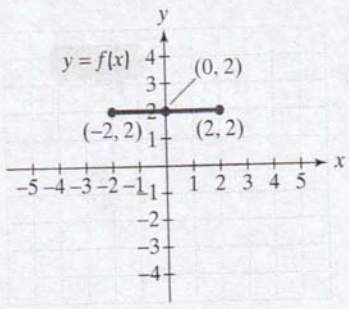
Exercise Set 2.5

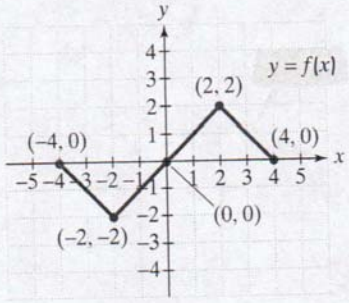
Practice Exercises

In Exercises 1–16, use the graph of $y = f(x)$ to graph each function g.



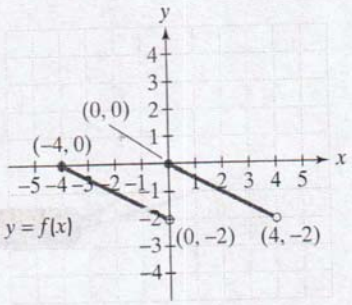
1. $g(x) = f(x) + 1$
2. $g(x) = f(x) - 1$
3. $g(x) = f(x + 1)$
4. $g(x) = f(x - 1)$
5. $g(x) = f(x - 1) - 2$
6. $g(x) = f(x + 1) + 2$
7. $g(x) = f(-x)$
8. $g(x) = -f(x)$
9. $g(x) = -f(x) + 3$
10. $g(x) = f(-x) + 3$
11. $g(x) = \frac{1}{2}f(x)$
12. $g(x) = 2f(x)$
13. $g(x) = f\left(\frac{1}{2}x\right)$
14. $g(x) = f(2x)$
15. $g(x) = -f\left(\frac{1}{2}x\right) + 1$
16. $g(x) = -f(2x) - 1$

In Exercises 17–32, use the graph of $y = f(x)$ to graph each function g.



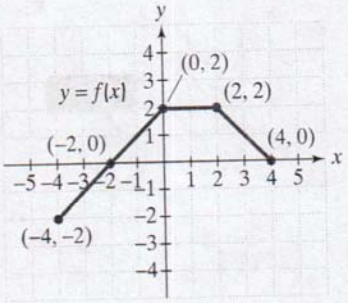
17. $g(x) = f(x) - 1$
18. $g(x) = f(x) + 1$
19. $g(x) = f(x - 1)$
20. $g(x) = f(x + 1)$
21. $g(x) = f(x - 1) + 2$
22. $g(x) = f(x + 1) - 2$
23. $g(x) = -f(x)$
24. $g(x) = f(-x)$
25. $g(x) = f(-x) + 1$
26. $g(x) = -f(x) + 1$
27. $g(x) = 2f(x)$
28. $g(x) = \frac{1}{2}f(x)$
29. $g(x) = f(2x)$
30. $g(x) = f\left(\frac{1}{2}x\right)$
31. $g(x) = 2f(x + 2) + 1$
32. $g(x) = 2f(x + 2) - 1$

In Exercises 33–44, use the graph of $y = f(x)$ to graph each function g.



33. $g(x) = f(x) + 2$
34. $g(x) = f(x) - 2$
35. $g(x) = f(x + 2)$
36. $g(x) = f(x - 2)$
37. $g(x) = -f(x + 2)$
38. $g(x) = -f(x - 2)$
39. $g(x) = -\frac{1}{2}f(x + 2)$
40. $g(x) = -\frac{1}{2}f(x - 2)$
41. $g(x) = -\frac{1}{2}f(x + 2) - 2$
42. $g(x) = -\frac{1}{2}f(x - 2) + 2$
43. $g(x) = \frac{1}{2}f(2x)$
44. $g(x) = 2f\left(\frac{1}{2}x\right)$

In Exercises 45–52, use the graph of $y = f(x)$ to graph each function g.



