Skills Practice

Name _____ Date _____

Shifting Away
Vertical and Horizontal Translations

Vocabulary

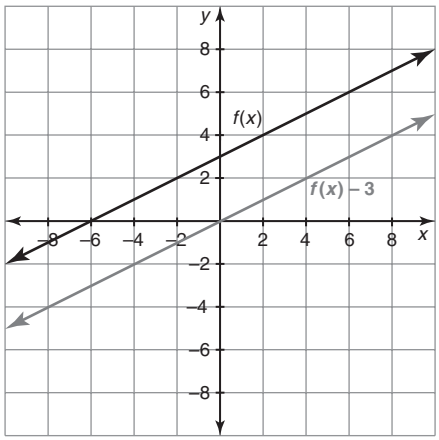
Describe the similarities and differences between the two terms.

1. horizontal translation and vertical translation

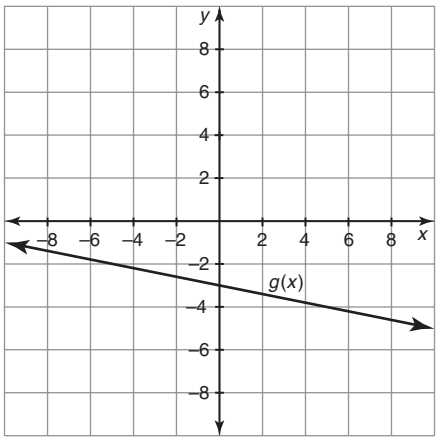
Problem Set

The graph of a function is shown. Sketch each translation of the function.

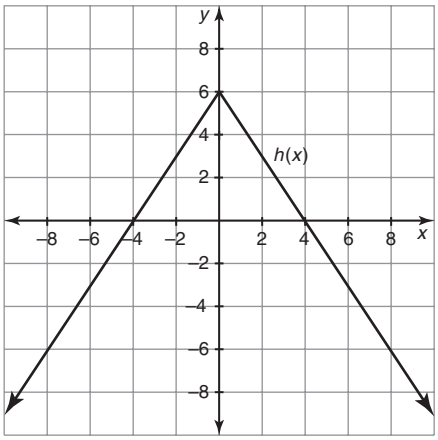
1. Sketch the graph of $f(x) - 3$.



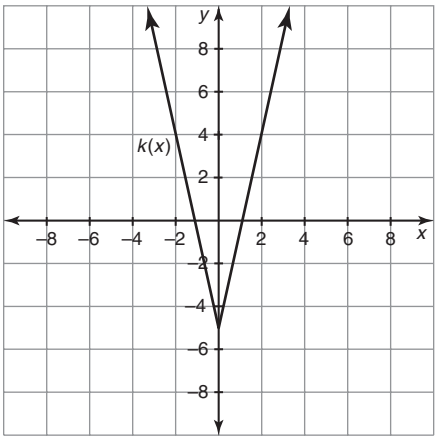
2. Sketch the graph of $g(x) + 5$.



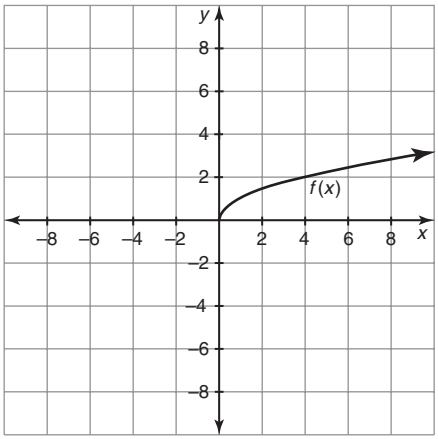
3. Sketch the graph of $h(x + 4)$.



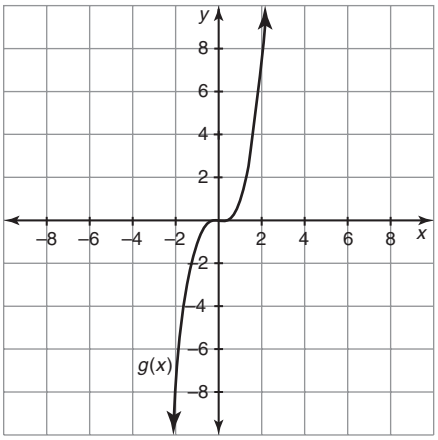
4. Sketch the graph of $k(x - 3)$.



5. Sketch the graph of $f(x) + 2$.



6. Sketch the graph of $g(x) - 4$.



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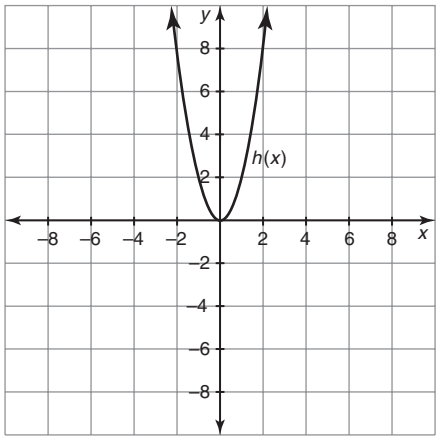
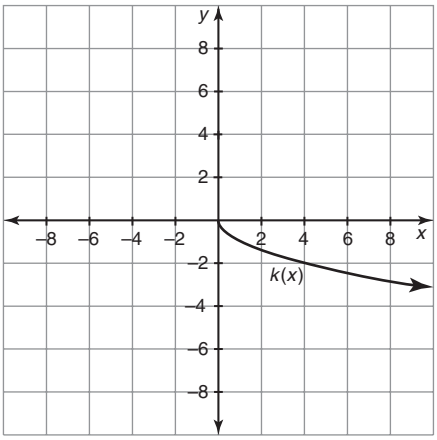
7. Sketch the graph of $h(x + 5)$.

