

TEST NAME: **BF. 3**
TEST ID: **439374**
GRADE: **09**
SUBJECT: **Mathematics**
TEST CATEGORY: **My Classroom**

Student: _____

Class: _____

Date: _____

Read the passage - 'Wendy's Novel' - and answer the question below:

Wendy's Novel

Wendy's Novel

Wendy wrote her first novel. Patrick, a publisher, helped her edit and publish the book through online retailers.

Patrick developed equations designed to model the revenue that he would receive from the sales of the novel and the costs that he would incur. The publisher's share of the revenue, R dollars, is modeled by the equation $R = 5.5n$, where n is the number of novels sold. The cost for Patrick to print the novel and release it to the market, C dollars, is modeled by the equation $C = 2n + 2600$.

Patrick gave Wendy two payment options for her novel. If she chose Option 1, she would receive a \$1,000 payment immediately, and then she would earn \$0.65 for each book sold. If she chose Option 2, she would receive no initial payment, but she would earn \$1.05 for each book sold.

When Wendy's book was released, the sales of the novel started off moderate, increased at a steady rate for the first week, and then decreased at a steady rate. The daily sales of Wendy's novel, s , are modeled by the equation $s = -40|x - 7| + 1000$, where x is the number of days since the book was released. For the first 21 days after the novel was released, Patrick's model was accurate to within 3% of the book's actual sales.

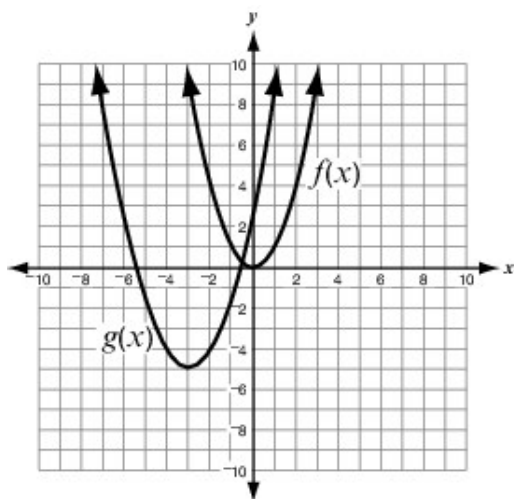
1. Read "Wendy's Novel" and answer the question.

If -40 was replaced with -20 in the equation which models the daily sales of Wendy's novel, what would be the effect on the graph?

- A. The graph would shift up by 20 units.
 - B. The graph would shift down by 20 units.
 - C. The graph would compress towards the y -axis by a factor of 2.
 - D. The graph would compress towards the line $y = 1000$ by a factor of 2.
-

2. Which translation when applied to the graph of $f(x) = 2x - 1$ results in the graph of $g(x) = 2x - 5$?
- A. up 4 units
 - B. down 4 units
 - C. left 4 units
 - D. right 4 units
3. If the function $g(x) = f(x + 2)$, how can the graph of the function $g(x)$ be obtained from the graph of $f(x)$?
- A. by translating the graph of $f(x)$ two units to the right
 - B. by translating the graph of $f(x)$ two units to the left
 - C. by translating the graph of $f(x)$ two units down
 - D. by translating the graph of $f(x)$ two units up
4. In Algebra class, Mrs. Martin asked the class to graph the function $y = 2^x + 1$. Levi accidentally wrote down the function $y = 2^x - 1$ in his notebook. How did Levi's mistake affect the graph of the function?
- A. The graph of Levi's function shifted up 2 units.
 - B. The graph of Levi's function shifted down 2 units.
 - C. The graph of Levi's function shifted up 1 unit.
 - D. The graph of Levi's function shifted down 1 unit.
5. Which translation would move the vertex of $f(x)$ up 7 units?
- A. $f(x) - 7$
 - B. $f(x) + 7$
 - C. $f(x - 7)$
 - D. $f(x + 7)$

6. The function $f(x) = 2^x - 5$ was replaced with $f(x) + 4$, resulting in the function $g(x)$. Which statement correctly compares the y -intercepts of $f(x)$ and $g(x)$?
- A. The y -intercept of $f(x)$ is 9 units below the y -intercept of $g(x)$.
 - B. The y -intercept of $f(x)$ is 4 units below the y -intercept of $g(x)$.
 - C. The y -intercept of $f(x)$ is 1 unit below the y -intercept of $g(x)$.
 - D. The y -intercept of $f(x)$ is the same as the y -intercept of $g(x)$.
7. The functions $f(x)$ and $g(x)$ are shown below.



How can $g(x)$ be written in terms of $f(x)$?

8. A linear function, $f(x)$ passes through the points $(2, 8)$ and $(5, 17)$. The function was replaced with $f(x + k)$ resulting in the function $g(x)$. The function $g(x)$ passes through the points $(2, 14)$ and $(5, 23)$. What is the value of k ?
- A. 2
 - B. 4
 - C. 6
 - D. 12

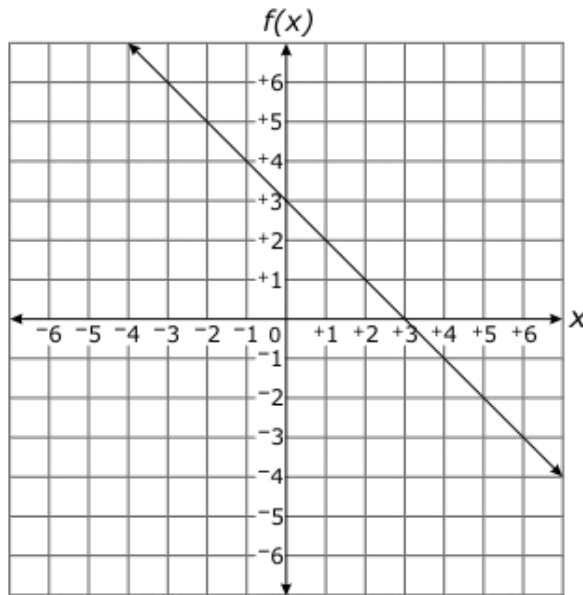
9. In the function $f(x) = |x - h| + k$, what values of h and k ensure that the vertex of the graph of the function appears in the 3rd quadrant?

