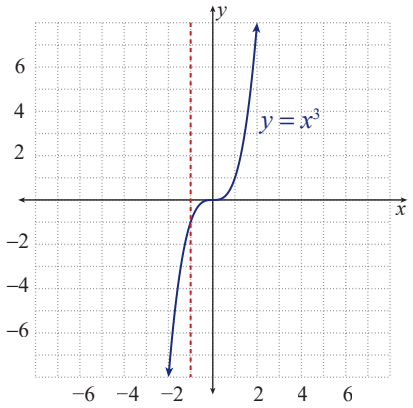
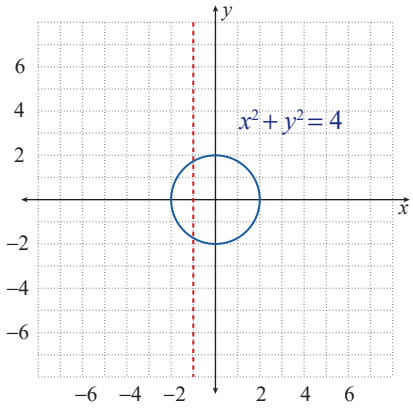
Solution

a.



The equation $y = x^3$ represents a function (which can also be written as $f(x) = x^3$). No vertical line can intersect the graph in more than one point.

b.



The graph of $x^2 + y^2 = 4$ is a circle. The graph shows that the equation does not represent a function. Vertical lines can be drawn that intersect the graph in more than one point.

3.1 EXERCISES

PRACTICE

In Exercises 1–9, evaluate the given function for parts **a.–d.**

1. $f(x) = 2x - 7$
- **a.** $f(5)$
- **b.** $f(-2)$
- **c.** $f(a + 1)$
- **d.** $f(a) + 1$

2. $f(x) = 3x + 5$
- **a.** $f(2)$
- **b.** $f(-1)$
- **c.** $f(a + 1)$
- **d.** $f(a) + 1$

3. $f(x) = x^2 - 2x + 1$
- **a.** $f(-2)$
- **b.** $f(3)$
- **c.** $f(a + 1)$
- **d.** $f(a) + 1$

4. $f(x) = 3x^2 - x + 2$
- **a.** $f(-3)$
- **b.** $f(2)$
- **c.** $f(a + 1)$
- **d.** $f(a) + 1$

5. $f(x) = x^3 + x^2 - 3x + 1$
- **a.** $f(-1)$
- **b.** $f(-3)$
- **c.** $f(a + 1)$
- **d.** $f(a) + 1$

6. $f(x) = 2x^3 - 4x^2 + x - 6$
- **a.** $f(-2)$
- **b.** $f(4)$
- **c.** $f(a + 1)$
- **d.** $f(a) + 1$

7. $f(x) = 4x^2 - 1$
- **a.** $f(3)$
- **b.** $f(a + 2)$
- **c.** $f(x + h)$
- **d.** $f(-2) - f(-1)$

8. $f(x) = 2 - 3x^2$
- **a.** $f(5)$
- **b.** $f(a - 3)$
- **c.** $f(x + h)$
- **d.** $f(3) - f(2)$

9. $f(x) = \sqrt{x+5}$
- **a.** $f(-1)$
- **b.** $f(a + 2)$, where $a \geq -7$
- **c.** $f(x + h)$
- **d.** $f(4) - f(1)$

10. Let $f(x) = \sqrt{x^2+1}$. Find **a.** $f(\sqrt{3})$, and **b.** $f(a+1)$.

11. Let $f(x) = \begin{cases} x-4 & \text{if } x \leq 2 \\ x^2-6 & \text{if } x > 2 \end{cases}$. Find **a.** $f(-1)$, **b.** $f(2)$, **c.** $f(2.5)$, and **d.** $f(3)$.

12. Let $f(x) = \begin{cases} x^2 & \text{if } x < 0 \\ 3x-2 & \text{if } x \geq 0 \end{cases}$. Find **a.** $f(0)$, **b.** $f(-2)$, **c.** $f(1.5)$, and **d.** $f(3)$.