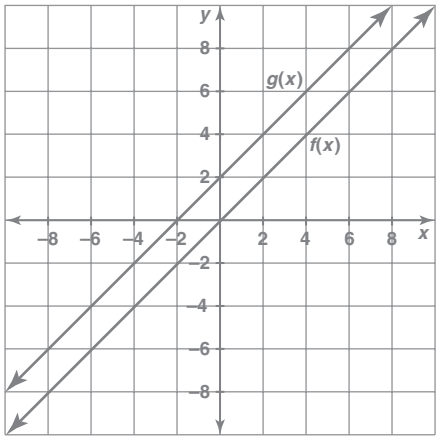


8. Sketch the graph of $k(x - 2)$.

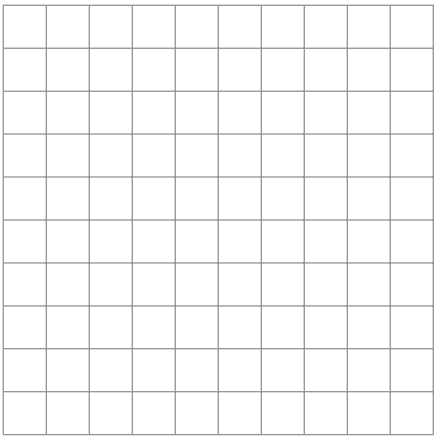


Graph each basic function $f(x)$ and translation $g(x)$ on the same grid.

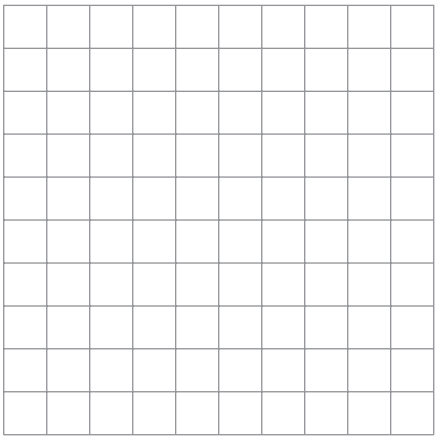
9. $f(x) = x$ and $g(x) = x + 2$



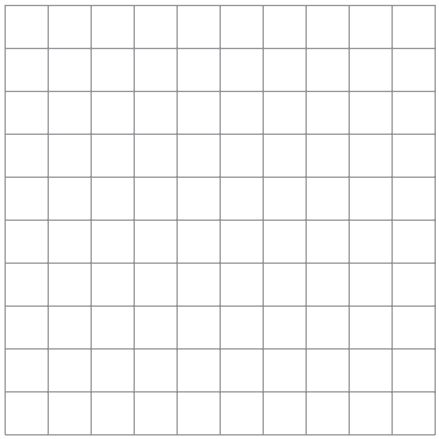
10. $f(x) = x$ and $g(x) = x - 5$



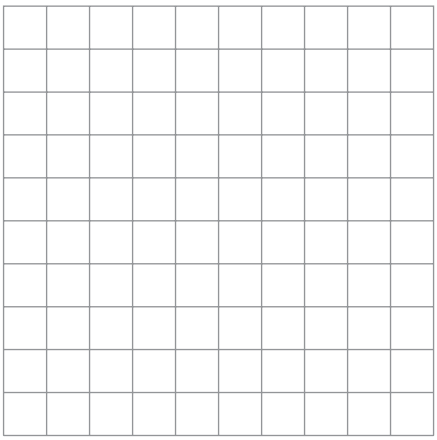
11. $f(x) = x^2$ and $g(x) = x^2 - 4$



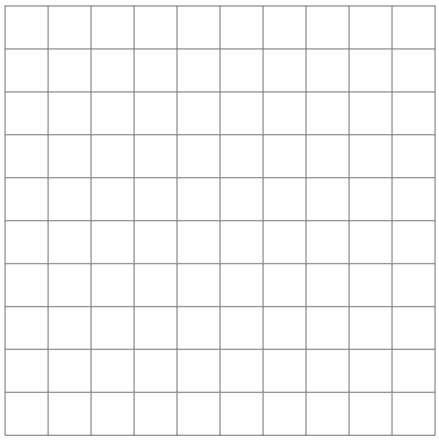
12. $f(x) = x^2$ and $g(x) = (x + 1)^2$



13. $f(x) = |x|$ and $g(x) = |x + 6|$



14. $f(x) = |x|$ and $g(x) = |x| - 3$



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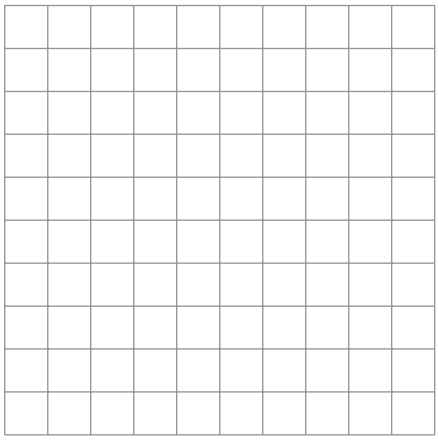
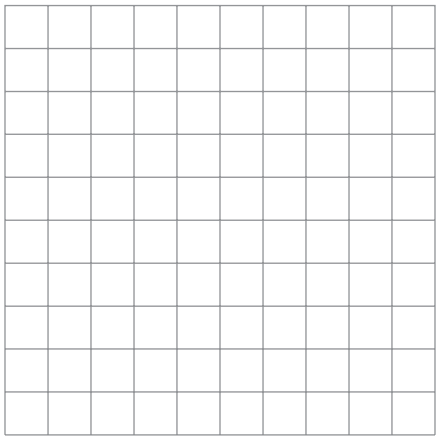
15. $f(x) = \sqrt{x}$ and $g(x) = \sqrt{x} + 2$

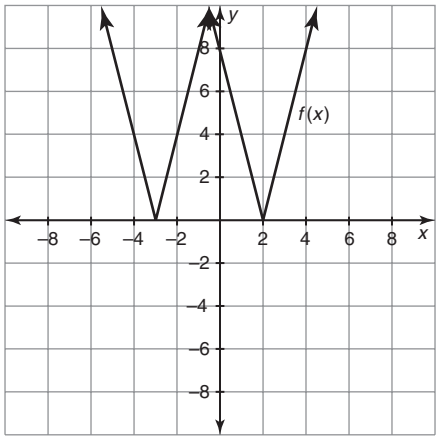


16. $f(x) = \sqrt{x}$ and $g(x) = \sqrt{x} - 5$



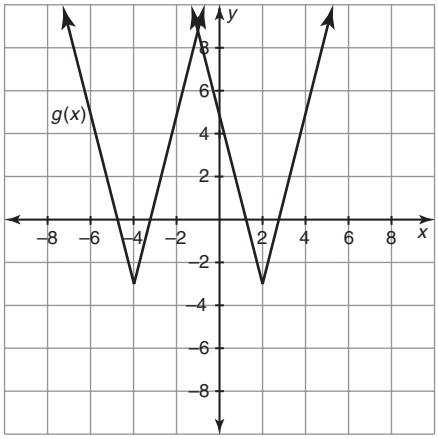
Given the graph of a function and its translation, write an equation for the translation in terms of the function.