- A. $h > 0$
 $k > 0$
- B. $h > 0$
 $k < 0$
- C. $h < 0$
 $k > 0$
- D. $h < 0$
 $k < 0$

10. Which statement is true for the function $f(x) = -x^3 + 4x$?

- A. $f(x)$ is an even function and has end behavior such that as $x \rightarrow \infty, f(x) \rightarrow \infty$ and as $x \rightarrow -\infty, f(x) \rightarrow \infty$.
- B. $f(x)$ is an odd function and has end behavior such that as $x \rightarrow \infty, f(x) \rightarrow -\infty$ and as $x \rightarrow -\infty, f(x) \rightarrow \infty$.
- C. $f(x)$ is an odd function and has end behavior such that as $x \rightarrow \infty, f(x) \rightarrow \infty$ and as $x \rightarrow -\infty, f(x) \rightarrow -\infty$.
- D. $f(x)$ is an even function and has end behavior such that as $x \rightarrow \infty, f(x) \rightarrow -\infty$ and as $x \rightarrow -\infty, f(x) \rightarrow -\infty$.

11. A function, f , is graphed below.

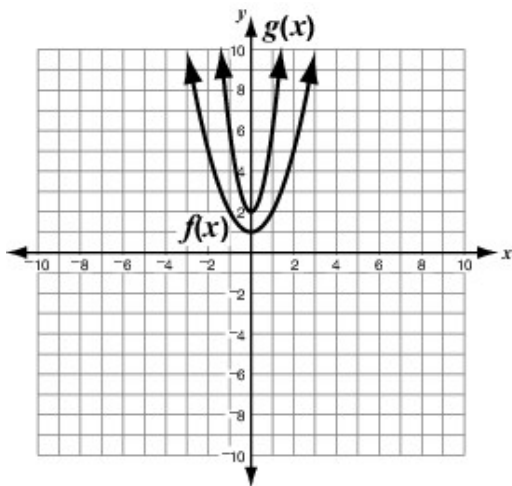


The function will undergo a translation resulting in the function $g(x) = -x - 3$. Which describes the translation?

- A. a shift up 6 units
 - B. a shift down 6 units
 - C. a shift up 3 units
 - D. a shift down 3 units
12. The graph of $g(x) = 4^x$ was translated 2 units to the right and 7 units up resulting in the graph of $h(x)$. Which is an equation of $h(x)$?
- A. $h(x) = 4^{(x+7)} - 2$
 - B. $h(x) = 4^{(x+7)} + 2$
 - C. $h(x) = 4^{(x-2)} + 7$
 - D. $h(x) = 4^{(x+2)} + 7$

13. The function $f(x) = 3(2)^x$ models the growth of a bacterial culture. What is the change that occurs to the graph of f if $f(x + k)$ is graphed and $k < 0$?
- A. The graph moves up k units.
 - B. The graph moves down k units.
 - C. The graph moves left k units.
 - D. The graph moves right k units.
14. The function $f(x) = 3x + 1$ was translated 4 units to the left and k units down resulting in the function $g(x) = 3x + 10$. What is the value of k ?
- A. 3
 - B. 5
 - C. 7
 - D. 9
15. The function $f(x) = x + 1$ will be shifted 6 units to the right creating $g(x)$. Which is an equation of $g(x)$?
- A. $g(x) = x - 7$
 - B. $g(x) = x - 5$
 - C. $g(x) = x + 5$
 - D. $g(x) = x + 7$

16. The graph of the function $f(x)$ and the transformed function $g(x) = f(ax) + k$ are shown below.



Which values are the **best** estimates for the values of a and k ?

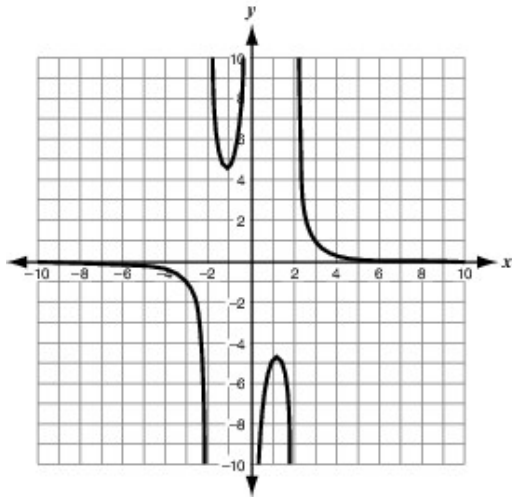
- A. $a = 4$ and $k = 1$
 - B. $a = 4$ and $k = -1$
 - C. $a = \frac{1}{2}$ and $k = 1$
 - D. $a = \frac{1}{2}$ and $k = -1$
17. The function $f(x) = x - 2$ was translated down 6 units, resulting in the function $g(x)$. Which function represents $g(x)$?
- A. $g(x) = 6x - 2$
 - B. $g(x) = 2x - 8$
 - C. $g(x) = x - 8$
 - D. $g(x) = x + 4$

18. The function $f(x) = 2x + 4$ was replaced with $f(x) + k$, resulting in the function $g(x) = 2x - 7$. What is the value of k ?

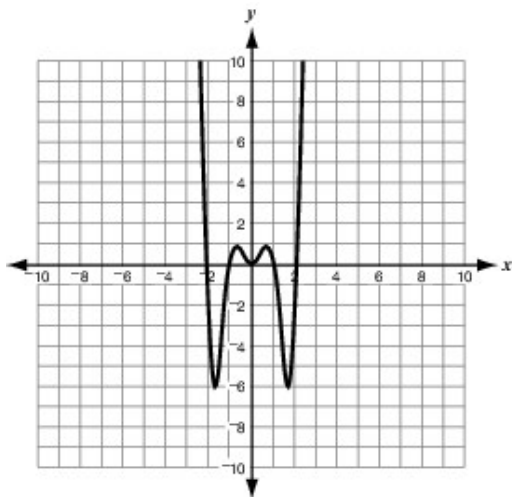
- A. 11
- B. 3
- C. -3
- D. -11

19. Which graph represents a polynomial function with a degree greater than 2?

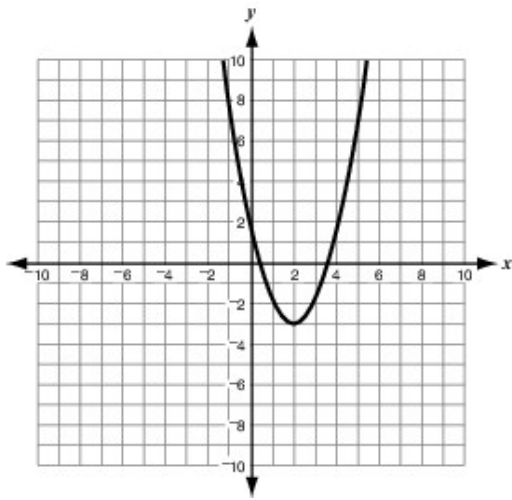
A.



