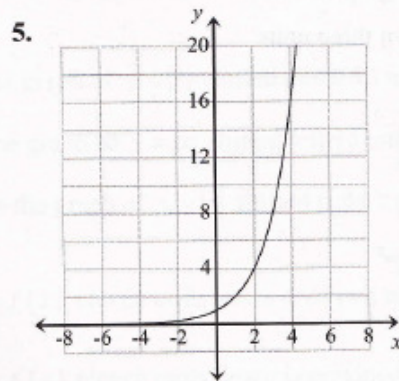
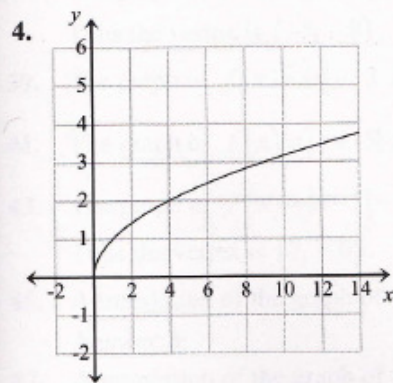
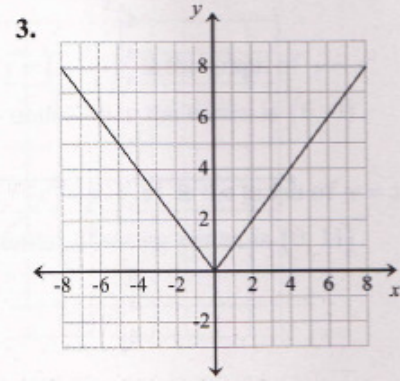
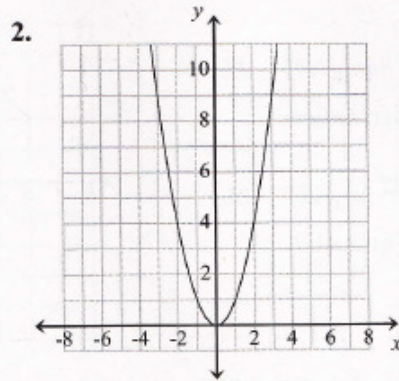
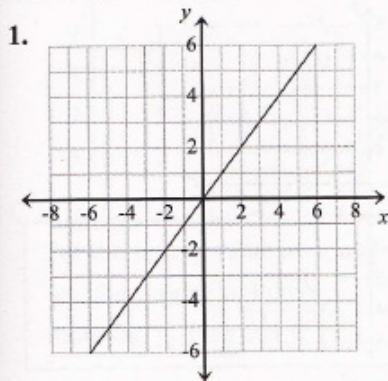


