Functions and Their Graphs

2

Outline

- 2.1 Functions
- 2.2 The Graph of a Function
- 2.3 Properties of Functions
- 2.4 Library of Functions; Piecewise-defined Functions
- 2.5 Graphing Techniques: Transformations
- 2.6 Mathematical Models: Building Functions
- · Chapter Review
- Chapter Test
- · Cumulative Review
- Chapter Projects

2.2 The Graph of a Function

PREPARING FOR THIS SECTION Before getting started, review the following:

- · Graphs of Equations (Section 1.2, pp. 9-11)
- Intercepts (Section 1.2, pp. 11–12)

Now Work the 'Are You Prepared?' problems on page 64.

- OBJECTIVES 1 Identify the Graph of a Function (p. 60)
 - 2 Obtain Information from or about the Graph of a Function (p.61)

Quick review of the definition of a function.

What does this mean for the graph of a function?

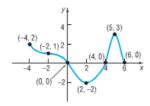
THEOREM

Vertical-line Test

A set of points in the xy-plane is the graph of a function if and only if every vertical line intersects the graph in at most one point.

In Words

If any vertical line intersects a graph at more than one point, the graph is not the graph of a function. 10. Use the given graph of the function f to answer parts (a)–(n).



- (a) Find f(0) and f(6).
- (b) Find f(2) and f(-2).
- (c) Is f(3) positive or negative?
- (d) Is f(-1) positive or negative?
- (e) For what values of x is f(x) = 0?
 - (f) For what values of x is f(x) < 0?
- (g) What is the domain of f?
- (h) What is the range of f?
- (i) What are the x-intercepts?
- (j) What is the y-intercept?
- (k) How often does the line y = -1 intersect the graph?
- (l) How often does the line x = 1 intersect the graph?
- (m) For what value of x does f(x) = 3?
- (n) For what value of x does f(x) = -2?

 $In\ Problems\ 11-22, determine\ whether\ the\ graph\ is\ that\ of\ a\ function\ by\ using\ the\ vertical-line\ test.\ If\ it\ is, use\ the\ graph\ to\ find:$

- In Problems 11-22, wear-man.

 (a) The domain and range
 (b) The intercepts, if any
 (c) Any symmetry with respect to the x-axis, the y-axis, or the origin

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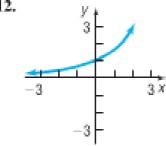




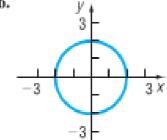




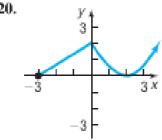
12.



16.



20.



In Problems 23–28, answer the questions about the given function.

- in Problems 25–26, answer the questions about the given function.

 23. $f(x) = 2x^2 x 1$ (a) Is the point (-1, 2) on the graph of f?

 (b) If x = -2, what is f(x)/What point is on the graph of f?

 (c) If f(x) = -1, what is x^2 What point(s) are on the graph of f?

 (d) What is the domain of f?

 (e) List the x-intercept, if there is one, of the graph of f.

 (1) List the y-intercept, if there is one, of the graph of f.

- (f) List the y-increept, if there is one, of the graph of f.
 24, f(x) = -3x² + 5x
 (a) Is the point (-1, 2) on the graph of f?
 (b) If x = -2, what is f(x)? What point is on the graph of f?
 (c) If f(x) = -2, what is x? What point(s) are on the graph of f?
 (d) What is the domain of f?
- (e) List the x-intercepts, if any, of the graph of f.
 (f) List the y-intercept, if there is one, of the graph of f.

- (b) List the *y*-intercept, if any, of the graph of f.

 25. $f(x) = \frac{x+2}{x-6}$ (a) Is the point (3, 14) on the graph of f?

 (b) If x = 4, what is f(x)? What point is on the graph of f?

 (c) If f(x) = 2, what is x? What point(s) are on the graph of f?

 (d) What is the domain of f?

 (e) List the *x*-intercept, if any, of the graph of f.

 (f) List the *y*-intercept, if any of the graph of f.

 (g) List the *x*-intercept, if any of the graph of f.

 (h) If x = 4, what is f(x)? What point is on the graph of f?

 (c) List the *x*-intercept, if any of the graph of f.

 (d) What is the domain of f?

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26. $f(x) = \frac{x^2 + 2}{x + 4}$

(a) Is the point $\left(1, \frac{3}{5}\right)$ on the graph of f?

- (b) If x = 0, what is f(x)? What point is on the graph of f?
- (b) If x = 0, what is f(x) * what point so one we go one x;
 (c) If f(x) = \frac{1}{2}\$, what is x? What point(s) are on the graph of f?
 (d) What is the domain of f?
 (e) List the x-intercepts, if any, of the graph of f.
 (f) List the y-intercept, if there is one, of the graph of f.