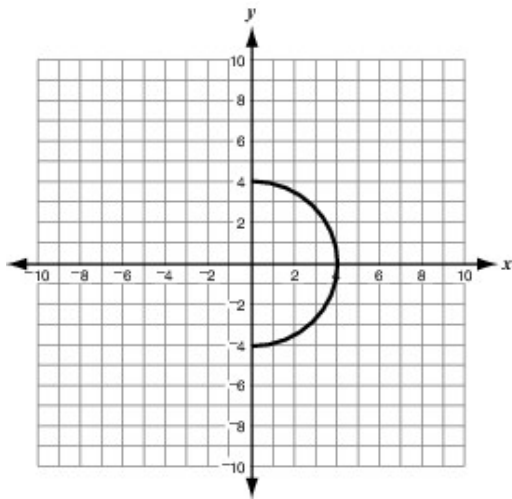
B.



C.



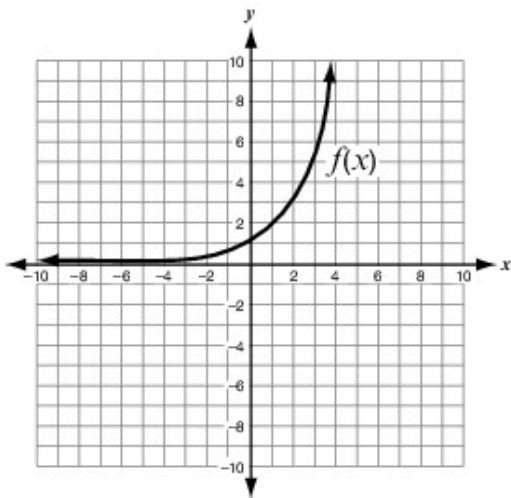
D.



20. Which statement is **true** for the function $f(x) = \frac{x^2 - 5}{|x| + 1}$?

- A. The function $f(x)$ is an odd function as $f(x) = f(-x)$.
- B. The function $f(x)$ is an even function as $f(x) = f(-x)$.
- C. The function $f(x)$ is an odd function as $f(-x) = -f(x)$.
- D. The function $f(x)$ is an even function as $f(-x) = -f(x)$.

21. Use the graph to answer the questions below.



Part A. The given graph represents a function $f(x) = 2^x$. What happens to the graph if $f(x)$ is replaced by $f(x) + 2$?

Part B. What happens to the graph if $f(x)$ is replaced by $f(x) - 2$?

Part C. The y -intercept of the graph $f(x) + k$ is 4. What is the value of k ?

Part D. Where does the function $f(x) - 3$ intersect the y -axis?

Use words, numbers, and/or pictures to show your work.

22. The graph of the function $f(x) = 3^x$ was translated 2 units to the right and 6 units down, resulting in the graph of $g(x)$. Which function represents $g(x)$?

A. $g(x) = 3^{(x - 2)} - 6$

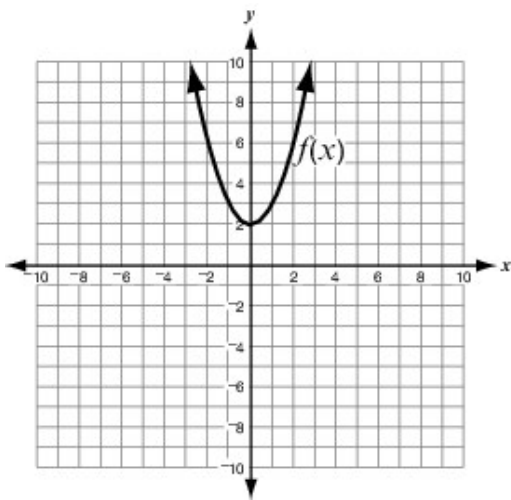
B. $g(x) = 3^{(x + 2)} - 6$

C. $g(x) = 3^{(x - 6)} - 2$

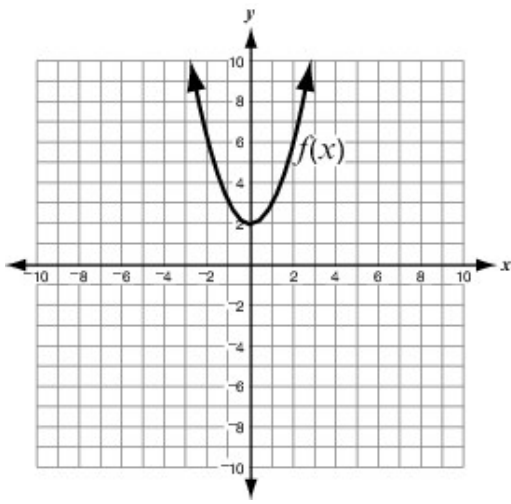
D. $g(x) = 3^{(x - 6)} + 2$

23. How is the graph of $g(x) = -x^2 - 2$ related to the graph of $f(x) = x^2$?
- A. The graph of $g(x) = -x^2 - 2$ is reflected across the y -axis and translated up 2 units.
 - B. The graph of $g(x) = -x^2 - 2$ is reflected across the x -axis and translated up 2 units.
 - C. The graph of $g(x) = -x^2 - 2$ is reflected across the y -axis and translated down 2 units.
 - D. The graph of $g(x) = -x^2 - 2$ is reflected across the x -axis and translated down 2 units.

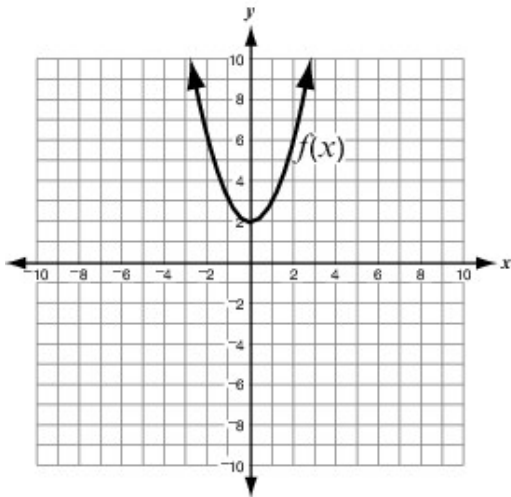
24. The graph below represents a function $f(x)$.



Part A. Use the graph of function $f(x)$ below to draw a sketch of the function $g(x) = f(2x) - 4$.