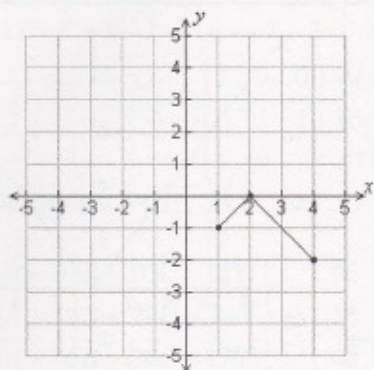
Quick Review 12.3



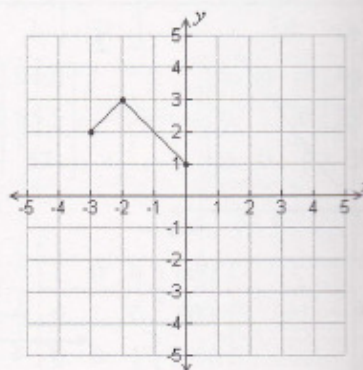
Exercises 12.3

1. The graph of $f(x) = |x| + 3$ is the graph of $y = |x|$ shifted up 3 units. Thus the answer is **C**.
3. The graph of $f(x) = |x| - 3$ is the graph of $y = |x|$ shifted down 3 units. Thus the answer is **D**.
5. The graph of $f(x) = x^2 - 5$ is the graph of $y = x^2$ shifted down 5 units. Thus the answer is **D**.
7. The graph of $f(x) = (x + 5)^2$ is the graph of $y = x^2$ shifted left 5 units. Thus the answer is **B**.
9. The graph of $f(x) = \sqrt{x - 4}$ is the graph of $y = \sqrt{x}$ shifted right 4 units. Thus the answer is **C**.
11. The graph of $f(x) = \sqrt{x} + 4$ is the graph of $y = \sqrt{x}$ shifted up 4 units. Thus the answer is **D**.
13. The graph of $f(x) = |x - 1| + 2$ is the graph of $y = |x|$ shifted right 1 unit and up 2 units. Thus the answer is **B**.
15. The graph of $f(x) = |x + 1| + 2$ is the graph of $y = |x|$ shifted left 1 unit and up 2 units. Thus the answer is **D**.

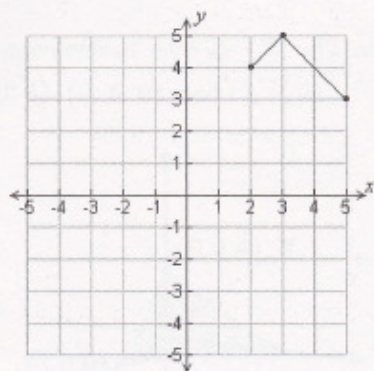
17. The graph of $y = f(x) - 3$ is the graph of $y = f(x)$ shifted down three units.



19. The graph of $y = f(x+4)$ is the graph of $y = f(x)$ shifted left four units.



21. The graph of $y = f(x-1) + 2$ is the graph of $y = f(x)$ shifted right one unit down three units.



23. The graph shown is the graph of $y = \frac{x}{2}$ shifted up 3 units. Thus the equation is $y = \frac{x}{2} + 3$. y -intercept: 3

25.

x	$y = f(x) + 10$
-3	$0 + 10 = 10$
-2	$8 + 10 = 18$
-1	$6 + 10 = 16$
0	$0 + 10 = 10$
1	$-4 + 10 = 6$
2	$0 + 10 = 10$

27. The elements in the y_2 column are 7 units less than the elements in the $y_1 = f(x)$ column. Thus the equation for y_2 is $y_2 = f(x) - 7$.

Section 12.3: Horizontal and Vertical Translations of the Graphs of Functions

29.

x	$y_1 = f(x)$
0	-3
1	-1
2	1
3	3
4	5
5	7

x	$y_2 = f(x-4)$
4	-3
5	-1
6	1
7	3
8	5
9	7

For the same y value in y_1 and y_2 , the x -value is 4 units more for y_2 than for y_1 .

31. For the same y value in y_1 and y_2 , the x -value is 3 units more for y_2 than for y_1 .

Thus the equation for y_2 is $y_2 = f(x-3)$.

33. The graph of $y = (x-6)^2$ is the graph of $y = x^2$ shifted right 6 units. Thus the vertex is $(6, 0)$.

35. The graph of $f(x) = x^2 + 11$ is the graph of $y = x^2$ shifted up 11 units. Thus the vertex is $(0, 11)$.

37. The graph of $f(x) = (x+5)^2 - 8$ is the graph of $y = x^2$ shifted left 5 units and down 8 units. Thus the vertex is $(-5, -8)$.

39. The graph of $f(x) = |x| - 13$ is the graph of $y = |x|$ shifted down 13 units. Thus the vertex is $(0, -13)$.

41. The graph of $f(x) = |x+15|$ is the graph of $y = |x|$ shifted left 15 units. Thus the vertex is $(-15, 0)$.

43. The graph of $f(x) = |x-7| - 6$ is the graph of $y = |x|$ shifted right 7 units and down 6 units. Thus the vertex is $(7, -6)$.

45. A translation of the graph of $y = f(x)$ eleven units left is obtained in the graph of $y = f(x+11)$. Answer: E.

47. A translation of the graph of $y = f(x)$ eleven units down is obtained in the graph of $y = f(x) - 11$. Answer: D.

49. A translation of the graph of $y = f(x)$ eleven units up and eleven units right is obtained in the graph of $y = f(x-11) + 11$. Answer: A.

