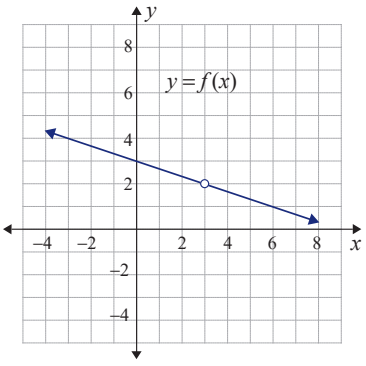
2.4 EXERCISES

PRACTICE

In Exercises 1–8, use the graph of $y = f(x)$ to answer the questions regarding the function.

1.



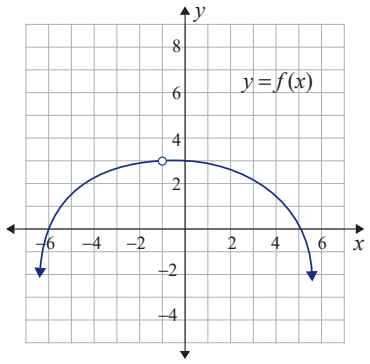
a. Find $\lim_{x \to 3^-} f(x)$.

b. Find $\lim_{x \to 3^+} f(x)$.

c. Find $f(3)$.

d. Is $f(x)$ continuous at $x = 3$? Explain.

2.



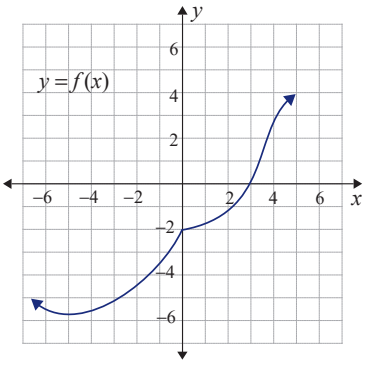
a. Find $\lim_{x \to -1^-} f(x)$.

b. Find $\lim_{x \to -1^+} f(x)$.

c. Find $f(-1)$.

d. Is $f(x)$ continuous at $x = -1$? Explain.

3.



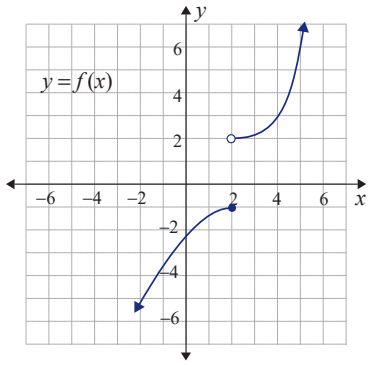
a. Find $\lim_{x \to 0^-} f(x)$.

b. Find $\lim_{x \to 0^+} f(x)$.

c. Find $f(0)$.

d. Is $f(x)$ continuous at $x = 0$? Explain.

4.



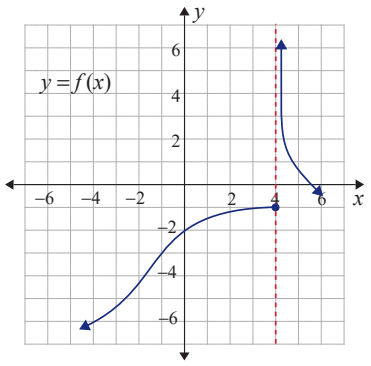
a. Find $\lim_{x \to 2^-} f(x)$.

b. Find $\lim_{x \to 2^+} f(x)$.

c. Find $f(2)$.

d. Is $f(x)$ continuous at $x = 2$? Explain.

5.



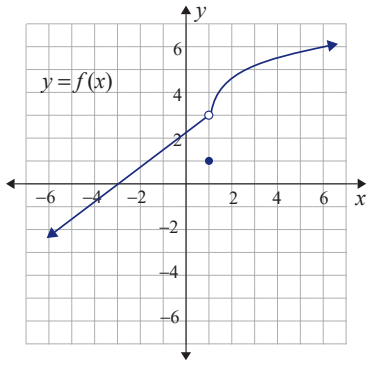
a. Find $\lim_{x \to 4^-} f(x)$.

b. Find $\lim_{x \to 4^+} f(x)$.

c. Find $f(4)$.

d. Is $f(x)$ continuous at $x = 4$? Explain.