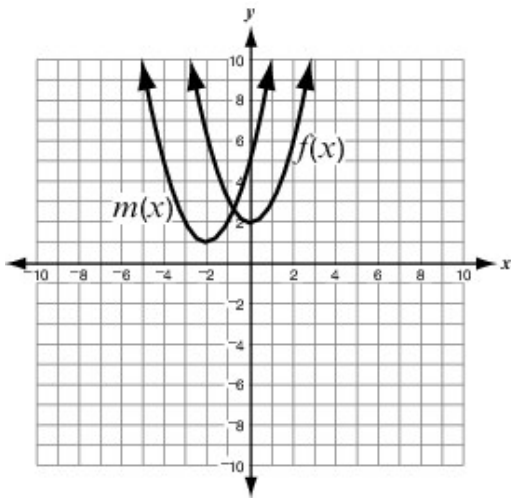


Part B. Use the graph of function $f(x)$ below to draw a sketch of the function $h(x) = 2f(x) + 2$.



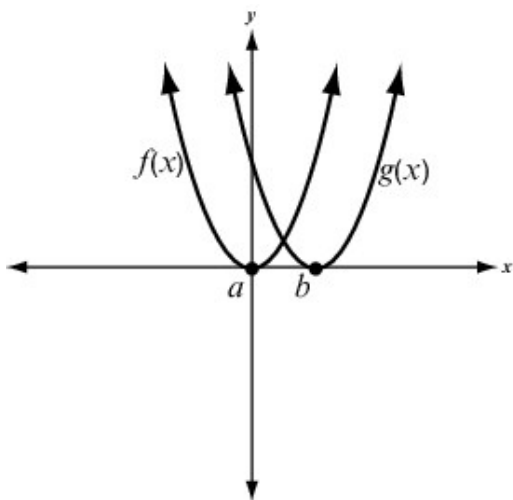
Part C. What is the difference between the transformations of $g(x) = f(2x) - 4$ and $h(x) = 2f(x) + 2$ seen in parts A and B?

Part D. The graph of functions $m(x)$ and $f(x)$ are shown below. Function $m(x)$ is formed by transforming $f(x)$. Write $m(x)$ in terms of $f(x)$.



Use words, numbers, and/or pictures to show your work.

25. The graph below represents the function $f(x)$ and the translated function $g(x)$.



If $f(x) = x^2$, which of the following functions could be an algebraic representation of $g(x)$?

- A. $g(x) = x^2 + b$
- B. $g(x) = x^2 - b$
- C. $g(x) = (x + b)^2$
- D. $g(x) = (x - b)^2$

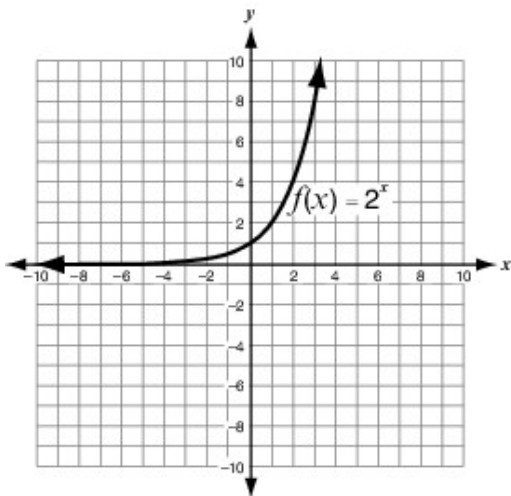
26. In the function described below, n is an odd number greater than 3.

$$f(x) = x^n - x^{n-2} + 1$$

Function $f(x)$ is translated 1 unit down to obtain another function $g(x)$. Which statement regarding functions f and g is correct?

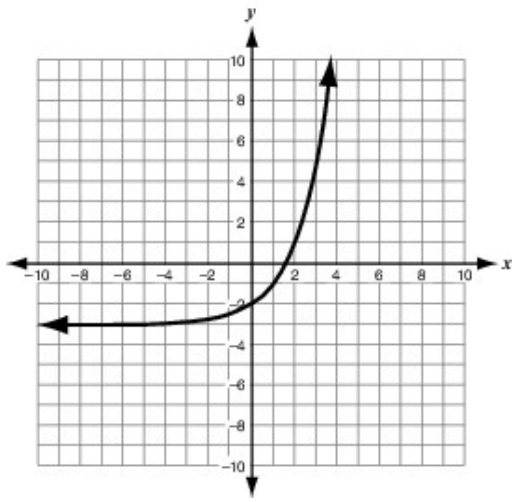
- A. Function f and g are both odd functions.
- B. Functions f and g are both even functions.
- C. Function f is an odd function, and function g is neither an even function nor an odd function.
- D. Function f is neither an even function nor an odd function, and function g is an odd function.

27. The graph below represents the function $f(x) = 2^x$.

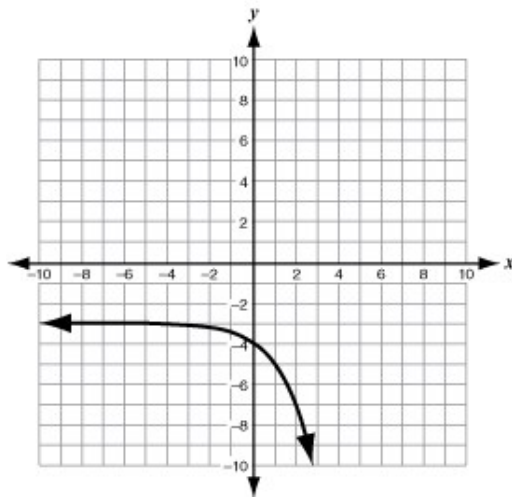


Which graph represents $-3f(x)$?

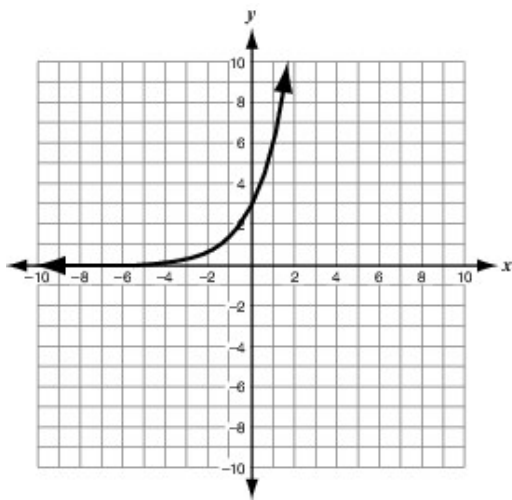
A.



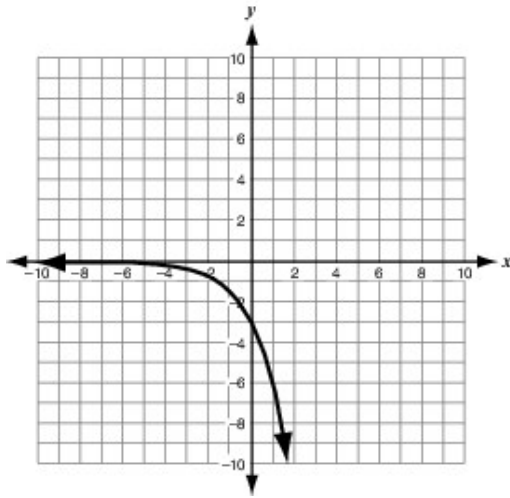
B.