- 27. $f(x) = \frac{2x^2}{x^4 + 1}$ (a) Is the point (-1, 1) on the graph of f?
 (b) If x = 2, what is f(x)? What point is on the graph of f?
 - of ??

 (a) If f(x) = 1, what is x? What point(s) are on the graph of f?

 (d) What is the domain of f?

 (e) List the x-intercepts, if any, of the graph of f.

 (f) List the y-intercept, if there is one, of the graph of f.

- (b) If x = 4, what is f(x)? What point is on the graph of f?
 (c) If f(x) = 1, what is x? What point(s) are on the graph

- of f?

 (d) What is the domain of f?

 (e) List the x-intercepts, if any, of the graph of f.

 (f) List the y-intercept, if there is one, of the graph of f.

28. $f(x) = \frac{2x}{x-2}$

(a) Is the point $\left(\frac{1}{2}, -\frac{2}{3}\right)$ on the graph of f?

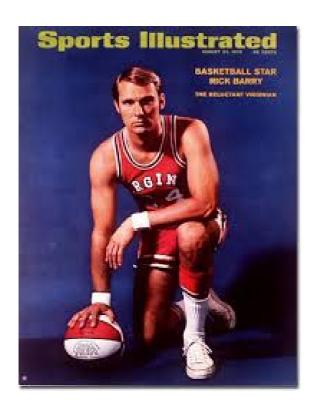
(b) If x = 4, what is f(x)? What point is on the graph of f?

(c) If f(x) = 1, what is x? What point(s) are on the graph of f?

(d) What is the domain of f?

(e) List the x-intercepts, if any, of the graph of f.

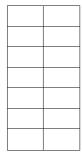
(f) List the y-intercept, if there is one, of the graph of f.

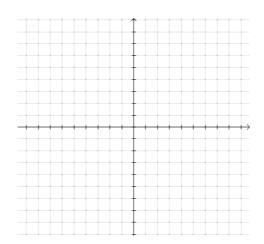


http://www.youtube.com/watch?v=9bqa-Hw0TpY

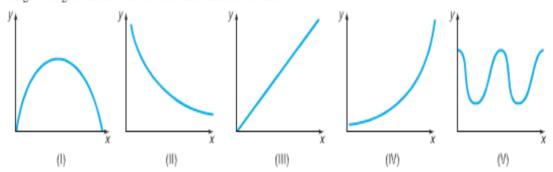
- 30. Granny Shots The last player in the NBA to use an underhand foul shot (a "granny" shot) was Hall of Fame forward Rick Barry who retired in 1980. Barry believes that current NBA players could increase their free-throw percentage if they were to use an underhand shot. Since underhand shots are released from a lower position, the angle of the shot must be increased. If a player shoots an underhand foul shot, releasing the ball at a 70-degree angle from a position 3.5 feet above the floor, then the path of the ball can be modeled by the function h(x) = -\frac{136x^2}{v^2} + 2.7x + 3.5, where h is the height of the ball above the floor, x is the forward distance of the ball in front of the foul line, and v is the initial velocity with which the ball is shot in feet per second.
- (a) The center of the hoop is 10 feet above the floor and 15 feet in front of the foul line. Determine the initial velocity with which the ball must be shot in order for the ball to go through the hoop.
- (b) Write the function for the path of the ball using the velocity found in part (a).
- (c) Determine the height of the ball after it has traveled 9 feet in front of the foul line.

(d) Find additional points and graph the path of the basketball.

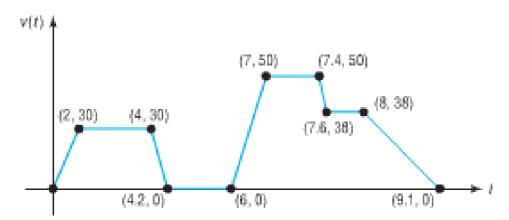




- 40. Match each of the following functions with the graph that best describes the situation.
 - (a) The temperature of a bowl of soup as a function of time
 - (b) The number of hours of daylight per day over a 2-year period
 - (c) The population of Florida as a function of time
 - (d) The distance traveled by a car going at a constant velocity as a function of time
 - (e) The height of a golf ball hit with a 7-iron as a function of time



44. The following sketch represents the speed v (in miles per hour) of Michael's car as a function of time t (in minutes).



- (a) Over what interval of time was Michael traveling fastest?
- (b) Over what interval(s) of time was Michael's speed zero?
- (c) What was Michael's speed between 0 and 2 minutes?
- (d) What was Michael's speed between 4.2 and 6 minutes?
- (e) What was Michael's speed between 7 and 7.4 minutes?
- (f) When was Michael's speed constant?