6.



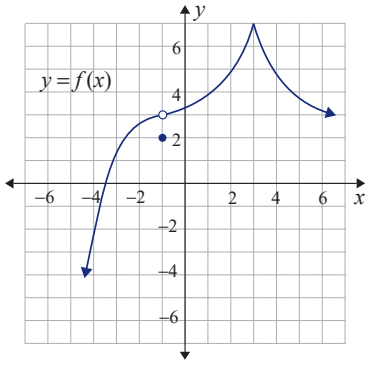
a. Find $\lim_{x \to 1^-} f(x)$.

b. Find $\lim_{x \to 1^+} f(x)$.

c. Find $f(1)$.

d. Is $f(x)$ continuous at $x = 1$? Explain.

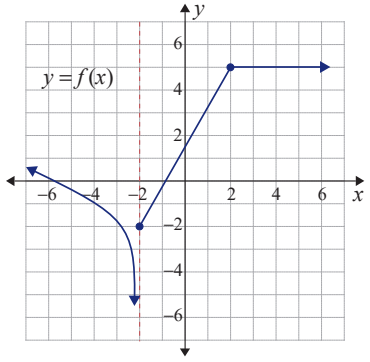
7.



a. Is $f(x)$ continuous at $x = -1$? Explain.

b. Is $f(x)$ continuous at $x = 3$? Explain.

8.

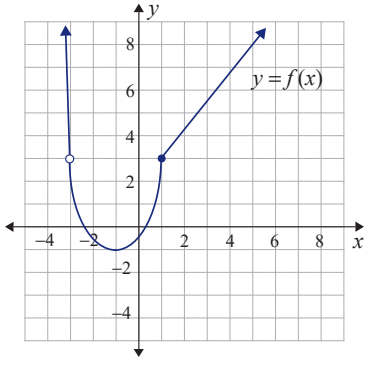


a. Is $f(x)$ continuous at $x = 2$? Explain.

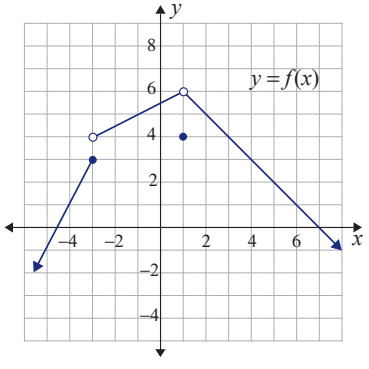
b. Is $f(x)$ continuous at $x = -2$? Explain.

In Exercises 9–12, use the graph of $y = f(x)$ to find the points of discontinuity, if any exist. Determine what type of discontinuity each is.

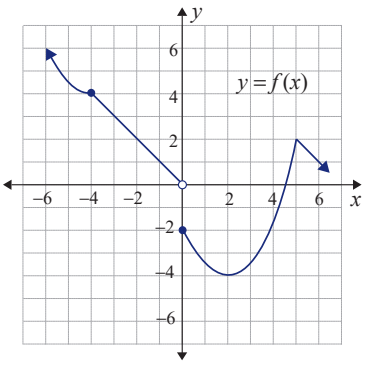
9.



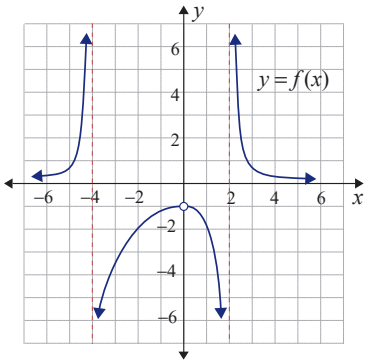
10.



11.



12.



In Exercises 13–20, use the definition of continuity to determine whether or not the function is continuous at the given value of *x*.

