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Let the Transformations Begin!

Translations of Linear and Exponential Functions

Vocabulary

Match each definition to its corresponding term.

- | | |
|---|---------------------------------|
| 1. the mapping, or movement, of all the points of a figure in a plane according to a common operation | A basic function |
| 2. a type of transformation that shifts the entire graph left or right | B transformation |
| 3. a function that can be described as the simplest function of its type | C vertical translation |
| 4. a type of transformation that shifts the entire graph up or down | D coordinate notation |
| 5. the variable on which a function operates | E argument of a function |
| 6. notation that uses ordered pairs to describe a transformation on a coordinate plane | F horizontal translation |

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Problem Set

Rewrite each function $g(x)$ in terms of the basic function $f(x)$.

- | | |
|--|-------------------------------------|
| 1. $f(x) = x$
$g(x) = x + 4$
$g(x) = f(x) + 4$ | 2. $f(x) = x$
$g(x) = x - 7$ |
| 3. $f(x) = x$
$g(x) = x - 8$ | 4. $f(x) = 3^x$
$g(x) = 3^x + 1$ |
| 5. $f(x) = 3^x$
$g(x) = 3^x + 2$ | 6. $f(x) = 4^x$
$g(x) = 4^x - 6$ |

Represent each vertical translation, $g(x)$, using coordinate notation.

7. $f(x) = x$
 $g(x) = x + 8$
 $(x, y) \rightarrow (x, y + 8)$

8. $f(x) = x$
 $g(x) = x + 9$

9. $f(x) = x$
 $g(x) = x - 4$

10. $f(x) = 4^x$
 $g(x) = 4^x - 1$

11. $f(x) = 4^x$
 $g(x) = 4^x + 6$

12. $f(x) = 3^x$
 $g(x) = 3^x - 5$

Rewrite each function $g(x)$ in terms of the basic function $f(x)$.

13. $f(x) = 3^x$
 $g(x) = 3^{(x+1)}$
 $g(x) = 3^{(x+1)} = f(x + 1)$

14. $f(x) = 3^x$
 $g(x) = 3^{(x+5)}$

15. $f(x) = 2^x$
 $g(x) = 2^{(x-1)}$

16. $f(x) = 2^x$
 $g(x) = 2^{(x-9)}$

17. $f(x) = 2x$
 $g(x) = 2(x - 3)$

18. $f(x) = 2x$
 $g(x) = 2(x + 4)$

Represent each horizontal translation, $g(x)$, using coordinate notation.

19. $f(x) = 3^x$
 $g(x) = 3^{(x-2)}$
 $(x, y) \rightarrow (x + 2, y)$

20. $f(x) = 3^x$
 $g(x) = 3^{(x+2)}$

21. $f(x) = 4^x$
 $g(x) = 4^{(x+1)}$

22. $f(x) = 4^x$
 $g(x) = 4^{(x-3)}$

23. $f(x) = 3x$
 $g(x) = 3(x - 1)$

24. $f(x) = 3x$
 $g(x) = 3(x + 1)$



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Describe each graph in relation to its basic function.

25. Compare $f(x) = (x) + b$ when $b < 0$ to the basic function $h(x) = x$.
The graph of $f(x)$ is b units below the graph of $h(x)$.

26. Compare $f(x) = b^{x-c}$ when $c > 0$ to the basic function $h(x) = b^x$.

27. Compare $f(x) = (x - b)$ when $b > 0$ to the basic function $h(x) = x$.

28. Compare $f(x) = b^{x-c}$ when $c < 0$ to the basic function $h(x) = b^x$.

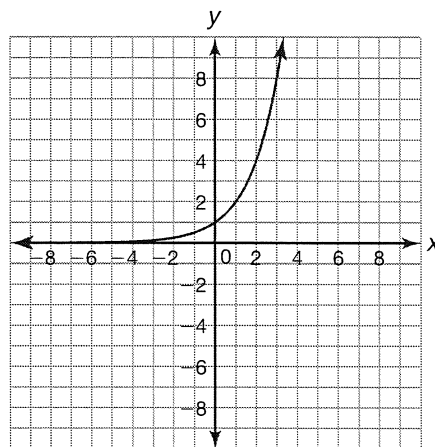
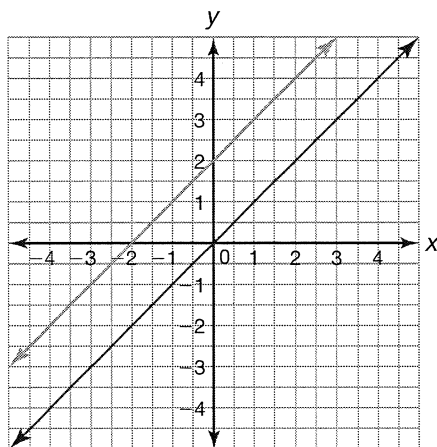
29. Compare $f(x) = b^x + k$ when $k > 0$ to the basic function $h(x) = b^x$.

