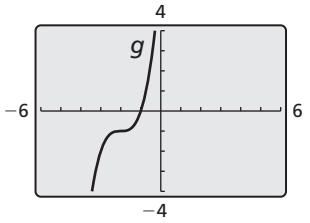
b.



c.



d.



4.7 Transformations of Polynomial Functions (continued)

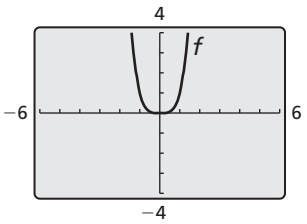
2 EXPLORATION: Transforming the Graph of the Quartic Function

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

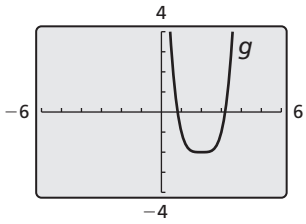
Work with a partner. The graph of the quartic function

$f(x) = x^4$

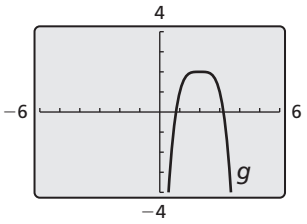
is shown. The graph of each quartic function g represents a transformation of the graph of f. Write a rule for g. Use a graphing calculator to verify your answers.



a.



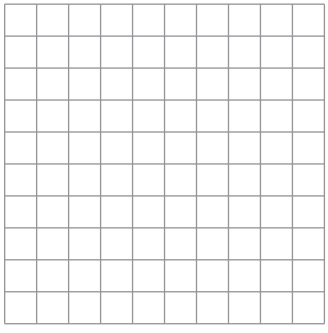
b.



Communicate Your Answer

3. How can you transform the graph of a polynomial function?

4. Describe the transformation of $f(x) = x^4$ represented by $g(x) = (x + 1)^4 + 3$. Then graph $g(x)$.



Name _____ Date _____

4.7 Notetaking with Vocabulary

For use after Lesson 4.7

In your own words, write the meaning of each vocabulary term.

polynomial function

transformations

Core Concepts

Transformation	$f(x)$ Notation	Examples	
Horizontal Translation Graph shifts left or right.	$f(x - h)$	$g(x) = (x - 5)^4$ $g(x) = (x + 2)^4$	5 units right 2 units left
Vertical Translation Graph shifts up or down.	$f(x) + k$	$g(x) = x^4 + 1$ $g(x) = x^4 - 4$	1 unit up 4 units down
Reflection Graph flips over x- or y-axis.	$f(-x)$ $-f(x)$	$g(x) = (-x)^4 = x^4$ $g(x) = -x^4$	over y-axis over x-axis
Horizontal Stretch or Shrink Graph stretches away from or shrinks toward y-axis	$f(ax)$	$g(x) = (2x)^4$ $g(x) = \left(\frac{1}{2}x\right)^4$	shrink by $\frac{1}{2}$ stretch by 2
Vertical Stretch or Shrink Graph stretches away from or shrinks toward x-axis.	$a \cdot f(x)$	$g(x) = 8x^4$ $g(x) = \frac{1}{4}x^4$	stretch by 8 shrink by $\frac{1}{4}$

Notes:

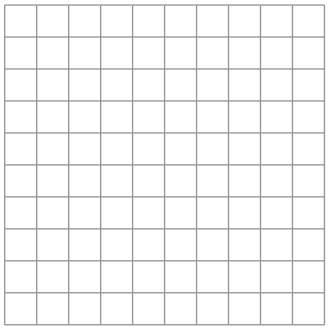
Name_____ Date _____

4.7 Notetaking with Vocabulary (continued)

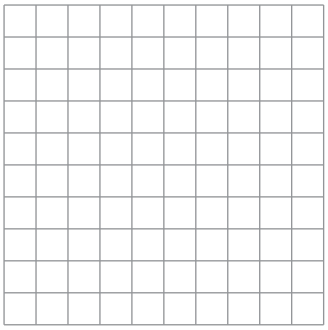
Extra Practice

In Exercises 1–6, describe the transformation of *f* represented by *g*. Then graph each function.

