1.2 Transformations of Linear and Absolute Value Functions Homework
Part 1: #3-7 odd, 11-15 odd, 17-21 odd
Part 2: #27-36, 43

Monitoring Progress and Modeling with Mathematics

In Exercises 3–8, write a function g whose graph represents the indicated transformation of the graph of f. Use a graphing calculator to check your answer. *(See Example 1.)*

3. $f(x) = x - 5$; translation 4 units to the left

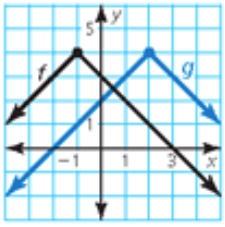
4. $f(x) = x + 2$; translation 2 units to the right

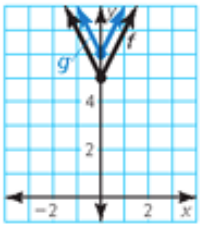
5. $f(x) = |4x + 3| + 2$; translation 2 units down

6. $f(x) = 2x - 9$; translation 6 units up

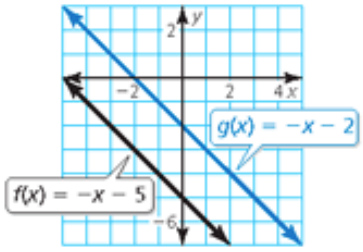
7. $f(x) = 4 - |x + 1|$

8. $f(x) = |4x| + 5$





9. **WRITING** Describe two different translations of the graph of f that result in the graph of g.



10. **PROBLEM SOLVING** You open a café. The function $f(x) = 4000x$ represents your expected net income (in dollars) after being open x weeks. Before you open, you incur an extra expense of \$12,000. What transformation of f is necessary to model this situation? How many weeks will it take to pay off the extra expense?

In Exercises 11–16, write a function g whose graph represents the indicated transformation of the graph of f. Use a graphing calculator to check your answer. *(See Example 2.)*

11. $f(x) = -5x + 2$; reflection in the x-axis

12. $f(x) = \frac{1}{2}x - 3$; reflection in the x-axis

13. $f(x) = |6x| - 2$; reflection in the y-axis

14. $f(x) = |2x - 1| + 3$; reflection in the y-axis

15. $f(x) = -3 + |x - 11|$; reflection in the y-axis

16. $f(x) = -x + 1$; reflection in the y-axis

In Exercises 17–22, write a function g whose graph represents the indicated transformation of the graph of f. Use a graphing calculator to check your answer. *(See Example 3.)*

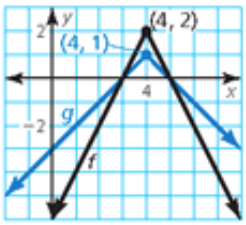
17. $f(x) = x + 2$; vertical stretch by a factor of 5

18. $f(x) = 2x + 6$; vertical shrink by a factor of $\frac{1}{2}$

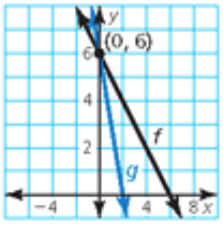
19. $f(x) = |2x| + 4$; horizontal shrink by a factor of $\frac{1}{2}$

20. $f(x) = |x + 3|$; horizontal stretch by a factor of 4

21. $f(x) = -2|x - 4| + 2$



22. $f(x) = 6 - x$



ANALYZING RELATIONSHIPS **In Exercises 23–26, match the graph of the transformation of f with the correct equation shown. Explain your reasoning.**

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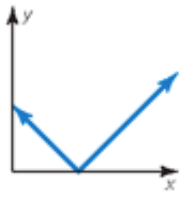

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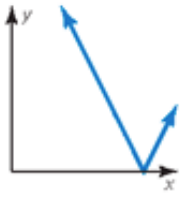

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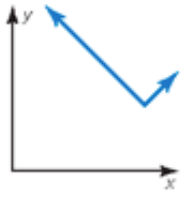

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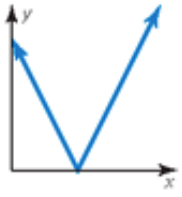


A. $y = 2f(x)$ **B.** $y = f(2x)$

C. $y = f(x + 2)$ **D.** $y = f(x) + 2$

In Exercises 27–32, write a function g whose graph represents the indicated transformations of the graph of f. *(See Example 4.)*

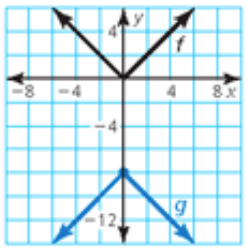
27. $f(x) = x$; vertical stretch by a factor of 2 followed by a translation 1 unit up