C.

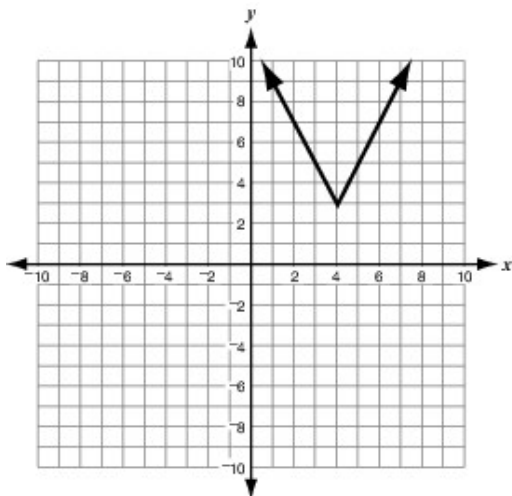


D.



28. The function $f(x)$ is an even polynomial function with a negative leading coefficient. The graph of $f(x)$ has an axis of symmetry at $x = -2$. Which statement describes the graph of $-f(x - 3)$?
- A. It falls to the left and falls to the right and has an axis of symmetry at $x = -5$.
 - B. It rises to the left and rises to the right and has an axis of symmetry at $x = -5$.
 - C. It rises to the left and rises to the right and has an axis of symmetry at $x = 1$.
 - D. It falls to the left and falls to the right and has an axis of symmetry at $x = 1$.

29. The figure below shows the graph of the function $g(x)$.



If $f(x) = |2x| + 3$, how is $g(x)$ related to $f(x)$?

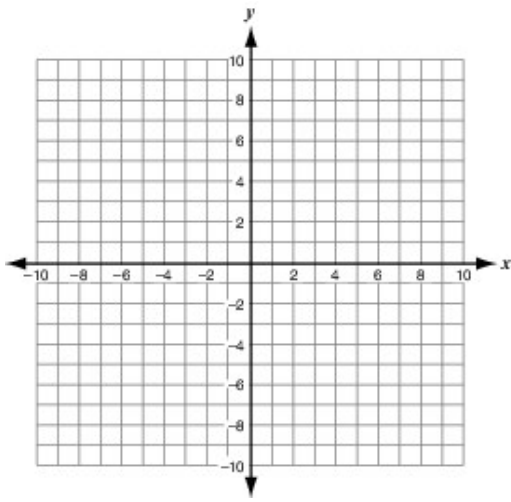
- A. $g(x) = f(x) - 4$
- B. $g(x) = f(x) + 4$
- C. $g(x) = f(x - 4)$
- D. $g(x) = f(x + 4)$

30. How many units and in what direction will the graph of $f(x)$ be shifted to create the graph of $f(x + 2)$?

31. **Slide, Stretch, and Squeeze**

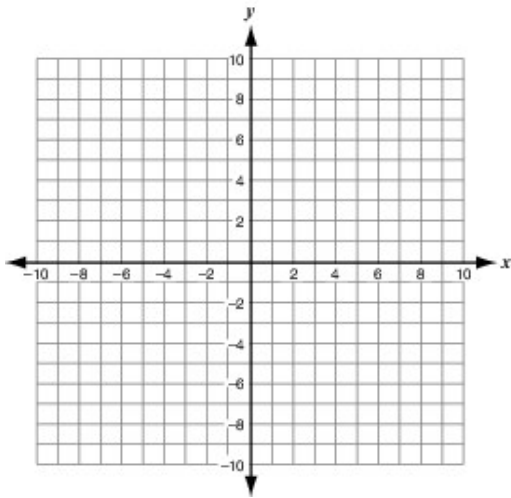
For this problem, you will take a basic exponential function and experiment with different ways to transform it. You may use a graphing calculator or graphing program and then sketch each graph on the grid provided.

Part A. Graph the function $f(x) = 2^x$. Describe the main features of the graph, including shape, quadrants, and key points.

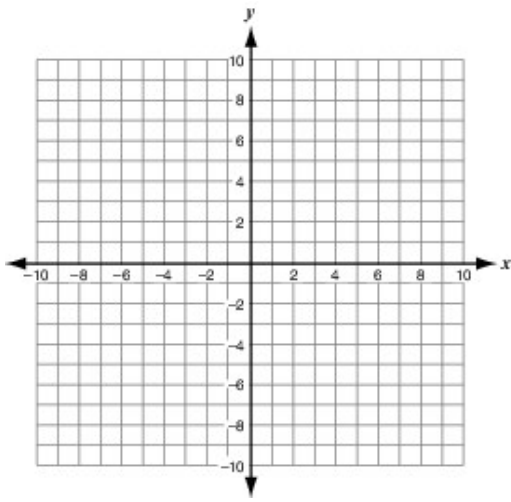


Part B. On the same grid, graph the function $g(x) = 2^x + 1$, identifying at least two key points. Describe how it differs from the graph of $f(x) = 2^x$.

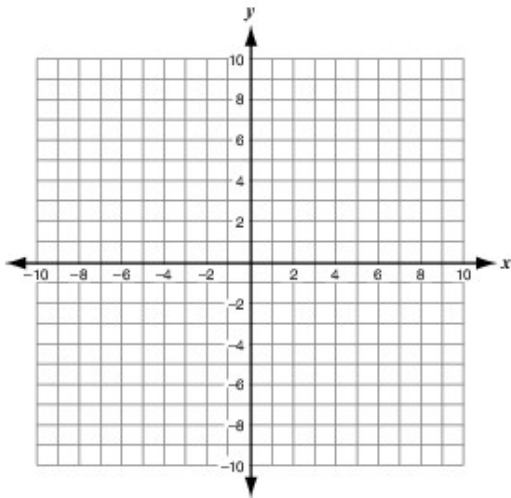
Part C. On the grid below, sketch $f(x) = 2^x$ again and then sketch $h(x) = -3(2^x)$. Describe how a coefficient of -3 on the 2^x term changes the graph of the function.



Part D. On the grid below, sketch $f(x) = 2^x$ again and then sketch $j(x) = 2^{3x}$. Describe the new graph and how it compares with the original graph.



Part E. On the grid below, sketch $f(x) = 2^x$ again and then sketch $k(x) = 2^{(x-3)}$. Describe the new graph and how it compares with the original graph.