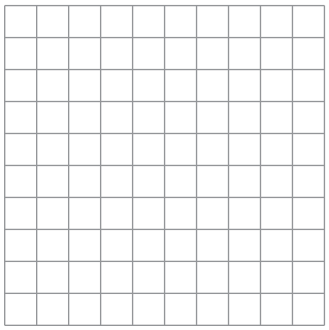
1. $f(x) = x^4;\ g(x) = x^4 - 9$



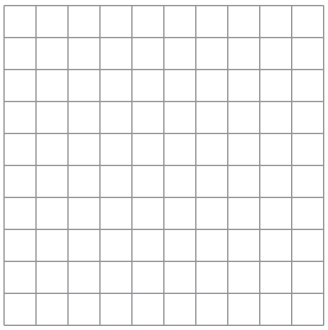
2. $f(x) = x^5;\ g(x) = (x + 1)^5 + 2$



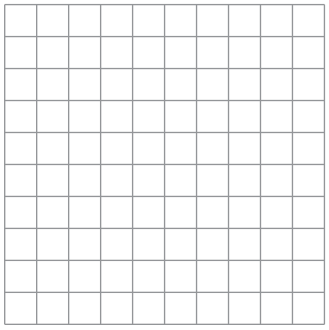
3. $f(x) = x^6;\ g(x) = -5(x - 2)^6$



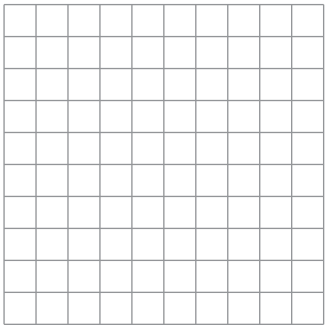
4. $f(x) = x^3;\ g(x) = \left(\frac{1}{2}x\right)^3 - 4$



5. $f(x) = x^4;\ g(x) = \frac{1}{8}(-x)^4$



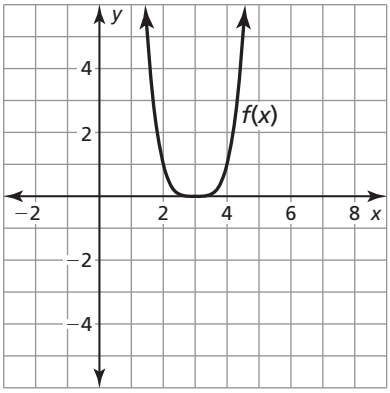
6. $f(x) = x^5;\ g(x) = (x - 10)^5 + 1$



Name _____ Date _____

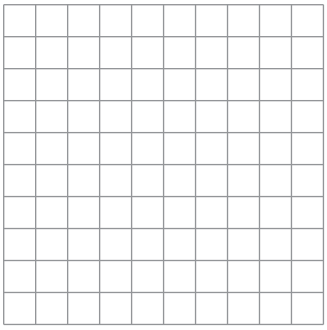
4.7 Notetaking with Vocabulary (continued)

7. Graph the function $g(x) = -f(x - 3)$ on the same coordinate plane as $f(x)$.

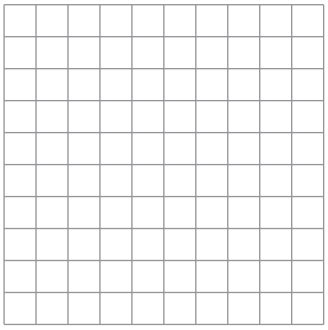


In Exercises 8 and 9, write a rule for *g* and then graph each function. Describe the graph of *g* as a transformation of the graph of *f*.

8. $f(x) = x^3 + 8; g(x) = f(-x) - 9$



9. $f(x) = 2x^5 - x^3 + 1; g(x) = 5f(x)$



In Exercises 10 and 11, write a rule for *g* that represents the indicated transformations of the graph of *f*.

10. $f(x) = x^3 - 6x^2 + 5;$ translation 1 unit left, followed by a reflection in the *x*-axis and a vertical stretch by a factor of 2

11. $f(x) = 3x^4 + x^3 + 3x^2 + 12;$ horizontal shrink by a factor of $\frac{1}{3}$ and a translation 8 units down, followed by a reflection in the *y*-axis