In Exercises 13–27, find $f(x+h) - f(x)$.

13. $f(x) = 3x - 1$ **14.** $f(x) = 5x - 2$ **15.** $f(x) = x^2 + 4$

16. $f(x) = x^2 - 3$ **17.** $f(x) = 2x^2 + 1$ **18.** $f(x) = 5 + 3x^2$

19. $f(x) = x^2 - x$ **20.** $f(x) = x^2 + 2x$ **21.** $f(x) = 3x - x^2$

22. $f(x) = 4x^2 - x$ **23.** $f(x) = 2x^2 - 3x$ **24.** $f(x) = x^3$

25. $f(x) = x^3 - 1$ **26.** $f(x) = x^3 + 7$ **27.** $f(x) = x^3 + 5$

In Exercises 28–39, determine the domain of each function.

28. $f(x) = \dfrac{3x+1}{(x-5)(x-6)}$ **29.** $f(x) = \sqrt{2x+10}$

30. $f(x) = \sqrt{x^2+2}$ **31.** $f(x) = \dfrac{5}{\sqrt{x+10}}$

32. $f(x) = \dfrac{2x}{x-2}$ **33.** $f(x) = \dfrac{x-3}{x+1}$

34. $f(x) = \dfrac{4}{x^2-x-12}$ **35.** $f(x) = x - 3$

36. $f(x) = 4 - 3x$

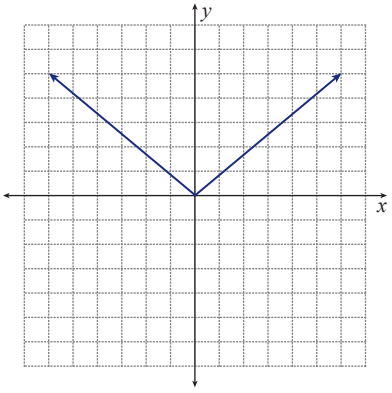
37. $f(x) = \dfrac{1}{\sqrt{2x+5}}$

38. $f(x) = \begin{cases} 3x+1 & \text{if } 0 \le x < 4 \\ 5x-2 & \text{if } x \ge 4 \end{cases}$

39. $f(x) = \begin{cases} 2-x^2 & \text{if } x \le 2 \\ x-4 & \text{if } x > 2 \end{cases}$

In Exercises 40–51, use the vertical line test to determine whether or not each graph represents a function.

40.



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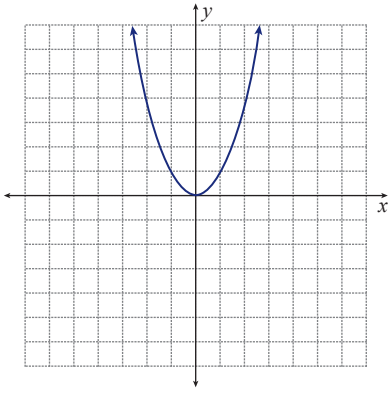

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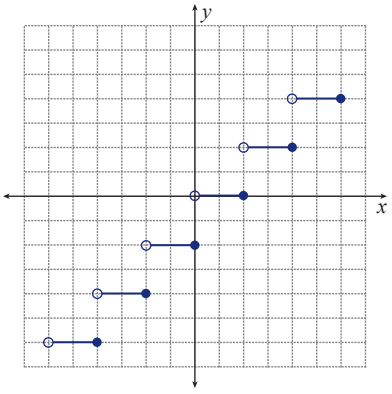

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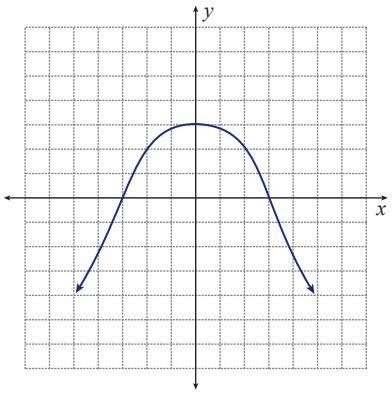