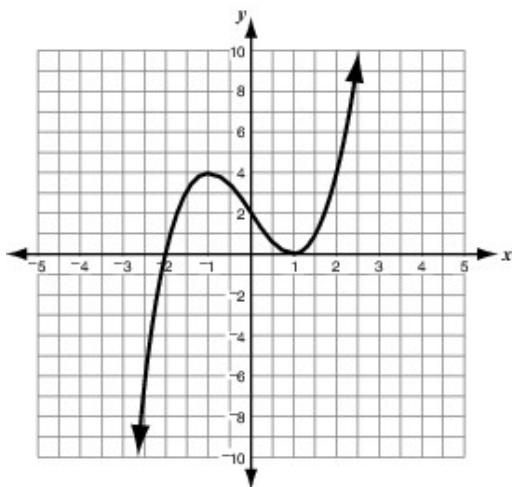


Part F. Name two ways that you could transform the function $f(x) = 2^x$ so that it passes through the point $(-1, 2)$. Sketch the graphs of the functions you provide.

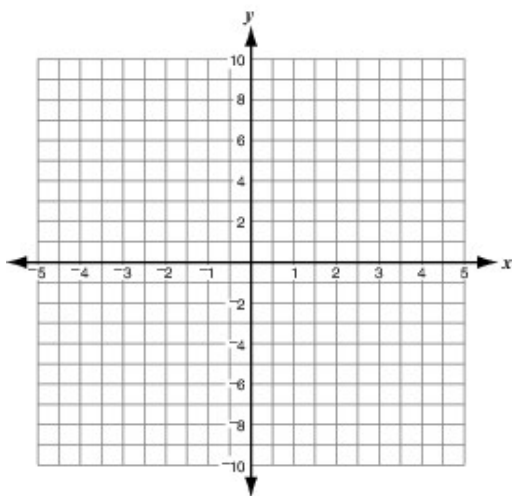
32. The function $f(x) = 2x - 14$ underwent a translation resulting in the function $g(x) = 2x - 22$. Which rule describes the translation?

- A. $f(x - 8)$
- B. $f(x + 8)$
- C. $f(x) - 8$
- D. $f(x) + 8$

33. The figure below shows the graph of the function $f(x)$.



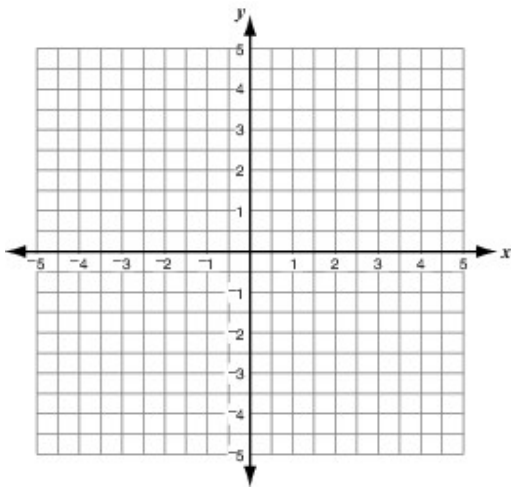
Part A. Graph the function $g(x) = 3f(x) - 6$. Explain how you can obtain the graph of $g(x)$ from the graph of $f(x)$.



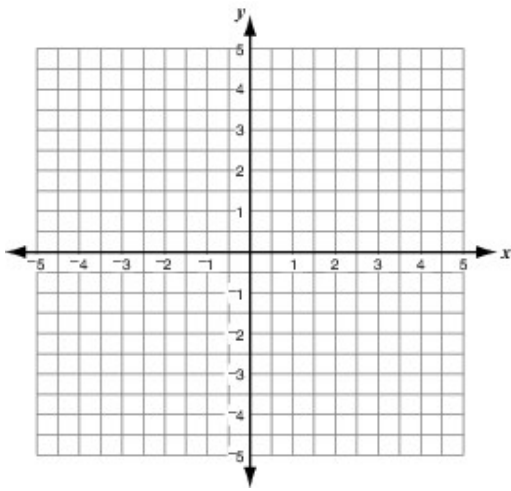
Part B. Is the function $g(x)$ odd or even? Explain.

Use words, numbers, and/or pictures to show your work.

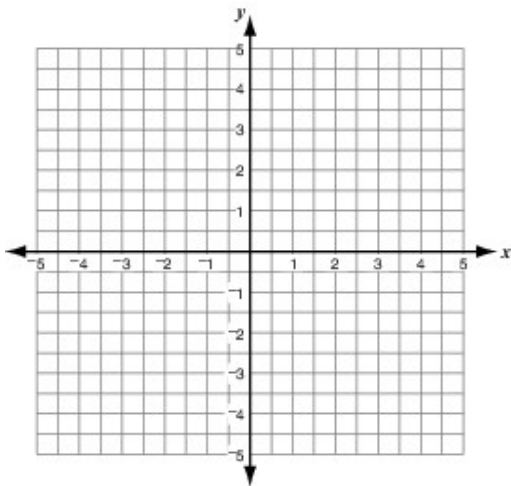
34. If the graph of $f(x) = \sqrt{x} + 3$ is translated 2 units right and 4 units down, which of these functions describes the transformed graph?
- A. $g(x) = \sqrt{x-2} - 1$
 - B. $g(x) = \sqrt{x+2} - 1$
 - C. $g(x) = \sqrt{x-2} + 7$
 - D. $g(x) = \sqrt{x+2} + 7$
35. The function $f(x) = 2^{(x+4)}$ was replaced with $f(x-2) + 4$ resulting in the function $g(x)$. Which describes the translation that occurred?
- A. shift 2 units down and 4 units left
 - B. shift 2 units down and 4 units right
 - C. shift 2 units right and 4 units up
 - D. shift 2 units left and 4 units up
36. What is the effect on the graph of $f(x) = 3x$ when it is replaced by $f(x) = 3x + 9$?
- A. The graph shifts left 9 units.
 - B. The graph shifts right 9 units.
 - C. The graph shifts up 9 units.
 - D. The graph shifts down 9 units.
37. Part A. Graph the function $f(x) = 2^x$, and on the same grid graph the function $g(x) = 2^x - 3$. Describe how $g(x)$ differs from the graph of $f(x) = 2^x$.



Part B. Sketch $h(x) = 2^{(x-3)}$. Describe how $h(x)$ compares with the original graph $f(x)$.



Part C. Sketch $j(x) = 2^{3x}$. Describe how $j(x)$ compares with the original graph $f(x)$.



