(d) \(32 \, 000 \, 000\)

(e) \((0.00000025) (0.00004)\)

(f) \(0.000036\)

26. The planet Venus is about 67 000 000 miles from the sun. How far does it travel in one revolution around the sun? Assume the orbit is circular.

27. Each red blood cell contains 250 000 000 molecules of hemoglobin. How many molecules will there be in \(5 \times 10^4\) red blood cells?

28. If light travels at \(1.86 \times 10^5\) miles per second, how many minutes will it take the light from the sun to reach Jupiter? Jupiter is about 480 million miles from the sun.

29. If the mass of a proton is \(0.00000000000000000000000167\) grams, how many protons would it take to make one ounce? One ounce is equal to 28.4 grams.

7 Chapter 4 Topics in Algebra


After completing this chapter you should be able to

- Simplify algebraic expressions by combining like terms and using the distributive property
- Evaluate algebraic expressions and formulas
- Solve linear equations in one variable
- Identify equations that have no solution or infinitely many solutions
- Translate verbal expressions into mathematical symbols
- Solve real-world problems using linear equations
• Solve linear inequalities and graph the solutions on the number line
• Solve real-word problems using linear inequalities
• Write ratios as fractions
• Simplify fractions
• Solve real-word problems using proportions and variation
• Solve quadratic equations using factoring or the quadratic formula
• Solve real-word problems using quadratic equations
• Graph points on the Cartesian plane
• Graph lines on the Cartesian plane
• Find the slope of a line given two points
• Write an equation of a line in slope-intercept form and identify the slope and intercepts
• Solve a linear system of equations in two variables by three methods: graphing, substitution, and addition/subtraction (elimination)
• Determine whether a system of linear equations is consistent, inconsistent, or dependent
• Solve real-world problems involving a system of linear equations
• Solve a system of linear inequalities in two variables
• Determine the domain and range of a relation
• Determine whether or not a relation is a function
• Determine the vertex, axis, and intercepts of a parabola
• Graph a parabola
• Graph an exponential function
• Solve real-world problems using quadratic or exponential function
8 Set of problems for Chapter 4

8.1 Fundamental Concepts of Algebra

1. Use the distributive property to multiply each.
   
   (a) $7(4x - 20)$
   (b) $5(3x - 7y + 18)$

2. Simplify each.
   
   (a) $5(7x + 10) - 4x + 8$
   (b) $-(2a + 6b) + 5c - 12a$

3. Evaluate each expression.
   
   (a) $9x - 17$ when $x = 3$
   (b) $2x^2 - 3x + 5$ when $x = -10$
   (c) $6x + 8y - 15$ when $x = -5$ and $y = 7$

4. For a certain occupation, it was found that the relationship between the number of hours, $x$, a person works per week and the number of accidents, $n$, the person has per year is given by the expression

   $$n = 0.5x - 17$$

   Find the number of yearly accidents for a person who works 40 hours per week.

5. Simplify each expression.
   
   (a) $-4(12x - 10)$
   (b) $3x^2 + 8x^2 - 15x^2$
   (c) $8A - 15A + 2A$
   (d) $5x - 8y + 9 + 4y - 27 + 2x$
   (e) $-9x^2 - 2x - 7 + 3 - 5x + 21x$
(f) \(9(3x + 8)\)
(g) \(4(6x - 3) - 7 - 10x\)
(h) \(-10(4x + 11) - 15x + 9\)
(i) \(9b + 12 + 8(2b + 3)\)
(j) \(14x + 9 - 6(3x - 2)\)

6. Evaluate each.

(a) \(-3x + 8\) when \(x = 5\)
(b) \(4w + 9\) when \(w = -12\)
(c) \(8x^2 - 7x + 4\) when \(x = 16\)
(d) \(14x^2 - 6x + 30\) when \(x = -7\)
(e) \(9a + 18b - 5\) when \(a = 7\) and \(b = 2\)
(f) \(5x^2 - 7x + 2y^2\) when \(x = -1\) and \(y = 5\)
(g) \(9x^2 + 7y^2 + 6x + 2y + 5\) when \(x = 1\) and \(y = 5\)
(h) \(10y^3 + 10y^2 + 7x - 6\) when \(x = -3\) and \(y = 10\)
(i) \(3x - \frac{7y}{6}\) when \(x = 7\) and \(y = 3\)
(j) \(6x^2 - \frac{10}{5y}\) when \(x = -5\) and \(y = 15\)

