

• *Linear Functions*

11. Graph the following equations. Determine if they are functions.

(a)  $y = 2$

(b)  $x = 2$

(c)  $y = 3x$

(d)  $y = -2x + 4$

12. **Definition.** The variable  $y$  is **directly proportional** to  $x$  (or **varies directly** with  $x$ ) if there is some positive constant  $m$  such that  $y = mx$ . We call  $m$  the **constant of proportionality**, or **variation constant**.

13. The weight  $M$  of a person's muscles is directly proportional to the person's body weight  $W$ . It is known that a person weighing 200 lb has 80 lb of muscle.

(a) Find an equation of variation expressing  $M$  as a function of  $W$ .

(b) What is the muscle weight of a person weighing 120 lb?

14. **Definition.** A **linear function** is any function that can be written in the form  $y = mx + b$  or  $f(x) = mx + b$ , called the **slope-intercept equation** of a line. The constant  $m$  is called the **slope**. The point  $(0, b)$  is called the  **$y$ -intercept**.

15. Find the slope and  $y$ -intercept of the graph of  $3x + 5y - 2 = 0$ .

16. Find an equation of the line that has slope 4 and passes through the point  $(-1, 1)$ .

17. **Definition.** The equation  $y - y_1 = m(x - x_1)$  is called the **point-slope equation** of a line. The point is  $(x_1, y_1)$ , and the slope is  $m$ .

18. Find the point-slope equation of Problem 16. Compare the two equations.

19. **Theorem.** The slope of a line passing through the points  $(x_1, y_1)$  and  $(x_2, y_2)$  is

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\Delta y}{\Delta x} = \frac{\text{change in } y}{\text{change in } x}.$$

Slope can also be considered as an **average rate of change**.

20. Find the slope of the line passing through the points  $(3, -2)$  and  $(1, 4)$ . Then find the equation of the line.

21. A skateboard ramp is 2 ft high and 5 ft long in base. Find its slope.

22. The tuition and fees at public two-year colleges were \$2063 in 2008 and \$3264 in 2014. Find the average rate of change.
23. A computer firm is planning to sell a new graphing calculator. For the first year, the fixed costs for setting up the new production line are \$100,000. The variable costs for each calculator are \$20. The sales department projects that 150,000 calculators will be sold during the first year at a price of \$45 each.
- Find the total cost  $C(x)$  of producing  $x$  calculators, the total revenue  $R(x)$  from the sale of  $x$  calculators, and the total profit  $P(x)$  from the production and sale of  $x$  calculators.
  - How many calculators must the firm sell in order to break even?
  - What profit or loss will the firm realize if the expected sale of 150,000 calculators occurs?

• *Quadratic Functions*

24. A **quadratic function**  $f$  is given by  $f(x) = ax^2 + bx + c$ , where  $a \neq 0$ . The graph of a quadratic function is called a **parabola**. The **line of symmetry** of the graph is  $x = -\frac{b}{2a}$ , and the **vertex** is  $\left(-\frac{b}{2a}, \frac{4ac-b^2}{4a}\right)$ .
25. Find the vertex and line of symmetry of  $f(x) = -2x^2 - 4x + 2$ . Then graph the function.
26. **The Quadratic Formula.** *The solutions (also called zeros or roots) of any quadratic equation  $ax^2 + bx + c = 0$ ,  $a \neq 0$ , are given by  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ .*
27. Solve the equation  $x^2 - 3x + 2 = 0$ .
28. **Definition.** A **polynomial function**  $f$  is given by

$$f(x) = a_n x^n + a_{n-1} x^{n-1} + \cdots + a_2 x^2 + a_1 x + a_0,$$

where  $n$  is a nonnegative integer (called the **degree**) and  $a_n, a_{n-1}, \dots, a_1, a_0$  are real numbers (called the **coefficients**).

29. **Definition.** Functions given by the quotient, or ratio, of two polynomials are called **rational functions**.
30. Graph  $f(x) = 1/x$ .
31. **Definition.**  $y$  is **inversely proportional** to  $x$  (or **varies inversely** with  $x$ ) if there is some positive number  $k$  for which  $y = k/x$ .