30. Compare $f(x) = (x - b)$ when $b < 0$ to the basic function $h(x) = x$.

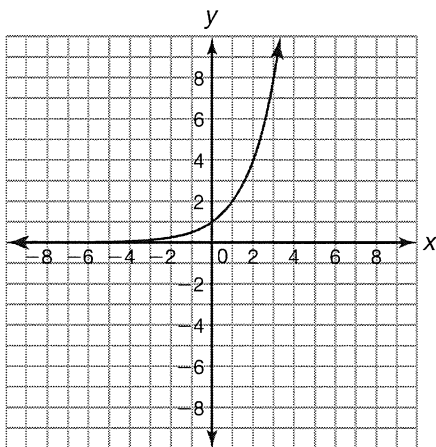
Each coordinate plane shows the graph of $f(x)$. Sketch the graph of $g(x)$.

31. $g(x) = f(x) + 2$

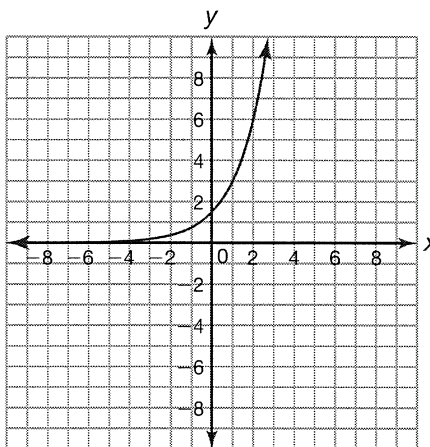
32. $g(x) = f(x) + 4$



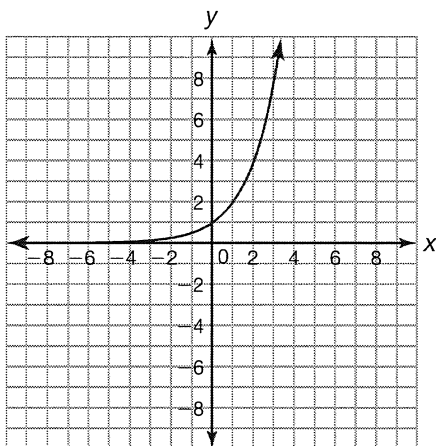
33. $g(x) = f(x) - 2$



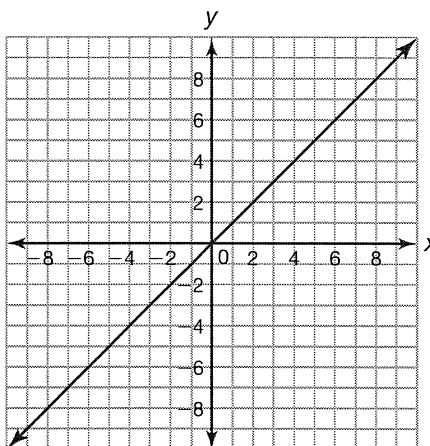
34. $g(x) = f(x - 3)$



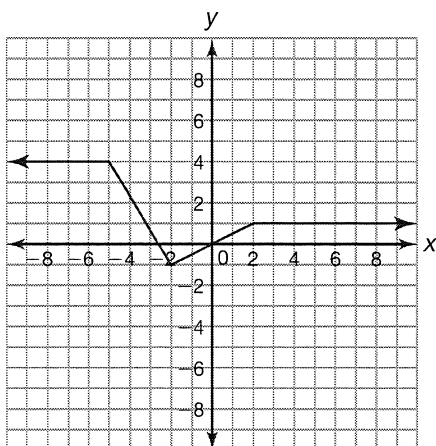
35. $g(x) = f(x + 3)$



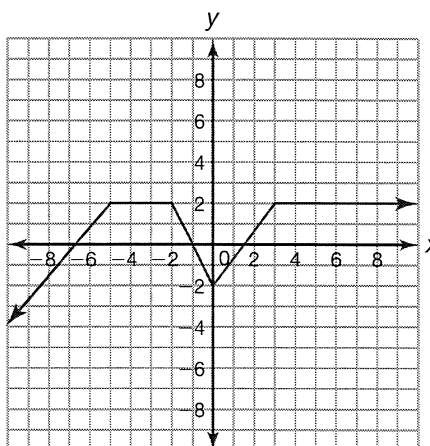
36. $g(x) = f(x - 4)$



37. $g(x) = f(x) + 5$



38. $g(x) = f(x + 5)$



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Write the equation of the function given each translation.