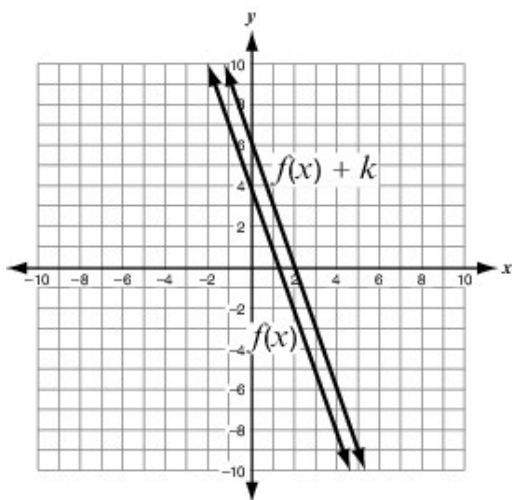
Part D. List two functions, $k(x)$ and $p(x)$, that will transform the function $f(x) = 2^x$ so that it passes through the point $(-2, 4)$. Describe how the graphs of $k(x)$ and $p(x)$ compare with the graph of the function $f(x)$.

Use words, numbers, and/or pictures to show your work.

38. Jennifer graphs the function $f(x) = x^2$. Then she graphs the function $f(x - 3)$. How does the graph of $f(x - 3)$ differ from the graph of $f(x)$?
- A. The graph is shifted 3 units up.
 - B. The graph is shifted 3 units down.
 - C. The graph is shifted 3 units left.
 - D. The graph is shifted 3 units right.
39. Which choice is the function that would result from shifting the graph of $f(x) = 6x$ up 2 units?
- A. $g(x) = 4x$
 - B. $g(x) = 6x - 2$
 - C. $g(x) = 6x + 2$
 - D. $g(x) = 8x$
40. The function $f(x) = 3^x$ underwent a translation resulting in the function $g(x) = 3^{(x + 2)}$. Which describes the translation that resulted in $g(x)$?
- A. a shift up 2 units
 - B. a shift down 2 units
 - C. a shift left 2 units
 - D. a shift right 2 units
41. If $f(x) = x^2 + 2$, how will the graph of $f(x - 2)$ compare with the graph of $f(x)$?

42. The graph of $f(x) = 2x + 4$ was translated resulting in the graph of $g(x) = 2x - 5$. Which describes the translation that occurred to $f(x)$?
- A. down 5 units
 - B. up 5 units
 - C. down 9 units
 - D. up 9 units
43. The function $f(x)$ will be translated 4 units down and 3 units to the right. Which function represents $f(x)$ after the translation?
- A. $f(x - 4) - 3$
 - B. $f(x - 4) + 3$
 - C. $f(x - 3) - 4$
 - D. $f(x + 3) - 4$
44. The function $f(x) = 2x + 4$ was replaced with $f(x + k)$ resulting in the function $g(x) = 2x + 22$. What is the value of k ?
- A. -18
 - B. -9
 - C. 9
 - D. 18
45. The function $f(x) = 4x$ was replaced with $f(x + 5)$ resulting in the function $g(x)$. What is the distance between the y -intercept of $f(x)$ and the y -intercept of $g(x)$?
- A. 4 units
 - B. 5 units
 - C. 10 units
 - D. 20 units

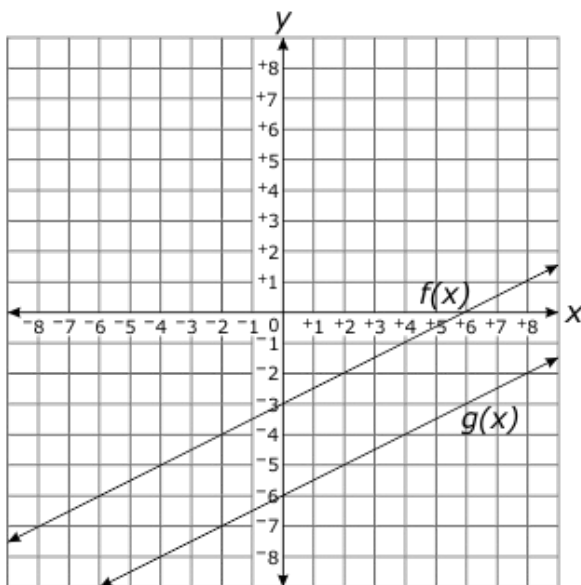
46. The graph of the function $f(x)$ and the transformed graph $f(x)+k$ are shown below.



What is the value of k ?

- A. -3
- B. -2
- C. 2
- D. 6

47. The functions $f(x)$ and $g(x)$ are graphed below.



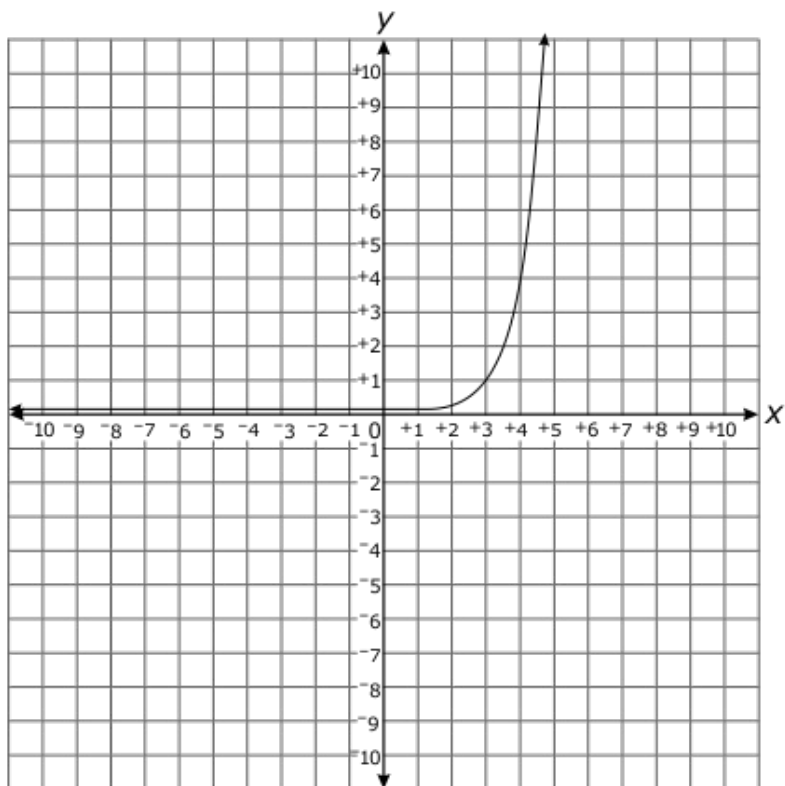
If $g(x) = f(x + k)$, what is the value of k ?

