- *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 **??**. 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.

    (a) 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.

    (b) How many calculators must the firm sell in order to break even?

    (c) 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* $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.

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 $a_n, a_{n-1}, \cdots, a_1, a_0$ 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 $y = k/x$.