45. $g(x) = f(x - 1) - 1$
46. $g(x) = f(x + 1) + 1$
47. $g(x) = -f(x - 1) + 1$
48. $g(x) = -f(x + 1) - 1$
49. $g(x) = 2f\left(\frac{1}{2}x\right)$
50. $g(x) = \frac{1}{2}f(2x)$
51. $g(x) = \frac{1}{2}f(x + 1)$
52. $g(x) = 2f(x - 1)$

In Exercises 53–66, begin by graphing the standard quadratic function, $f(x) = x^2$. Then use transformations of this graph to graph the given function.

53. $g(x) = x^2 - 2$
54. $g(x) = x^2 - 1$
55. $g(x) = (x - 2)^2$
56. $g(x) = (x - 1)^2$
57. $h(x) = -(x - 2)^2$
58. $h(x) = -(x - 1)^2$
59. $h(x) = (x - 2)^2 + 1$
60. $h(x) = (x - 1)^2 + 2$
61. $g(x) = 2(x - 2)^2$
62. $g(x) = \frac{1}{2}(x - 1)^2$
63. $h(x) = 2(x - 2)^2 - 1$
64. $h(x) = \frac{1}{2}(x - 1)^2 - 1$
65. $h(x) = -2(x + 1)^2 + 1$
66. $h(x) = -2(x + 2)^2 + 1$

In Exercises 67–80, begin by graphing the square root function, $f(x) = \sqrt{x}$. Then use transformations of this graph to graph the given function.

67. $g(x) = \sqrt{x} + 2$

68. $g(x) = \sqrt{x} + 1$

69. $g(x) = \sqrt{x + 2}$

70. $g(x) = \sqrt{x + 1}$

71. $h(x) = -\sqrt{x + 2}$

72. $h(x) = -\sqrt{x + 1}$

73. $h(x) = \sqrt{-x + 2}$

74. $h(x) = \sqrt{-x + 1}$

75. $g(x) = \frac{1}{2}\sqrt{x + 2}$

76. $g(x) = 2\sqrt{x + 1}$

77. $h(x) = \sqrt{x + 2} - 2$

78. $h(x) = \sqrt{x + 1} - 1$

79. $g(x) = 2\sqrt{x + 2} - 2$

80. $g(x) = 2\sqrt{x + 1} - 1$

In Exercises 81–94, begin by graphing the absolute value function, $f(x) = |x|$. Then use transformations of this graph to graph the given function.

81. $g(x) = |x| + 4$

82. $g(x) = |x| + 3$

83. $g(x) = |x + 4|$

84. $g(x) = |x + 3|$

85. $h(x) = |x + 4| - 2$

86. $h(x) = |x + 3| - 2$

87. $h(x) = -|x + 4|$

88. $h(x) = -|x + 3|$

89. $g(x) = -|x + 4| + 1$

90. $g(x) = -|x + 4| + 2$

91. $h(x) = 2|x + 4|$

92. $h(x) = 2|x + 3|$

93. $g(x) = -2|x + 4| + 1$

94. $g(x) = -2|x + 3| + 2$

In Exercises 95–106, begin by graphing the standard cubic function, $f(x) = x^3$. Then use transformations of this graph to graph the given function.

95. $g(x) = x^3 - 3$

96. $g(x) = x^3 - 2$

97. $g(x) = (x - 3)^3$

98. $g(x) = (x - 2)^3$

99. $h(x) = -x^3$

100. $h(x) = -(x - 2)^3$

101. $h(x) = \frac{1}{2}x^3$

102. $h(x) = \frac{1}{4}x^3$

103. $r(x) = (x - 3)^3 + 2$

104. $r(x) = (x - 2)^3 + 1$

105. $h(x) = \frac{1}{2}(x - 3)^3 - 2$

106. $h(x) = \frac{1}{2}(x - 2)^3 - 1$

In Exercises 107–118, begin by graphing the cube root function, $f(x) = \sqrt[3]{x}$. Then use transformations of this graph to graph the given function.