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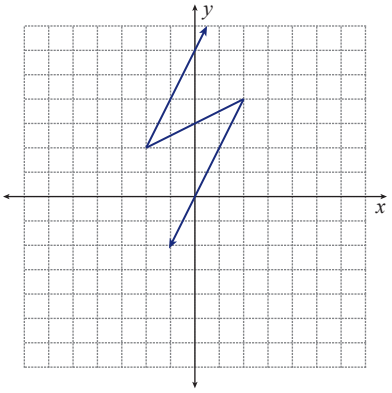

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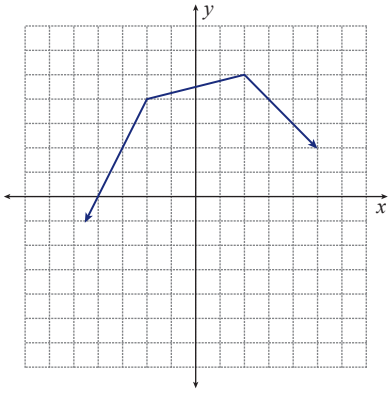

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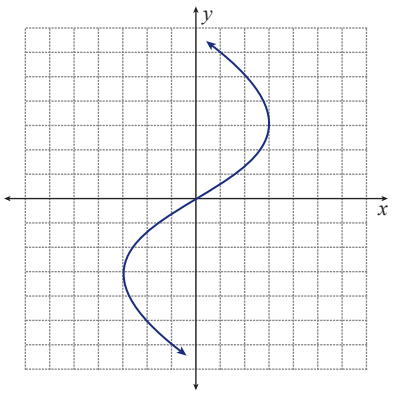

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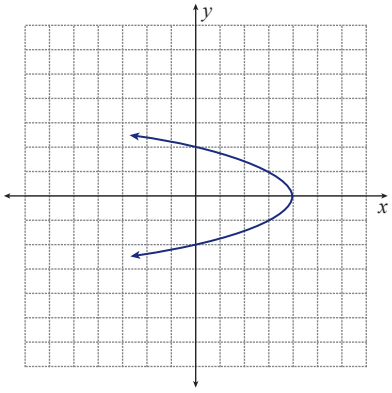

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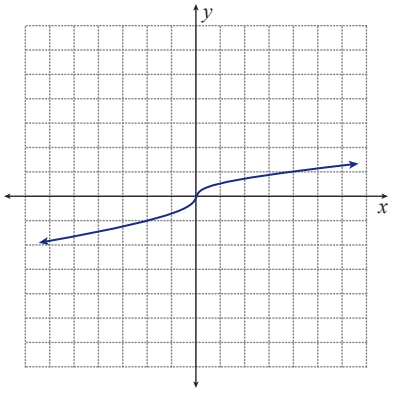

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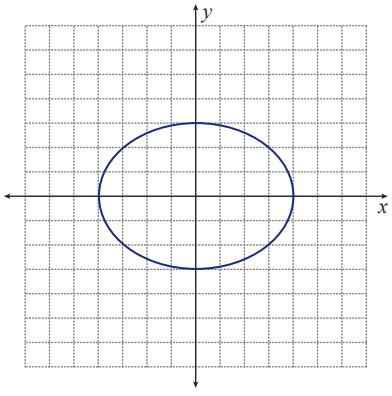

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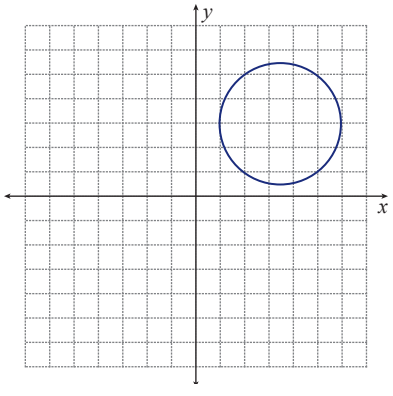

51.