13. $f(x) = 3 - 2x;\ x = 1$

14. $f(x) = 5x - x^2;\ x = 0$

15. $f(x) = \dfrac{x^2 - x - 2}{x - 2};\ x = 2$

16. $f(x) = \dfrac{x + 1}{x^2 - 1};\ x = 0$

17. $f(x) = \begin{cases} 2x + 1 & \text{if } x \le 1 \\ 3 & \text{if } x > 1 \end{cases};\ x = 1$

18. $f(x) = \begin{cases} x^2 & \text{if } x \le 2 \\ 2x & \text{if } x > 2 \end{cases};\ x = 2$

19. $f(x) = \begin{cases} 1 - 3x & \text{if } x < 0 \\ 4x & \text{if } x \ge 0 \end{cases};\ x = 0$

20. $f(x) = \begin{cases} \dfrac{x}{x - 3} & \text{if } x \ne 3 \\ 2 & \text{if } x = 3 \end{cases};\ x = 3$

In Exercises 21–28, find the points of discontinuity for each function, if any exist. Determine what type of discontinuity each is.

21. $f(x) = 2x^2 + 3x - 1$

22. $f(x) = 3x^2 - x + 7$

23. $f(x) = \dfrac{5}{x + 3}$

24. $f(x) = \dfrac{x + 8}{x}$

25. $f(x) = \dfrac{x}{x^2 - 9}$

26. $f(x) = \dfrac{2}{x^2 - 4x}$

27. $f(x) = \begin{cases} 2 + 3x & \text{if } x \le 1 \\ x^2 + 4 & \text{if } x > 1 \end{cases}$

28. $f(x) = \begin{cases} x^2 + 1 & \text{if } x \le 2 \\ 2x - 1 & \text{if } x > 2 \end{cases}$

In Exercises 29–32, find a value for *k* so that the given function will be continuous at the indicated value for *x*.

29. $f(x) = \begin{cases} 3x & \text{if } x \le 2 \\ x^2 + k & \text{if } x > 2 \end{cases};\ x = 2$

30. $f(x) = \begin{cases} 7 & \text{if } x < -3 \\ k - 2x & \text{if } x \ge -3 \end{cases};\ x = -3$

31. $f(x) = \begin{cases} 3x - k & \text{if } x \le 1 \\ \dfrac{x^2 - 3x + 2}{x - 1} & \text{if } x > 1 \end{cases};\ x = 1$

32. $f(x) = \begin{cases} \dfrac{x^2 + 3x}{x} & \text{if } x < 0 \\ 2x^2 - k & \text{if } x \ge 0 \end{cases};\ x = 0$

APPLICATIONS

33. Pricing: A leather craft store has the following pricing policy for a belt buckle:

$$C(x)=\begin{cases}0.79x & \text{if } 0<x<12\\ 0.71x & \text{if } 12\le x<50\\ 0.67x & \text{if } x\ge 50\end{cases},$$

where x is the number of buckles and $C(x)$ is in dollars.

a. Graph the function $C(x)$.

b. Is $C(x)$ a continuous function? Explain your answer.

34. Salary: A salesperson's weekly salary is determined by the function

$$S(x)=\begin{cases}550 & \text{if } 0<x<10,000\\ 0.06x & \text{if } x\ge 10,000\end{cases},$$

where x is the weekly sales.

a. Graph the function $S(x)$.

b. Is $S(x)$ a continuous function? Explain your answer.

35. Cost of a phone call: The cost of an overseas call is given by the function

$$C(x)=\begin{cases}9.00 & \text{if } 0<x\le 3\\ 0.95x+6.15 & \text{if } x>3\end{cases},$$

where $C(x)$ is in dollars and x is in minutes.

a. Graph the function $C(x)$.

b. Is $C(x)$ a continuous function? Explain your answer.

36. Revenue: The revenue from the sale of a particular model of wireless speaker is given by the function

$$R(p)=\begin{cases}84p & \text{if } 0<p\le 20\\ 144p-3p^2 & \text{if } p>20\end{cases},$$

where p is the price in dollars.

a. Graph the function $R(p)$.

b. Is $R(p)$ a continuous function? Explain your answer.