- A. -6
- B. -3
- C. 3
- D. 6

48. The function $f(x) = x - 3$ was replaced with $f(x) + 2$ resulting in the function $g(x)$. What is the y -intercept of $g(x)$?

- A. $(0, -1)$
- B. $(0, -5)$
- C. $(0, 2)$
- D. $(0, 5)$

49. The function $f(x) = 3^{2x}$ was replaced with $f(x + k)$ resulting in the function, $g(x)$, graphed below.



What is the value of k ?

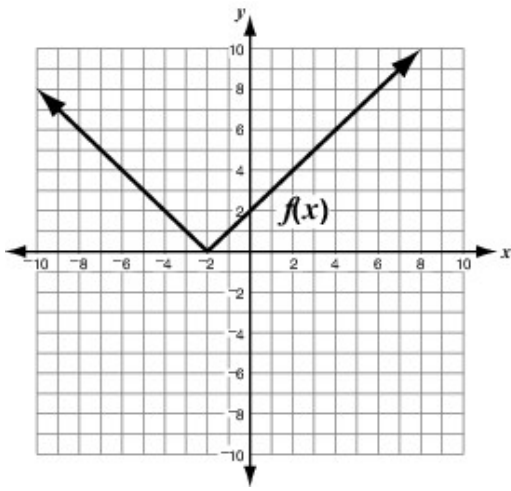
- A. -6
 B. -3
 C. 3
 D. 6
50. The equation $g(x) = f(x + 2)$ is graphed on a coordinate plane. Which equation, $h(x)$, results from moving $g(x)$ to the right 2 units and up 3 units?
- A. $h(x) = f(x)$
 B. $h(x) = f(x) + 2$
 C. $h(x) = f(x) + 3$
 D. $h(x) = f(x + 2) + 3$

51. The function $f(x) = 6^x$ was replaced with $f(x) + k$ resulting in the function shown in the table below.

x	y
0	10
1	15
2	45
3	225

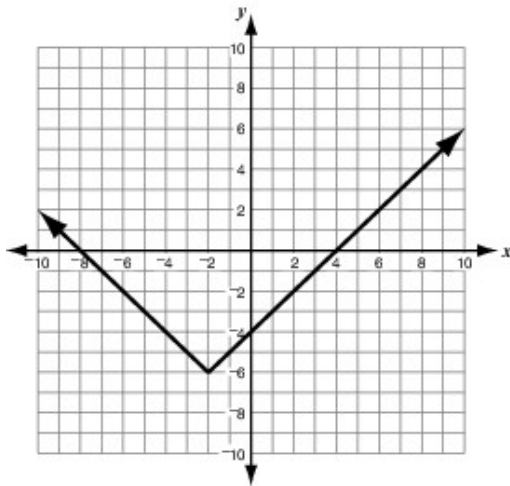
What is the value of k ?

- A. 7
- B. 8
- C. 9
- D. 10
52. The function $f(x) = 2x + 4$ was replaced with $f(x + k) + j$ resulting in the function $g(x) = 2x + 14$. The value of j is 8 less than the value of k . What is the value of k ?
- A. 2
- B. 4
- C. 6
- D. 8
53. Which transformation occurs to the graph of $f(x) = x$ to produce the graph of $g(x) = x + 2$?
- A. down 2 units
- B. up 2 units
- C. left 2 units
- D. right 2 units
54. The graph of the function $f(x)$ is shown below.

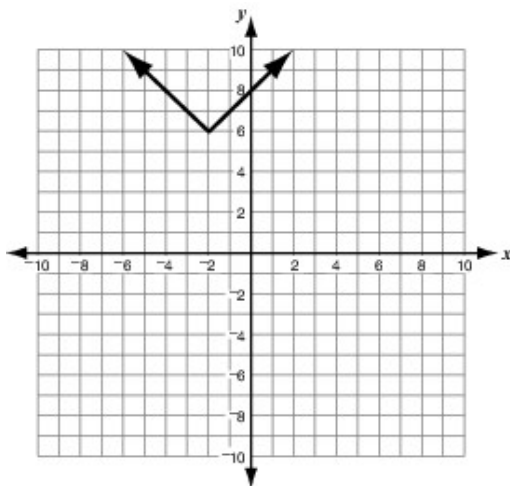


Another function is given as $g(x) = f(x - 6)$. Which of these represents the graph of the function $g(x)$?

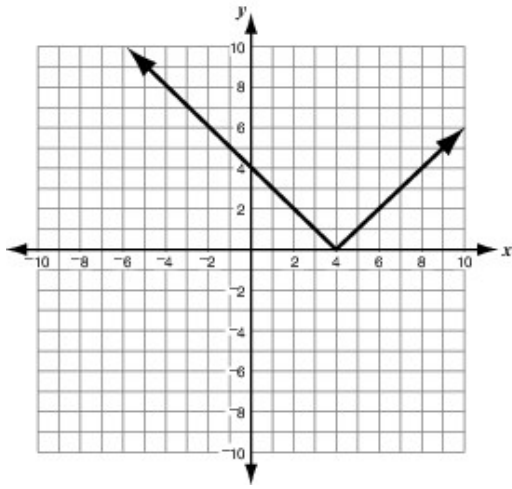
A.



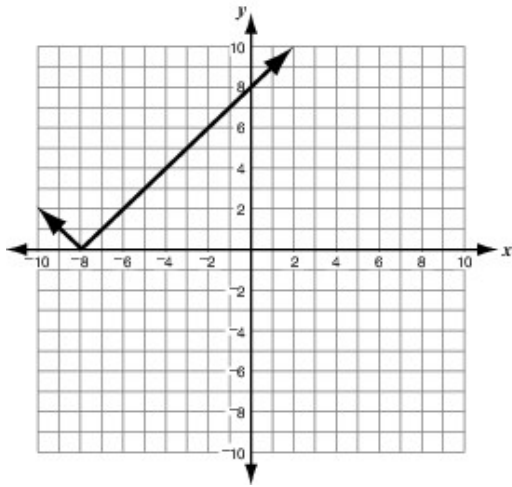
B.



C.



D.



55. Alice saves \$25 per week and her savings can be modeled by the equation $y = 25x$, where x is the number of weeks she has saved. Jason's savings can be modeled by the equation $y = 25x + 15$, where x is the number of weeks he has saved. If Alice's equation and Jason's equation were both graphed, which statement would best describe the relationship between the graphs?

- A. Jason's graph is shifted 15 units to the left of Alice's graph.
- B. Jason's graph is shifted 15 units to the right of Alice's graph.
- C. Jason's graph is shifted 15 units down from Alice's graph.
- D. Jason's graph is shifted 15 units up from Alice's graph.