7. Evaluate each formula

(a) \(P = 2l + 2w\) when \(l = 10cm\) and \(w = 5cm\)
(b) \(S = \frac{1}{2}gt^2\) when \(g = 10m/sec^2\) and \(t = 20\) seconds
(c) \(S = 4\pi r^2\) when \(r = 7\) and \(\pi = 3.14\)
(d) \(v = V + gt\) when \(V = 50\), \(g = 32\), and \(t = 8\)
(e) \(T = 2\pi \sqrt{\frac{L}{g}}\) when \(\pi = 3.14\), \(L = 10\), and \(g = 32\).

8. For a particular occupation, a person’s hourly income can be estimated by using the expression

\[11.2 + 1.88x + 0.547y\]

where \(x\) is the number of years of experience on the job and \(y\) is the number of years of higher education completed. Find the income of the person who has completed 4 years of college and has worked for the company for 5 years.
9. A real estate agent found that the value of a farm in thousands of dollars can be estimated by

\[ 7.56x - 0.266y + 44.9 \]

where \( x \) is the number of acres on the farm and \( y \) is the number of rooms in the farmhouse. Predict the value of a farm that has 371 acres and a farmhouse with 6 rooms.

10. Find the Celsius temperature that corresponds to a Fahrenheit temperature of 50°.

\[ C = \frac{5}{9}(F - 32) \]

11. The future value (\( FV \)) of a compound interest investment (\( P \)) at a specific interest rate (\( R \)) for a specific number of periods, \( N \), is found by the formula

\[ FV = P (1 + R)^N \]

Find the future value of 9000$ invested at 8% compounded annually for 6 years.

### 8.2 Solving Linear Equations

1. Solve each equation.

(a) \( 7 + x = 43 \)
(b) \( 36 = x - 9 \)
(c) \( 12 = x + 8 \)
(d) \( 6x = 42 \)
(e) \( -42 = -7x \)
(f) \( 10x - 30 = -5 \)
(g) \( -3x + 18 = 42 \)
(h) \( 5x - 6 = 2x - 24 \)
(i) \( 9x - 18 = 7x + 4 \)
(j) \( 5x + 8 = 10x - 32 \)
(k) \( 9 - 2x = 7 - x \)
(l) \(2(x - 6) = 2\)
(m) \(7(x - 3) = 42\)
(n) \(-2(4x - 7) = 3x - 8\)
(o) \(5(9 - x) = 4(x + 6)\)
(p) \(-2x + 3 + 4(x - 6) = 18\)
(q) \(-\frac{3}{2}x = 21\)
(r) \(-\frac{1}{2}x = 25\)
(s) \(\frac{1}{5}x - 10 = -16\)
(t) \(\frac{3x}{4} + \frac{7x}{2} = 18\)
(u) \(\frac{4x}{6} + \frac{x}{5} = \frac{2}{3} - \frac{5}{6}\)
(v) \(\frac{3x}{2} + \frac{1}{2} = \frac{4x}{5} + \frac{3}{5}\)
(w) \(\frac{5}{12} - \frac{1}{3}x = \frac{2}{3}x - \frac{7}{6}\)
(x) \(\frac{6x}{8} + \frac{4x}{2} - 5 = \frac{3x}{4}\).

2. Solve each equation for the specified variable.
   
   (a) \(5y = 3x + 2\) for \(x\)
   
   (b) \(5y - 3x + 2 = 10\) for \(y\)
   
   (c) \(3y + 6 = 2x + 8\) for \(x\)

3. Determine whether each equation has a solution set \(\{x \mid x \text{ is a real number}\}\) or \(\emptyset\).
   
   (a) \(8x - 5 + 2x = 10x - 10 + 5\)
   
   (b) \(3x + 7 - x = 2x + 21\)
   
   (c) \(5(x - 3) + 2 = 5x - 8\)
   
   (d) \(4(x + 2) + 6 = 2x + 2x + 14\)

4. The illumination of a light can be found by the formula
   
   \[ I = \frac{C}{D^2} \]
   
   Solve the formula for \(C\).
5. The formula for the perimeter of a rectangle is

\[ P = 2l + 2w \]

Solve the formula for \( w \).

