

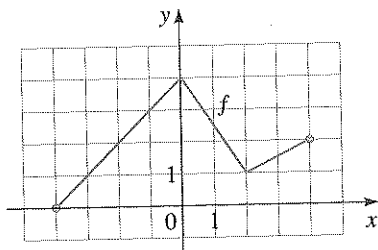
4.5 EXERCISES

1–8 ■ Suppose the graph of f is given. Describe how the graph of each function can be obtained from the graph of f .

- (a) $y = f(x) - 4$ (b) $y = f(x - 4)$
- (a) $y = f(x + 5)$ (b) $y = f(x) + 5$
- (a) $y = 3f(x)$ (b) $y = \frac{1}{3}f(x)$
- (a) $y = -f(x)$ (b) $y = f(-x)$
- (a) $y = -f(x) + 5$ (b) $y = f(-x) + 5$
- (a) $y = -4f(x)$ (b) $y = -\frac{1}{4}f(x)$
- (a) $y = f(x - 2) - 3$ (b) $y = 2f(x - 3)$
- (a) $y = \frac{1}{2}f(x) + 10$ (b) $y = \frac{1}{2}f(x + 10)$

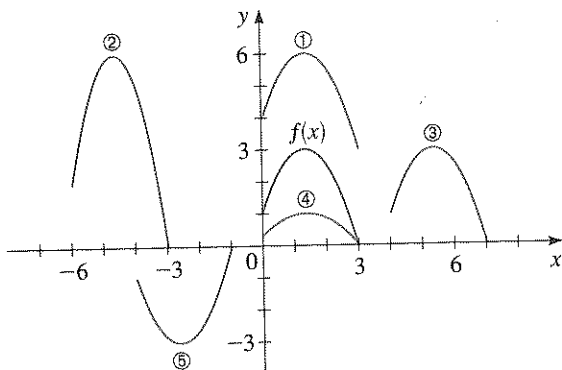
9. The graph of f is given. Sketch the graphs of the following functions.

- $y = f(x - 2)$ (b) $y = f(x) - 2$
- $y = 2f(x)$ (d) $y = -f(x) + 3$
- $y = f(-x)$ (f) $y = \frac{1}{2}f(x - 1)$



10. The graph of $y = f(x)$ is given. Match each equation with its graph.

- $y = f(x - 4)$ (b) $y = f(x) + 3$
- $y = \frac{1}{3}f(x)$ (d) $y = -f(x + 4)$
- $y = 2f(x + 6)$



11. (a) Sketch the graph of $f(x) = \frac{1}{x}$ by plotting points.

(b) Use the graph of f to sketch the graphs of the following functions.

(i) $y = -\frac{1}{x}$ (ii) $y = \frac{1}{x-1}$

(iii) $y = \frac{2}{x+2}$ (iv) $y = 1 + \frac{1}{x-3}$

12. (a) Sketch the graph of $g(x) = \sqrt[3]{x}$ by plotting points.

(b) Use the graph of g to sketch the graphs of the following functions.

(i) $y = \sqrt[3]{x-2}$ (ii) $y = \sqrt[3]{x+2} + 2$

(iii) $y = 1 - \sqrt[3]{x}$

13–16 ■ Explain how the graph of g is obtained from the graph of f .

13. (a) $f(x) = x^2$, $g(x) = (x + 2)^2$

(b) $f(x) = x^2$, $g(x) = x^2 + 2$

14. (a) $f(x) = x^3$, $g(x) = (x - 4)^3$

(b) $f(x) = x^3$, $g(x) = x^3 - 4$

15. (a) $f(x) = \sqrt{x}$, $g(x) = 2\sqrt{x}$

(b) $f(x) = \sqrt{x}$, $g(x) = \frac{1}{2}\sqrt{x-2}$

16. (a) $f(x) = |x|$, $g(x) = 3|x| + 1$

(b) $f(x) = |x|$, $g(x) = -|x + 1|$

17–32 ■ Sketch the graph of the function, not by plotting points, but by starting with the graph of a standard function and applying transformations.

17. $f(x) = (x - 2)^2$

18. $f(x) = (x + 7)^2$

19. $f(x) = -(x + 1)^2$

20. $f(x) = 1 - x^2$

21. $f(x) = x^3 + 2$

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

23. $y = 1 + \sqrt{x}$

24. $y = 2 - \sqrt{x+1}$

25. $y = \frac{1}{2}\sqrt{x+4} - 3$

26. $y = 3 - 2(x - 1)^2$

27. $y = 5 + (x + 3)^2$

28. $y = \frac{1}{3}x^3 - 1$

29. $y = |x| - 1$

30. $y = |x - 1|$

31. $y = |x + 2| + 2$

32. $y = 2 - |x|$