39. $f(x) = x$

Vertical translation up 2 units

$g(x) = x + 2$

40. $f(x) = x$

Vertical translation down 5 units

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

Horizontal translation right 4 units

42. $f(x) = 2^x$

Horizontal translation left 6 units

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

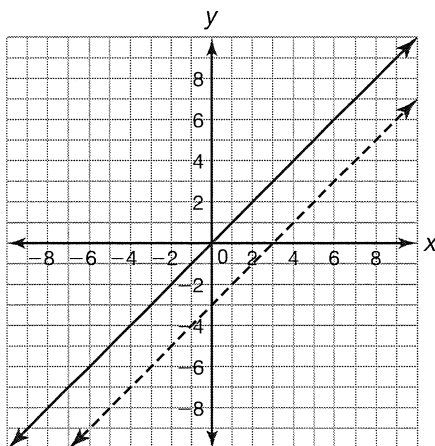
Vertical translation down 5 units

44. $f(x) = 4x$

Horizontal translation right 3 units

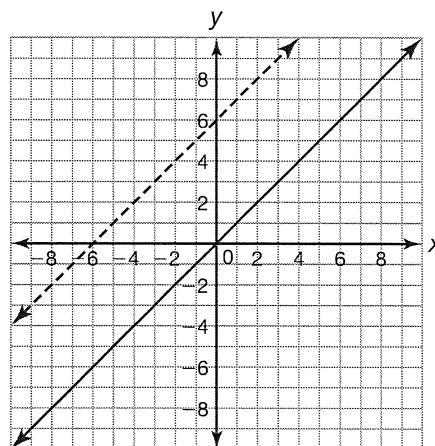
Each graph shows the function $g(x)$ as a translation of the function $f(x)$. Write the equation of $g(x)$.

45.

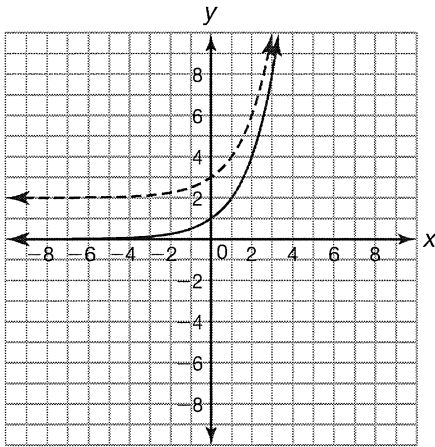


$g(x) = x - 3$

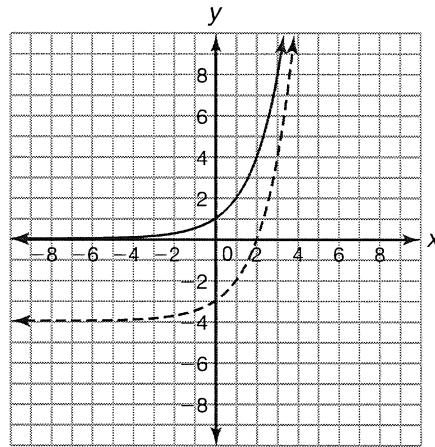
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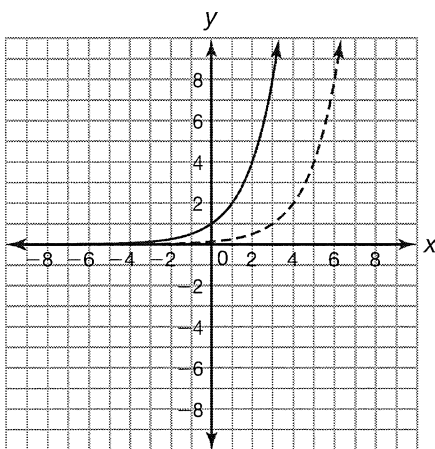
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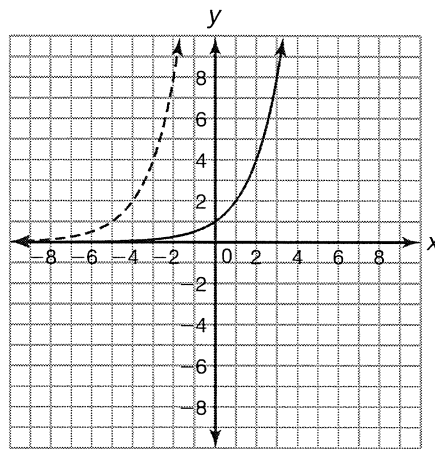
48.



49.



50.



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