17. Write an equation for the translation in terms of $f(x)$.

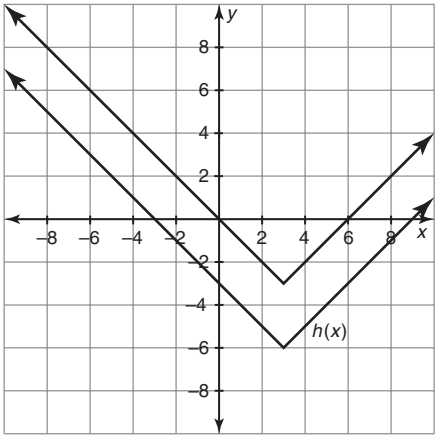


The translated graph is 5 units left of $f(x)$, so the equation for the translation is $f(x + 5)$.

18. Write an equation for the translation in terms of $g(x)$.



19. Write an equation for the translation in terms of $h(x)$.



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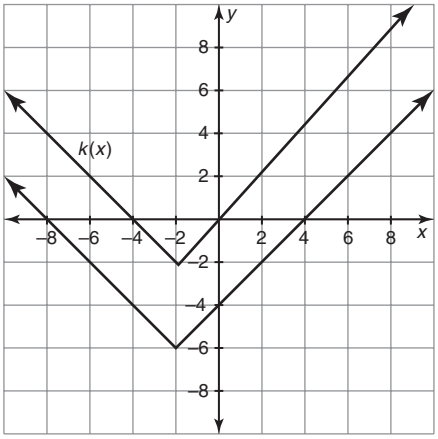
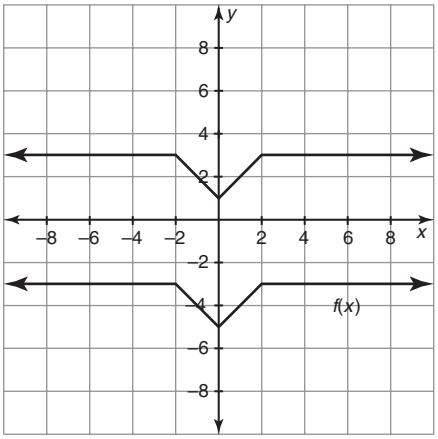
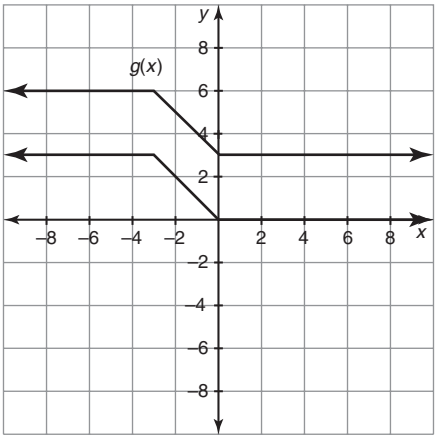
20. Write an equation for the translation in terms of $k(x)$.



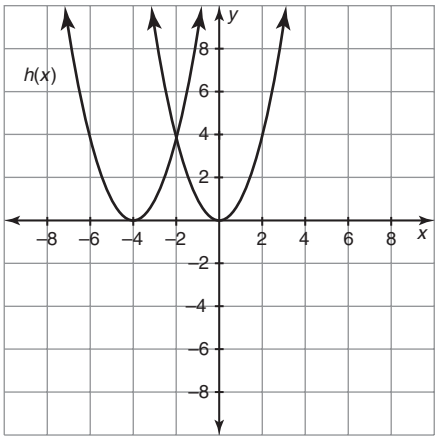
21. Write an equation for the translation in terms of $f(x)$.



22. Write an equation for the translation in terms of $g(x)$.



23. Write an equation for the translation in terms of $h(x)$.



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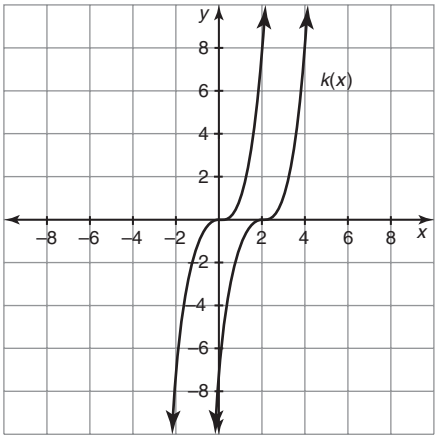
24. Write an equation for the translation in terms of $k(x)$.



9

Skills Practice

Name _____ Date _____

Expanding, Contracting, and Mirroring Dilations and Reflections

Vocabulary

Define each term using your own words.

1. dilation

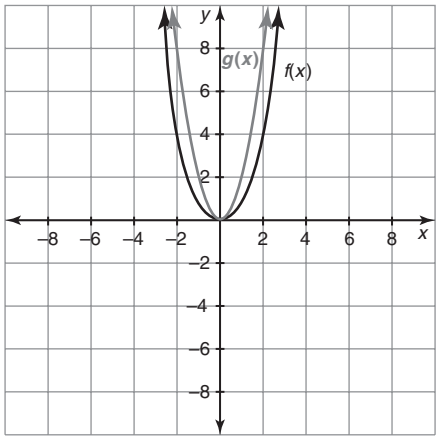
2. reflection

3. line of reflection

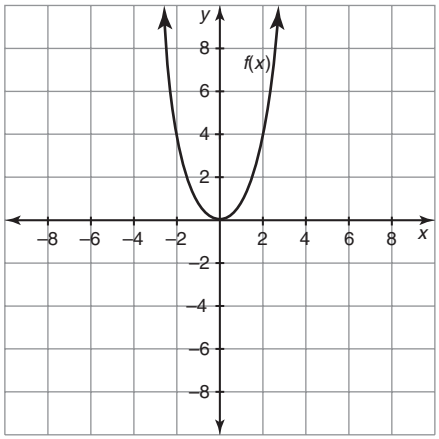
Problem Set

The graph of a function *f*(*x*) is shown. Sketch the graph of the dilated function, *g*(*x*).

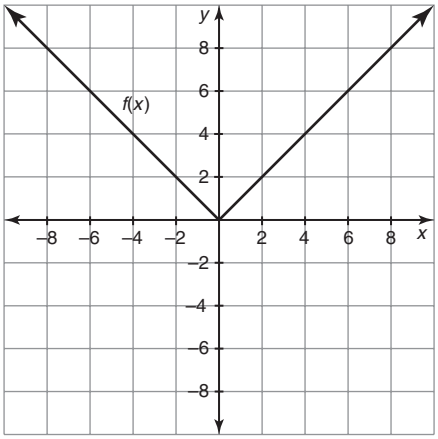
1. Sketch the graph of $g(x)$, if $g(x) = 2f(x)$.