28. $f(x) = x$; translation 3 units down followed by a vertical shrink by a factor of $\frac{1}{3}$

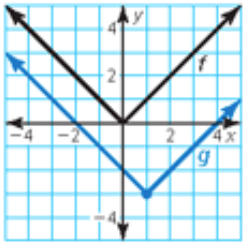
29. $f(x) = |x|$; translation 2 units to the right followed by a horizontal stretch by a factor of 2

30. $f(x) = |x|$; reflection in the y-axis followed by a translation 3 units to the right

31. $f(x) = |x|$



32. $f(x) = |x|$



ERROR ANALYSIS **In Exercises 33 and 34, identify and correct the error in writing the function g whose graph represents the indicated transformations of the graph of f.**

33.

✗ $f(x) = |x|$; translation 3 units to the right followed by a translation 2 units up

$g(x) = |x + 3| + 2$

34.

✗ $f(x) = x$; translation 6 units down followed by a vertical stretch by a factor of 5

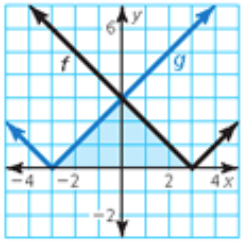
$g(x) = 5x - 6$

35. **MAKING AN ARGUMENT** Your friend claims that when writing a function whose graph represents a combination of transformations, the order is not important. Is your friend correct? Justify your answer.

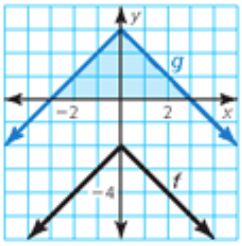
36. MODELING WITH MATHEMATICS During a recent period of time, bookstore sales have been declining. The sales (in billions of dollars) can be modeled by the function $f(t) = -\frac{7}{5}t + 17.2$, where t is the number of years since 2006. Suppose sales decreased at twice the rate. How can you transform the graph of f to model the sales? Explain how the sales in 2010 are affected by this change. *(See Example 5.)*

MATHEMATICAL CONNECTIONS For Exercises 37–40, describe the transformation of the graph of f to the graph of g. Then find the area of the shaded triangle.

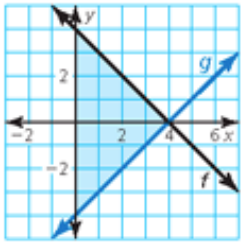
37. $f(x) = |x - 3|$



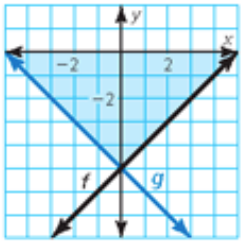
38. $f(x) = -|x| - 2$



39. $f(x) = -x + 4$



40. $f(x) = x - 5$

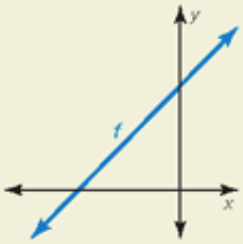


41. ABSTRACT REASONING The functions $f(x) = mx + b$ and $g(x) = mx + c$ represent two parallel lines.

a. Write an expression for the vertical translation of the graph of f to the graph of g.

b. Use the definition of slope to write an expression for the horizontal translation of the graph of f to the graph of g.

42. HOW DO YOU SEE IT? Consider the graph of $f(x) = mx + b$. Describe the effect each transformation has on the slope of the line and the intercepts of the graph.



a. Reflect the graph of f in the y-axis.

b. Shrink the graph of f vertically by a factor of $\frac{1}{3}$.

c. Stretch the graph of f horizontally by a factor of 2.

43. REASONING The graph of $g(x) = -4|x| + 2$ is a reflection in the x-axis, vertical stretch by a factor of 4, and a translation 2 units down of the graph of its parent function. Choose the correct order for the transformations of the graph of the parent function to obtain the graph of g. Explain your reasoning.

44. THOUGHT PROVOKING You are planning a cross-country bicycle trip of 4320 miles. Your distance d (in miles) from the halfway point can be modeled by $d = 72|x - 30|$, where x is the time (in days) and $x = 0$ represents June 1. Your plans are altered so that the model is now a right shift of the original model. Give an example of how this can happen. Sketch both the original model and the shifted model.

45. CRITICAL THINKING Use the correct value 0, −2, or 1 with a, b, and c so the graph of $g(x) = a|x - b| + c$ is a reflection in the x-axis followed by a translation one unit to the left and one unit up of the graph of $f(x) = 2|x - 2| + 1$. Explain your reasoning.