Determine whether or not each of the following graphs represents a function.





For each set of points,

- (a) Graph the set of points.
- (b) Determine whether or not the set of points represents a function. Justify your answer.
- **11.**  $\{(1, 5), (2, 4), (-3, 4), (2, -1), (3, 6)\}$
- **12.**  $\{(-3, 2), (1, 2), (0, -3), (2, 1), (-2, 1)\}$

## Answer the following.

- **13.** Analyze the coordinates in each of the sets above. Describe a method of determining whether or not the set of points represents a function without graphing the points.
- **14.** Determine whether or not each set of points represents a function <u>without</u> graphing the points. Justify each answer.
  - (a)  $\{(-7,3), (3,-7), (1,5), (5,1), (-2,1)\}$
  - **(b)**  $\{(6,3), (-4,3), (2,3), (-3,3), (5,3)\}$
  - (c)  $\{(3, 6), (3, -4), (3, 2), (3, -3), (3, 5)\}$
  - (d)  $\{(-2, -5), (-5, 2), (2, 5), (5, -2), (5, 2)\}$

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## Answer the following.

**15.** The graph of y = f(x) is shown below.



- (a) Find the domain of the function. Write your answer in interval notation.
- (b) Find the range of the function. Write your answer in interval notation.
- (c) Find the *y*-intercept(s) of the function.
- (d) Find the following function values: f(-2); f(0); f(4); f(6)
- (e) For what value(s) of x is f(x) = 9?
- (f) On what interval(s) is *f* increasing?
- (g) On what interval(s) is *f* decreasing?
- (h) What is the maximum value of the function?
- (i) What is the minimum value of the function?
- **16.** The graph of y = g(x) is shown below.



- (a) Find the domain of the function. Write your answer in interval notation.
- (b) Find the range of the function. Write your answer in interval notation.

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- (c) Find the *y*-intercept(s) of the function.
- (d) Find the following function values: g(-2); g(0); g(1); g(3); g(6)
- (e) For what value(s) of x is g(x) = -2?
- (f) On what interval(s) is g increasing?
- (g) On what interval(s) is g decreasing?
- (h) What is the maximum value of the function?
- (i) What is the minimum value of the function?
- 17. The graph of y = g(x) is shown below.



- (a) Find the domain of the function. Write your answer in interval notation.
- (b) Find the range of the function. Write your answer in interval notation.
- (c) How many *x*-intercept(s) does the function have?
- (d) Find the following function values: g(-2); g(0); g(2); g(4); g(6)
- (e) Which is greater, g(-2) or g(3)?
- (f) On what interval(s) is g increasing?
- (g) On what interval(s) is g decreasing?

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**18.** The graph of y = f(x) is shown below.



- (a) Find the domain of the function. Write your answer in interval notation.
- (b) Find the range of the function. Write your answer in interval notation.
- (c) Find the *x*-intercept(s) of the function.
- (d) Find the following function values: f(-3); f(-2); f(-1); f(1); f(4)
- (e) Which is smaller, f(0) or f(3)?
- (f) On what interval(s) is *f* increasing?
- (g) On what interval(s) is f decreasing?

For each of the following functions:

- (a) State the domain of the function. Write your answer in interval notation.
- (b) Find the intercepts of the function.
- (c) Choose *x*-values corresponding to the domain of the function, calculate the corresponding *y*values, plot the points, and draw the graph of the function.
- **19.**  $f(x) = -\frac{3}{2}x + 6$
- **20.**  $f(x) = \frac{2}{3}x 4$
- **21.**  $h(x) = 3x 5, -1 \le x < 3$
- **22.**  $h(x) = -2x, -3 < x \le 2$
- **23.** g(x) = |x-3|
- **24.** g(x) = |x| 4

25.  $f(x) = \sqrt{x-3}$ 26.  $f(x) = \sqrt{5-x}$ 27.  $F(x) = x^2 - 4x$ 28.  $G(x) = (x-3)^2 + 1$ 29.  $f(x) = x^3 + 1$ 30.  $f(x) = x^4 - 16$ 31.  $g(x) = \frac{12}{x}$ 

**32.**  $h(x) = -\frac{8}{x}$ 

- For each of the following piecewise-defined functions:
  - (a) State the domain of the function. Write your answer in interval notation.
  - (b) Find the *y*-intercept of the function.
  - (c) Choose *x*-values corresponding to the domain of the function, calculate the corresponding *y*-values, plot the points, and draw the graph of the function.

**33.** 
$$f(x) = \begin{cases} 2x+4, \text{ if } -2 \le x < 1 \\ -x+3, \text{ if } 1 \le x \le 5 \end{cases}$$

**34.** 
$$f(x) = \begin{cases} \frac{1}{3}x + 2, & \text{if } -3 \le x \le 0\\ -4x + 3, & \text{if } x > 0 \end{cases}$$

**35.** 
$$f(x) = \begin{cases} 3, & \text{if } x < -2 \\ -5, & \text{if } x \ge -2 \end{cases}$$

**36.** 
$$f(x) = \begin{cases} -4, & \text{if } -5 \le x < 1 \\ 2, & \text{if } 1 \le x \le 3 \end{cases}$$

**37.** 
$$f(x) = \begin{cases} 4, \text{ if } x < 0 \\ x^2 + 1, \text{ if } x \ge 0 \end{cases}$$

**38.** 
$$f(x) = \begin{cases} 3 - x^2, & \text{if } x \le 1 \\ -3, & \text{if } x > 1 \end{cases}$$

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**39.** 
$$f(x) = \begin{cases} x, \text{ if } x \le -3 \\ x^2, \text{ if } -3 < x < 2 \\ 4, \text{ if } x \ge 2 \end{cases}$$
  
**40.** 
$$f(x) = \begin{cases} x^2 - 5, \text{ if } x < 0 \\ 1, \text{ if } 0 \le x \le 3 \\ 2 - x, \text{ if } x > 3 \end{cases}$$

## Answer the following.

- **41.** (a) If a function is odd, then it is symmetric with respect to the \_\_\_\_\_\_. (*x*-axis, *y*-axis, or origin?)
  - (b) If a function is even, then it is symmetric with respect to the \_\_\_\_\_. (x-axis, y-axis, or origin?)
- **42.** (a) If a function is symmetric with respect to the *y*-axis, then the function is \_\_\_\_\_. (Odd, even, both, or neither?)
  - (b) If a function is symmetric with respect to the origin, then the function is \_\_\_\_\_. (Odd, even, both or neither?)
- **43.** Suppose that y = f(x) is an odd function and that (-3, 6) is a point on the graph of *f*. Find another point on the graph.
- 44. Suppose that y = f(x) is an even function and that (2, -7) is a point on the graph of *f*. Find another point on the graph.

Determine whether each of the following functions is even, odd, both or neither.

45. 
$$f(x) = x^3 - 5x$$
  
46.  $f(x) = x^2 + 3x$   
47.  $f(x) = x^4 + 2x^2$   
48.  $f(x) = x^5 + 2x^3$   
49.  $f(x) = 2x^3 + x^2 - 5x + 1$   
50.  $f(x) = 3x^6 + \frac{2}{x^2}$ 

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