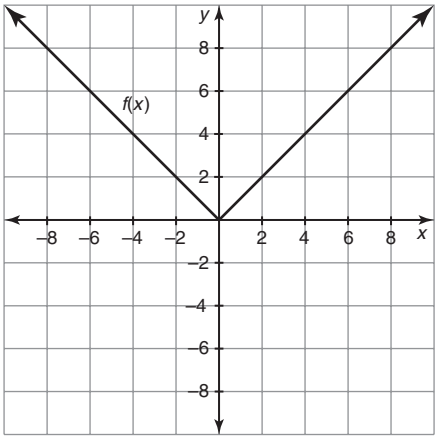
2. Sketch the graph of $g(x)$, if $g(x) = \frac{1}{2}f(x)$.



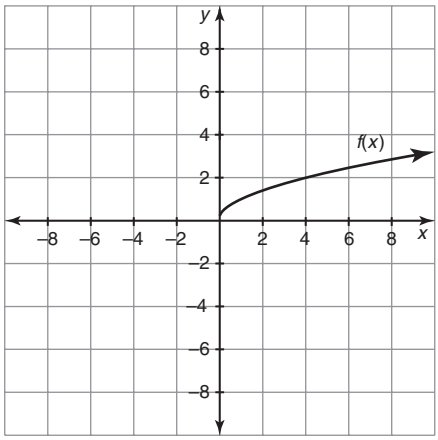
3. Sketch the graph of $g(x)$, if $g(x) = \frac{1}{3}f(x)$.



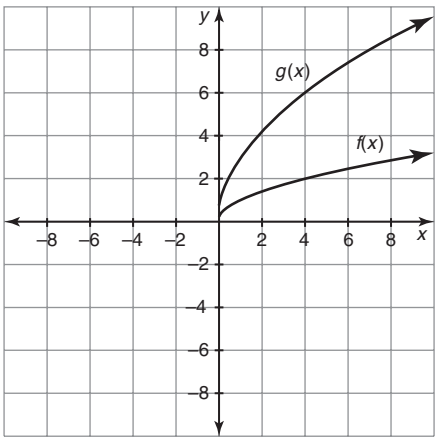
4. Sketch the graph of $g(x)$, if $g(x) = \frac{1}{4}f(x)$.



5. Sketch the graph of $g(x)$, if $g(x) = \frac{1}{2}f(x)$.



6. Sketch the graph of $g(x)$, if $g(x) = 3f(x)$.



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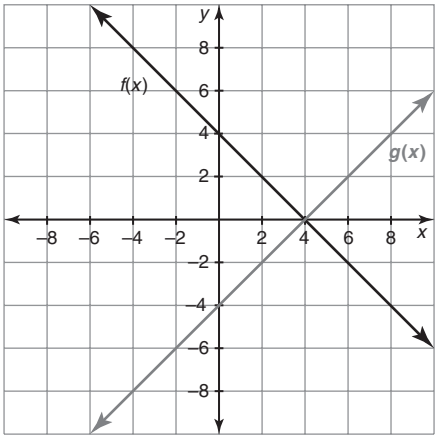
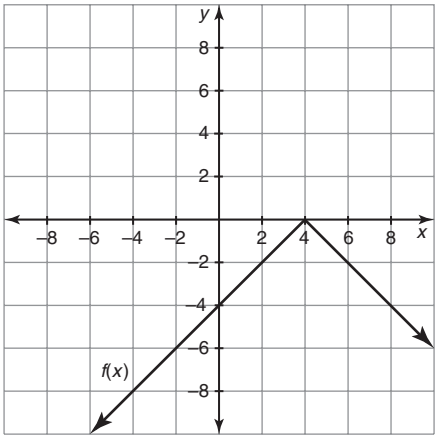
The graph of a function *f*(*x*) is shown. Sketch the graph of the reflected function, *g*(*x*).

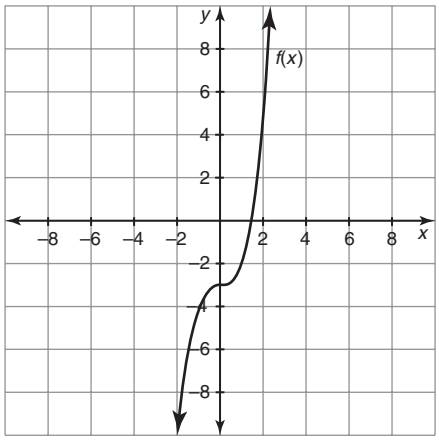
7. Sketch the graph of $g(x)$, if $g(x) = -f(x)$.



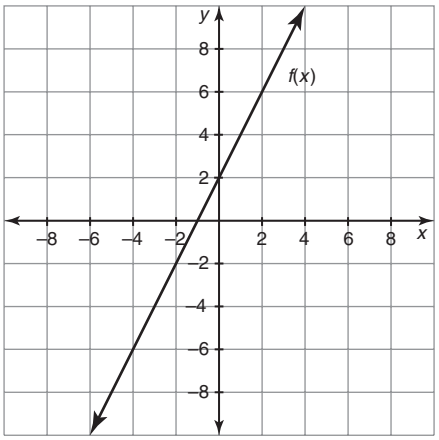
8. Sketch the graph of $g(x)$, if $g(x) = -f(x)$.



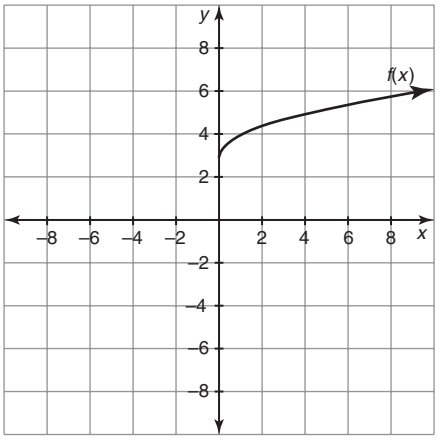
9. Sketch the graph of $g(x)$, if $g(x) = f(-x)$.