6. The formula for the volume of a rectangular solid is

\[ V = lwh \]

Solve the formula for \( h \).

7. The formula for converting mass to energy is

\[ E = mc^2 \]

Solve the formula for \( m \).

8. The formula for the average \( a \) of two numbers \( b \) and \( c \) is

\[ a = \frac{b + c}{2} \]

Solve for \( b \).

### 8.3 Applications of Linear Equations

1. Write each phrase in symbols.
   - (a) A number decreased by 17
   - (b) 6 increased by a number
   - (c) 8 more than a number
   - (d) 6 subtracted from a number
   - (e) Seven times a number
   - (f) One-half a number
   - (g) The quotient of three times a number and 6
   - (h) Four times a number
   - (i) Four less than six times a number
(j) A number divided by 8

2. Solve each.

(a) The sum of a number and the number plus two is equal to 20. Find the number.
(b) The larger of two numbers is 10 more than the smaller number. The sum of the numbers is 42. Find the numbers.
(c) Five times a number is equal to the number increased by 12. Find the number.
(d) The difference between one-half a number and the number is 8. Find the number.

3. A mathematics class containing 57 students was divided into two sections. One section has three more students than the other. How many students were in each section?

4. For a certain year, the combined revenues for PepsiCo and Coca-Cola were 47 billions dollars. If the revenue for PepsiCo was 11 billion dollars more than Coca-Cola, how much was the revenue of each company?

5. The cost, including the sales tax, of a Ford Focus is 13 884.94$. If the sales tax is 6%, find the cost of the automobile before the tax was added.

6. Pete is three times as old as Bill. The sum of their ages is 48. How old is each?

7. An electric bill for September is 2.32$ less than the electric bill for October. If the total bill for two months is 119.56$, find the bill for each month.

8. If a person invested half of her money at 8% and half at 6% and received 210$ interest, find the total amount of money invested.

9. A basketball team played 32 games and won 4 more games than it lost. Find the number of games the team won.
10. The population of a city decreased by 6% between the years of 1990 and 1998. If the total population for the two years was 16 984, find the population in 1990 and 1998.

11. If a television set is marked 1/3 off and sells for 180$, what was the original price?

### 8.4 Solving Linear Inequalities

1. Show the solutions of the linear inequalities, using a graph.
   
   (a) $x \geq 3$
   (b) $x < -4$
   (c) $x \leq -9$
   (d) $x > 0$
   (e) $-3 < x \leq 7$
   (f) $-3 \leq x < 0$
   (g) $4 \leq x \leq 10$
   (h) $2 < x < 8$

2. Solve each inequality and graph the solution set on the number line.
   
   (a) $x - 2 \leq 15$
   (b) $x + 9 > 20$
   (c) $5x < 30$
   (d) $9 - x \leq 20$
   (e) $\frac{3}{2}x \geq 36$
   (f) $-25x \geq 100$
   (g) $5x - 6 < 39$
   (h) $5 - 2x > 20$
   (i) $-3(2x + 7) < -16$
   (j) $9(4x - 1) > 71$
   (k) $3(x + 1) - 10 < 2x + 7$
(l) \(4(x - 8) - 2x < -22\)

(m) \(9 - 5(x + 6) \geq 32\)

(n) \(6(2x + 3) \geq 5(2x - 15)\)

(o) \(-x \geq -15\)

(p) \(6x - 7 \geq 5(x - 2) - 17\)

(q) \(3x + 6 < -8x + 7\)

3. Mary wishes to purchase a used car. She wishes to spend at most 8000$. The sales tax rate is 7%. Title and license plate fee is 120$. What is the maximum amount she can spend for an automobile?

4. Bill has three test grades of 95, 84, and 85 so far. If the final examination, still to come, counts for two test scores, what is the lowest he can score on the final exam and still get an A for the course? He needs at least 450 points for an A.

5. In order to get a C for her sociology course, Betsy needs at least a 70% average. On exam 1 she scored 78% and on exam 2 she scored 68%. What is the lowest score she can get on the last exam?

6. A husband and wife wish to sell their house and make at least a 10% profit. The real estate agent’s commission is 7% and closing costs are 1000$. If they paid 150 000$ for their home, what is the minimum price they should ask for their house?