107. $g(x) = \sqrt[3]{x} + 2$

108. $g(x) = \sqrt[3]{x} - 2$

109. $g(x) = \sqrt[3]{x + 2}$

110. $g(x) = \sqrt[3]{x - 2}$

111. $h(x) = \frac{1}{2}\sqrt[3]{x + 2}$

112. $h(x) = \frac{1}{2}\sqrt[3]{x - 2}$

113. $r(x) = \frac{1}{2}\sqrt[3]{x + 2} - 2$

114. $r(x) = \frac{1}{2}\sqrt[3]{x - 2} + 2$

115. $h(x) = -\sqrt[3]{x + 2}$

116. $h(x) = -\sqrt[3]{x - 2}$

117. $g(x) = \sqrt[3]{-x - 2}$

118. $g(x) = \sqrt[3]{-x + 2}$

Practice Plus

In Exercises 119–122, use transformations of the graph of the greatest integer function, $f(x) = \text{int}(x)$, to graph each function. (The graph of $f(x) = \text{int}(x)$ is shown in ***Figure 2.22*** *on page 222.)*

119. $g(x) = 2\,\text{int}\,(x + 1)$

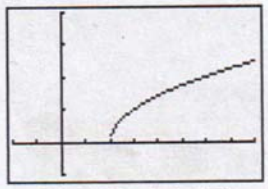
120. $g(x) = 3\,\text{int}\,(x - 1)$

121. $h(x) = \text{int}\,(-x) + 1$

122. $h(x) = \text{int}\,(-x) - 1$

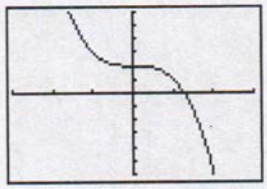
In Exercises 123–126, write a possible equation for the function whose graph is shown. Each graph shows a transformation of a common function.

123.



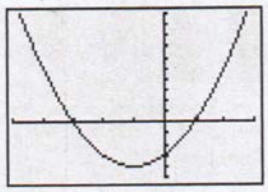
[−2, 8, 1] by [−1, 4, 1]

124.



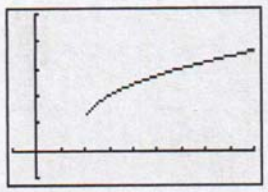
[−3, 3, 1] by [−6, 6, 1]

125.



[−5, 3, 1] by [−5, 10, 1]

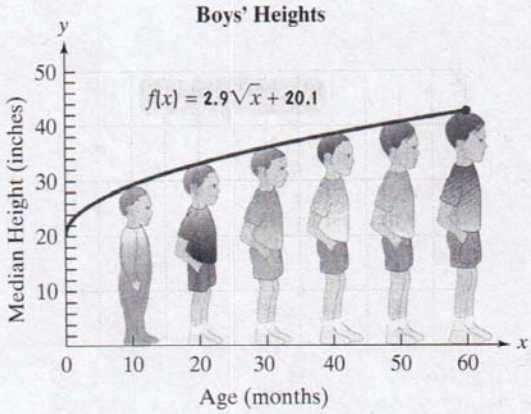
126.



[−1, 9, 1] by [−1, 5, 1]

Application Exercises

127. The function $f(x) = 2.9\sqrt{x} + 20.1$ models the median height, $f(x)$, in inches, of boys who are x months of age. The graph of f is shown.



Source: Laura Walther Nathanson, *The Portable Pediatrician for Parents*

a. Describe how the graph can be obtained using transformations of the square root function $f(x) = \sqrt{x}$.

b. According to the model, what is the median height of boys who are 48 months, or four years, old? Use a calculator and round to the nearest tenth of an inch. The actual median height for boys at 48 months is 40.8 inches. How well does the model describe the actual height?

(This exercise continues on the next page.)