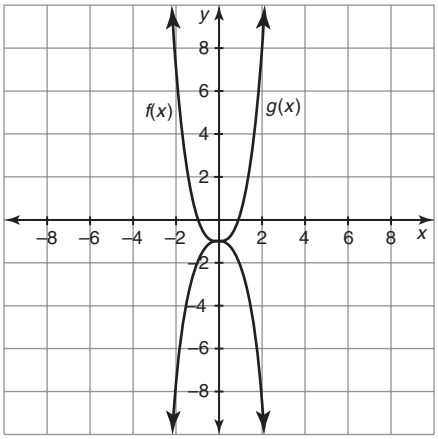
10. Sketch the graph of $g(x)$, if $g(x) = f(-x)$.



11. Sketch the graph of $g(x)$, if $g(x) = -f(-x)$.

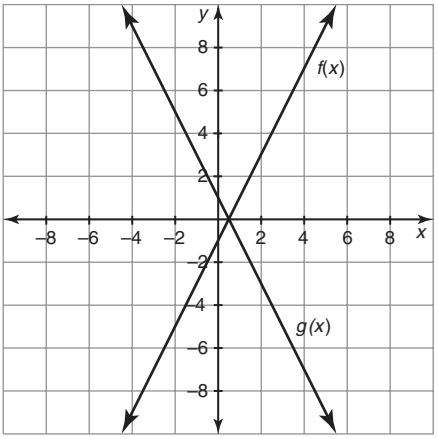


12. Sketch the graph of $g(x)$, if $g(x) = -f(-x)$.

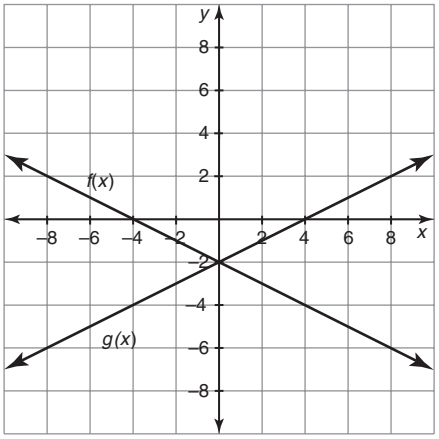


Given the graph of a function $f(x)$ and its transformation $g(x)$, write an equation for $g(x)$ in terms of $f(x)$.

13.



14.



The graph of $g(x)$ is the graph of $f(x)$ reflected in the x-axis, so $g(x) = -f(x)$.

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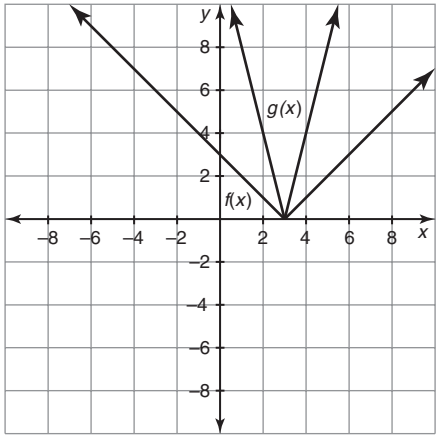
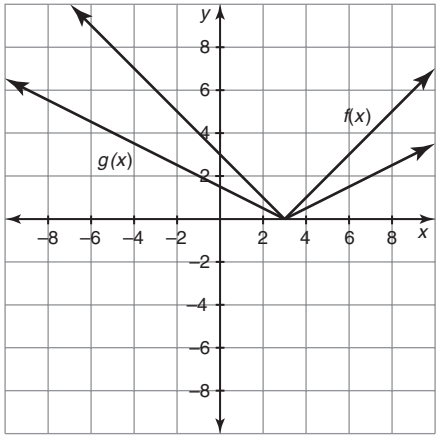
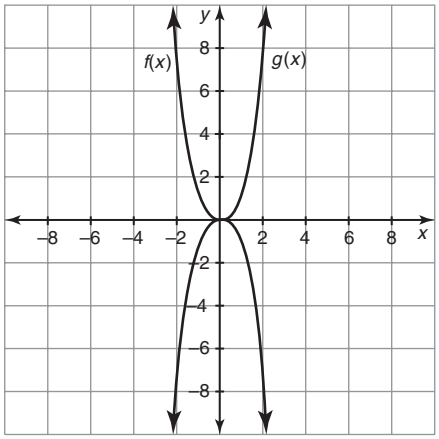
15.



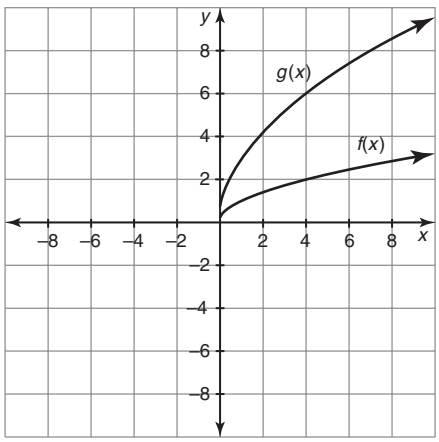
16.



17.



18.



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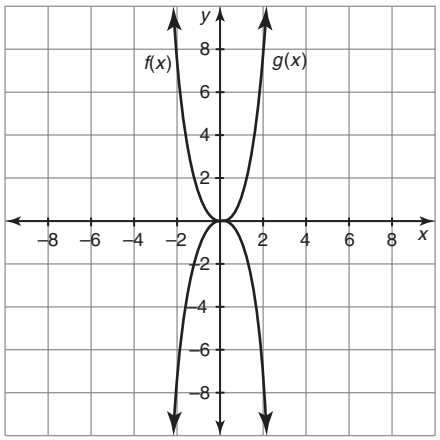

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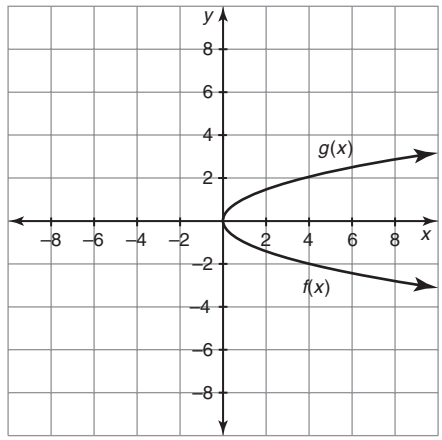

Complete the table to calculate the average rate of change for each function.