51. Domain: $[0+3, 5+3] = [3, 8]$; Range: $[2, 4]$

53. Domain: $[0, 5]$; Range: $[2-7, 4-7] = [-5, -3]$

55. Domain: $[0-4, 5-4] = [-4, 1]$; Range: $[2+5, 4+5] = [7, 9]$

57. The graph of $f(x) = x - 6$ is the graph of the linear equation $y = x$ shifted down 6 units. Answer: D.

59. The graph of $f(x) = |x+5|$ is the graph of the absolute value equation $y = |x|$ shifted left 5 units. Answer: A.

61. The graph of $f(x) = \sqrt{x} + 3$ is the graph of the square root equation $y = \sqrt{x}$ shifted up 3 units. Answer: E.

63. The graph of $f(x) = \sqrt[3]{x} - 5$ is the graph of the cube root equation $y = \sqrt[3]{x}$ shifted down 5 units. Answer: H.

65. a.

n	$a_n = 2n$
1	$a_1 = 2(1) = 2$
2	$a_2 = 2(2) = 4$
3	$a_3 = 2(3) = 6$
4	$a_4 = 2(4) = 8$
5	$a_5 = 2(5) = 10$

b.

n	$a_n = 2n + 3$
1	$a_1 = 2(1) + 3 = 5$
2	$a_2 = 2(2) + 3 = 7$
3	$a_3 = 2(3) + 3 = 9$
4	$a_4 = 2(4) + 3 = 11$
5	$a_5 = 2(5) + 3 = 13$

c.

n	$a_n = 2(n+3)$
1	$a_1 = 2(1+3) = 2(4) = 8$
2	$a_2 = 2(2+3) = 2(5) = 10$
3	$a_3 = 2(3+3) = 2(6) = 12$
4	$a_4 = 2(4+3) = 2(7) = 14$
5	$a_5 = 2(5+3) = 2(8) = 16$

d.

n	$a_n = -2n$
1	$a_1 = -2(1) = -2$
2	$a_2 = -2(2) = -4$
3	$a_3 = -2(3) = -6$
4	$a_4 = -2(4) = -8$
5	$a_5 = -2(5) = -10$

67.

t Celsius	V $V(t) = 4t$
200	800
150	600
100	400
50	200
0	0

t Kelvin	V $V = 4(t - 273)$
473	800
423	600
373	400
323	200
273	0

For the same V value in the tables, the x -value is 273 units more for the second table than the first table.

69.

x item #	$P(x) + 1$ price
1	$24.95 + 1 = 25.95$
2	$33.79 + 1 = 34.79$
3	$12.98 + 1 = 13.98$
4	$26.78 + 1 = 27.78$
5	$19.95 + 1 = 20.95$

Cumulative Review

$$\begin{aligned}
 1. \quad \frac{x}{x-2} + \frac{1}{x} &= \frac{x}{x-2} \cdot \frac{x}{x} + \frac{1}{x} \cdot \frac{x-2}{x-2} \\
 &= \frac{x^2}{x(x-2)} + \frac{x-2}{x(x-2)} \\
 &= \frac{x^2 + x - 2}{x(x-2)} = \frac{x^2 + x - 2}{x(x-2)} \\
 &= \frac{(x+2)(x-1)}{x(x-2)}
 \end{aligned}$$

$$2. \quad \frac{x}{x-2} \cdot \frac{1}{x} = \frac{\cancel{x}}{x-2} \cdot \frac{1}{\cancel{x}} = \frac{1}{x-2}$$

$$3. \quad \frac{x}{x-2} \div \frac{1}{x} = \frac{x}{x-2} \cdot \frac{x}{1} = \frac{x^2}{x-2}$$

$$\begin{aligned}
 4. \quad (x-y)^2 - x^2 - y^2 &= x^2 - 2xy + y^2 - x^2 - y^2 \\
 &= x^2 - x^2 - 2xy + y^2 - y^2 \\
 &= -2xy
 \end{aligned}$$

$$\begin{aligned}
 5. \quad 5(2x-3y) - 4(x-2y) + 3x - y &= 10x - 15y - 4x + 8y + 3x - y \\
 &= 10x + 3x - 4x - 15y + 8y - y \\
 &= 9x - 8y
 \end{aligned}$$