21. Complete the table to calculate the average rate of change from 0 to 10.

Function	Value at $x = 0$	Value at $x = 10$	Average Rate of Change
$f(x) = \lvert x \rvert$	$f(0) = \lvert 0 \rvert = 0$	$f(10) = \lvert 10 \rvert = 10$	$\frac{\Delta f(x)}{\Delta x} = \frac{f(10) - f(0)}{10 - 0} = \frac{10 - 0}{10} = 1$
$g(x) = 0.25\lvert x \rvert$	$g(0) = 0.25\lvert 0 \rvert = 0$	$g(10) = 0.25\lvert 10 \rvert = 2.5$	$\frac{\Delta g(x)}{\Delta x} = \frac{g(10) - g(0)}{10 - 0} = \frac{2.5 - 0}{10} = 0.25$
$h(x) = 6\lvert x \rvert$	$h(0) = 6\lvert 0 \rvert = 0$	$h(10) = 6\lvert 10 \rvert = 60$	$\frac{\Delta h(x)}{\Delta x} = \frac{h(10) - h(0)}{10 - 0} = \frac{60 - 0}{10} = 6$

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22. Complete the table to calculate the average rate of change from 0 to 25.

Function	Value at $x = 0$	Value at $x = 25$	Average Rate of Change
$f(x) = \sqrt{x}$	$f(0) =$	$f(25) =$	$\frac{\Delta f(x)}{\Delta x} =$
$g(x) = 0.1\sqrt{x}$	$g(0) =$	$g(25) =$	$\frac{\Delta g(x)}{\Delta x} =$
$h(x) = 2\sqrt{x}$	$h(0) =$	$h(25) =$	$\frac{\Delta h(x)}{\Delta x} =$

23. Complete the table to calculate the average rate of change from 0 to 4.

Function	Value at $x = 0$	Value at $x = 4$	Average Rate of Change
$f(x) = x^2$	$f(0) =$	$f(4) =$	$\frac{\Delta f(x)}{\Delta x} =$
$g(x) = 0.5x^2$	$g(0) =$	$g(4) =$	$\frac{\Delta g(x)}{\Delta x} =$
$h(x) = 3x^2$	$h(0) =$	$h(4) =$	$\frac{\Delta h(x)}{\Delta x} =$

24. Complete the table to calculate the average rate of change from 0 to 5.

Function	Value at $x = 0$	Value at $x = 5$	Average Rate of Change
$f(x) = x^3$	$f(0) =$	$f(5) =$	$\frac{\Delta f(x)}{\Delta x} =$
$g(x) = 0.2x^3$	$g(0) =$	$g(5) =$	$\frac{\Delta g(x)}{\Delta x} =$
$h(x) = 2x^3$	$h(0) =$	$h(5) =$	$\frac{\Delta h(x)}{\Delta x} =$

Given a function, evaluate the function for each value.

25. If $f(x) = 2x + 3$ and $g(x) = -f(x)$, evaluate $f(5)$ and $g(5)$.

$f(5) = 2(5) + 3 = 10 + 3 = 13$

$g(5) = -f(5) = -13$

9

26. If $f(x) = \sqrt{x}$ and $g(x) = -f(x)$, evaluate $f(4)$ and $g(4)$.

27. If $f(x) = 4x^3$ and $g(x) = f(-x)$, evaluate $f(-3)$ and $g(-3)$.

28. If $f(x) = 6x - 2$ and $g(x) = f(-x)$, evaluate $f(2)$ and $g(2)$.

29. If $f(x) = 0.25x - 4$ and $g(x) = -f(-x)$, evaluate $f(8)$ and $g(8)$.

30. If $f(x) = x^3 + 7$ and $g(x) = -f(-x)$, evaluate $f(3)$ and $g(3)$.

Skills Practice

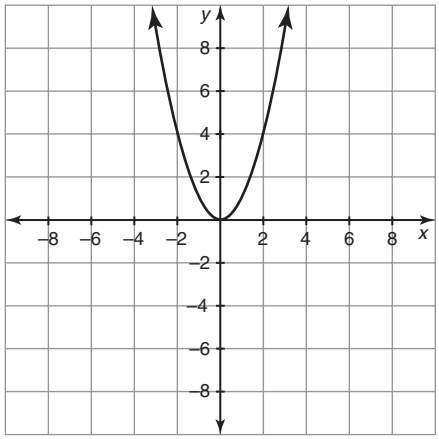
Name _____ Date _____

Mirroring!
Symmetry and Odd/Even

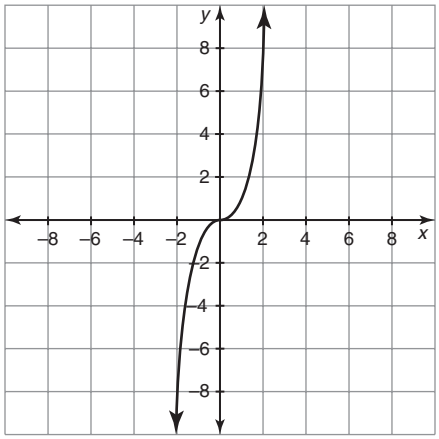
Vocabulary

Identify which figure is an example of the key term. Explain your answer.

A. $y = x^2$



B. $y = x^3$



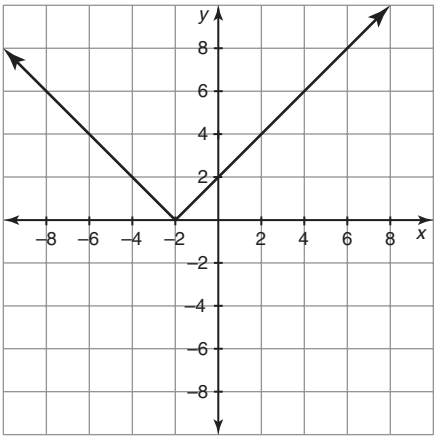
1. even function

2. odd function

Problem Set

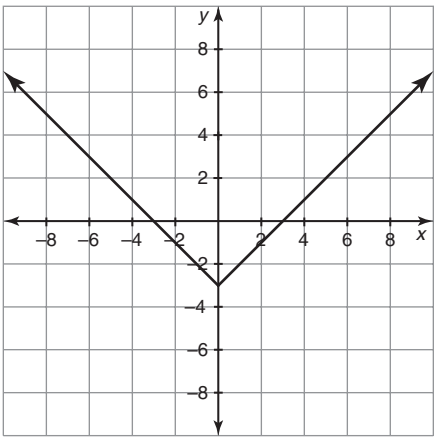
Determine whether each function has a line of symmetry. If so, identify the line of symmetry.

1. Identify the line of symmetry for the function $y = |x + 2|$.



The line of symmetry for the function is $x = -2$.

2. Identify the line of symmetry for the function $y = |x| - 3$.



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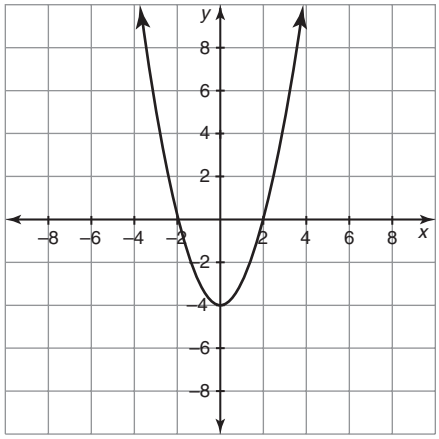
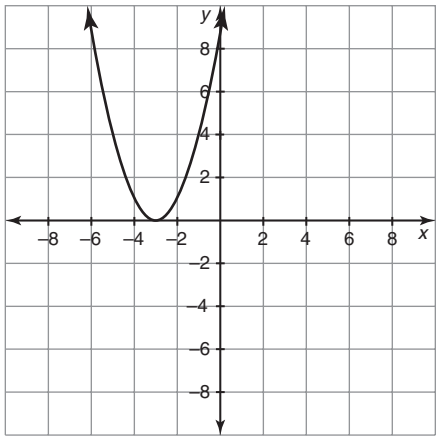
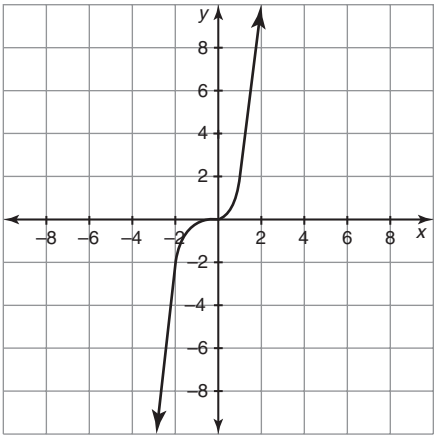
3. Identify the line of symmetry for the function $y = x^2 - 4$.



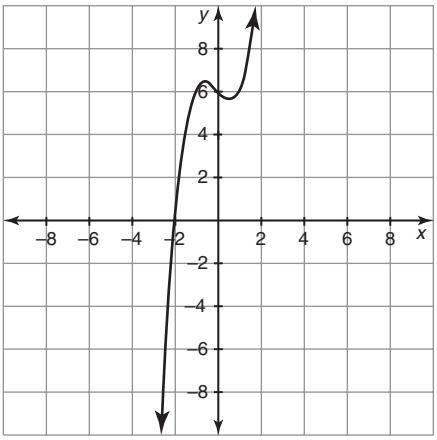
4. Identify the line of symmetry for the function $y = (x + 3)^2$.



5. Identify the line of symmetry for the function $y = x^3 + x^2$.



6. Identify the line of symmetry for the function $y = x^3 - x + 6$.



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Classify each function as even, odd, or neither. Explain your answer.

7. $f(x) = x^3 - x$

If $f(x)$ is even, then $f(x) = f(-x)$.

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

$f(x)$ does not equal $f(-x)$ so $f(x)$ is not even.

If $f(x)$ is odd, then $f(x) = -f(-x)$.

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

$f(x) = -f(-x)$ so $f(x)$ is odd.

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

9. $f(x) = x^2 + 2x$

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

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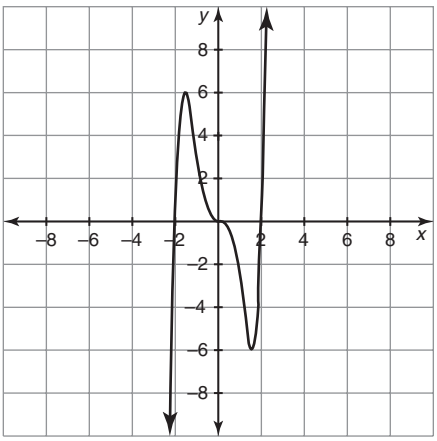
11. $f(x) = |x^3| + 4$

12. $f(x) = |x^2 + x|$

Classify the function shown in each graph as even, odd, or neither. Explain your answer.

13. $f(x) = x^5 - 4x^3$

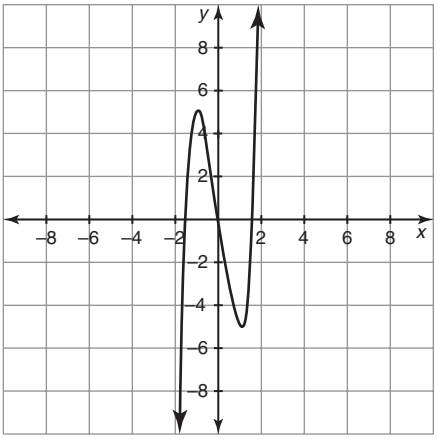


The function is odd.

Explanations may vary; sample answer:

Looking at the graph, for each value of x, $f(x) = -f(-x)$. For example, $f(2) = 0 = -f(-2)$.

14. $f(x) = x^5 - 6x$



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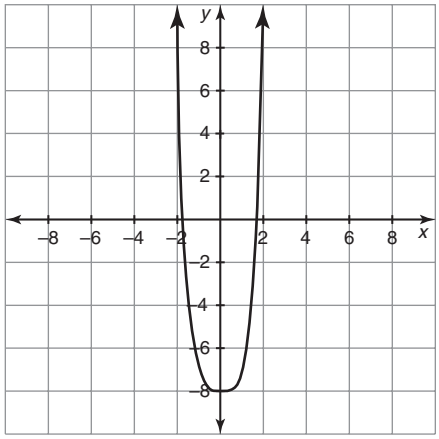
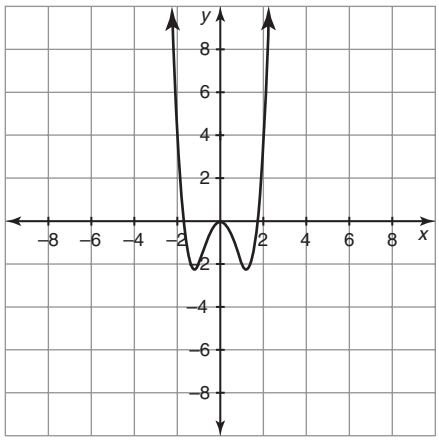
15. $f(x) = x^4 - 8$



16. $f(x) = x^4 - 3x^2$



Skills Practice

Name _____ Date _____

Machine Parts
Solving Equations Graphically

Vocabulary

point of intersection	consistent
identity	inconsistent

Complete each statement with the correct term from the box.

1. Two equations are _____ if the graphs of the two equations have at least one point of intersection.
2. An _____ is an equation that is true for all values of x.
3. The _____ is the location on a graph where two lines or functions intersect, indicating that the values at that point are the same.
4. Two equations are _____ if the graphs of the two equations do not have a point of intersection.

Problem Set

Write an equation that represents each situation.

1. An online store charges $15 per T-shirt, plus a flat fee of $6 for shipping. Write an equation for the total cost, c, of buying t T-shirts.

   $c = 15t + 6$

2. A kitchen store charges $4 per dish, plus a flat fee of $8 for shipping. If d is the number of dishes and c is the total cost, write an equation for the total cost of buying dishes.

3. A phone plan costs $30 per month, plus $0.10 for each text message. If p is the total cost of the phone service and t is the number of text messages sent and received, write an equation for the total cost of the phone service for one month.

4. A phone plan costs \$20 per month, plus \$0.25 for each text message. If p is the total cost of the phone service and t is the number of text messages sent and received, write an equation for the total cost of the phone service for one month.

5. A bookstore charges \$25 for hardcover books, plus \$1.25 per item in shipping. Write an equation for the total cost, c, of buying b books.

6. An online music store charges \$0.99 per song, plus \$0.05 tax per song. Write an equation for the total cost, c, of buying s songs.

Calculate the point(s) of intersection for each pair of functions algebraically.

7. $f(x) = x^2$ and $g(x) = x + 20$

   $x^2 = x + 20$

   $0 = x^2 - x - 20$

   $0 = (x - 5)(x + 4)$

   $x = 5$ or $x = -4$

   $f(5) = 5^2 = 25$

   $f(-4) = (-4)^2 = 16$

   The two points of intersection are (5, 25) and (−4, 16).

8. $f(x) = 4x$ and $g(x) = x^2 + 4$

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9. $f(x) = 5x - 1$ and $g(x) = 2x + 26$

10. $f(x) = x + 15$ and $g(x) = 3x - 11$

11. $f(x) = x^3 + x^2 - x - 1$ and $g(x) = (x + 1)(x - 1)(x + 1)$

12. $f(x) = (x - 2)(x - 1)(x + 2)$ and $g(x) = x^3 - x^2 - 4x + 4$

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Use the given information to answer each question.

13. Company A charges a flat fee of $25 per month plus $0.15 per text message for phone service. Company B charges a flat fee of $35 per month with unlimited text messages. If Devon sends 80 text messages during the month, which company's plan would be less expensive?

Company A: $c = 25 + 0.15t$

$c = 25 + 0.15(80) = 25 + 12 = 37$

Company A's plan would cost $37 for the month, so company B's plan would be less expensive for Devon.

14. Gym A charges a flat fee of $90 per month for members. Gym B charges a flat fee of $40 per month, plus $5 per visit. If Emily visits the gym 12 times each month, which gym would be less expensive?

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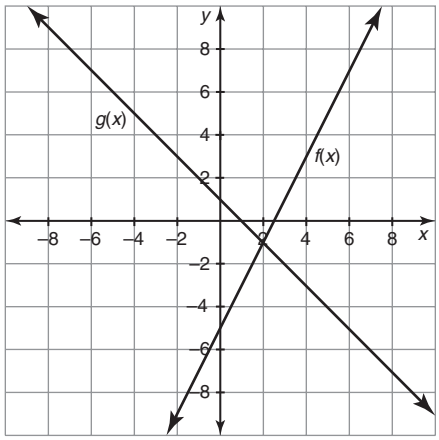
15. Bookstore A charges $14 per book plus a $5 flat fee for shipping. Bookstore B charges $12 per book, plus a shipping fee of $1.50 per book. If Manisha wants to buy 8 books, which company should she buy them from?

16. Company A charges a flat fee of $5 per month plus $1.20 per song for music downloads. Company B charges a flat fee of $20 per month, plus $0.25 per song. If Jason downloads 35 songs during the month, which company's plan would be less expensive?

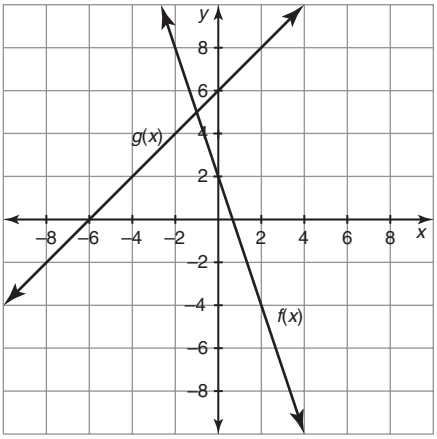
Solve for the point(s) of intersection graphically.

17. $f(x) = 2x - 5$ and $g(x) = -x + 1$

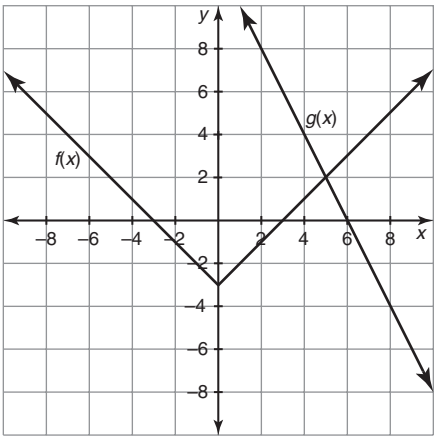


The point of intersection is (2, −1).

18. $f(x) = -3x + 2$ and $g(x) = x + 6$



19. $f(x) = |x| - 3$ and $g(x) = -2x + 12$



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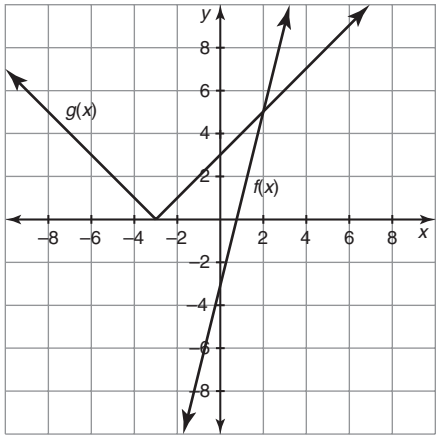
20. $f(x) = 4x - 3$ and $g(x) = |x + 3|$



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