REVIEW EXERCISES

5.1

In Exercises 1–5, solve by the method of your choice. Identify systems with no solution and systems with infinitely many solutions, using set notation to express their solution sets.

1. $\begin{cases} y = 4x + 1 \\ 3x + 2y = 13 \end{cases}$

2. $\begin{cases} x + 4y = 14 \\ 2x - y = 1 \end{cases}$

3. $\begin{cases} 5x + 3y = 1 \\ 3x + 4y = -6 \end{cases}$

4. $\begin{cases} 2y - 6x = 7 \\ 3x - y = 9 \end{cases}$

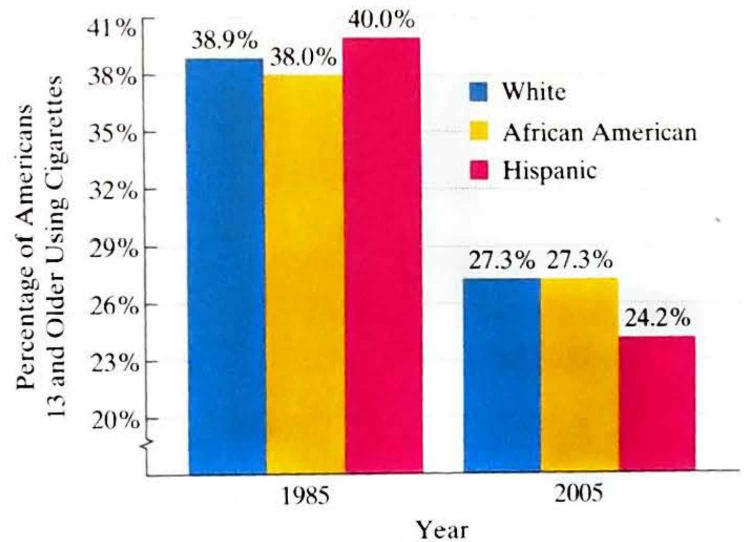
5. $\begin{cases} 4x - 8y = 16 \\ 3x - 6y = 12 \end{cases}$

6. A company is planning to manufacture computer desks. The fixed cost will be \$60,000 and it will cost \$200 to produce each desk. Each desk will be sold for \$450.
   a. Write the cost function, C, of producing x desks.
   b. Write the revenue function, R, from the sale of x desks.
   c. Determine the break-even point. Describe what this means.

7. A chemist needs to mix a solution that is 34% silver nitrate with one that is 4% silver nitrate to obtain 100 milliliters of a mixture that is 7% silver nitrate. How many milliliters of each of the solutions must be used?

8. The bar graph in the next column shows the percentage of Americans who used cigarettes, by ethnicity, in 1985 and 2005. For each of the groups shown, cigarette use has been linearly decreasing.

Cigarette Use in the United States



Source: Department of Health and Human Services

   a. In 1985, 38% of African Americans used cigarettes. For the period shown by the graph, this has decreased at an average rate of 0.54% per year. Write a function that models the percentage of African Americans who used cigarettes, y, x years after 1985.
   b. The function $0.79x + y = 40$ models the percentage of Hispanics who used cigarettes, y, x years after 1985. Use this model and the model you obtained in part (a) to determine the year during which cigarette use was the same for African Americans and Hispanics. What percentage of each group used cigarettes during that year?

9. The perimeter of a table tennis top is 28 feet. The difference between 4 times the length and 3 times the width is 21 feet. Find the dimensions.

10. A travel agent offers two package vacation plans. The first plan costs \$360 and includes 3 days at a hotel and a rental car for 2 days. The second plan costs \$500 and includes 4 days at a hotel and a rental car for 3 days. The daily charge for the hotel is the same under each plan, as is the daily charge for the car. Find the cost per day for the hotel and for the car.

11. The calorie-nutrient information for an apple and an avocado is given in the table. How many of each should be eaten to get exactly 1000 calories and 100 grams of carbohydrates?

	One Apple	One Avocado
Calories	100	350
Carbohydrates (grams)	24	14

5.2

Solve each system in Exercises 12–13.

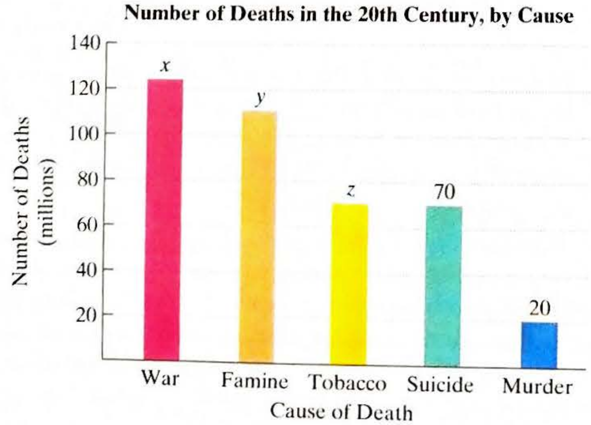
12. $\begin{cases} 2x - y + z = 1 \\ 3x - 3y + 4z = 5 \\ 4x - 2y + 3z = 4 \end{cases}$

13. $\begin{cases} x + 2y - z = 5 \\ 2x - y + 3z = 0 \\ 2y + z = 1 \end{cases}$

14. Find the quadratic function $y = ax^2 + bx + c$ whose graph passes through the points $(1, 4)$, $(3, 20)$, and $(-2, 25)$.

15. 20th Century Death The greatest cause of death in the 20th century was disease, killing 1390 million people. The bar graph shows the five leading causes of death in that century, excluding disease.

Number of Deaths in the 20th Century, by Cause



Source: Wikipedia

War, famine, and tobacco combined resulted in 306 million deaths. The difference between the number of deaths from war and famine was 13 million. The difference between the number of deaths from war and tobacco was 53 million. Find the number of 20th century deaths from war, famine, and tobacco.

5.3

In Exercises 16–24, write the partial fraction decomposition of each rational expression.

16. $\dfrac{x}{(x-3)(x+2)}$

17. $\dfrac{11x - 2}{x^2 - x - 12}$

18. $\dfrac{4x^2 - 3x - 4}{x(x+2)(x-1)}$

19. $\dfrac{2x + 1}{(x-2)^2}$

20. $\dfrac{2x - 6}{(x-1)(x-2)^2}$

21. $\dfrac{3x}{(x-2)(x^2+1)}$

22. $\dfrac{7x^2 - 7x + 23}{(x-3)(x^2+4)}$

23. $\dfrac{x^3}{(x^2+4)^2}$

24. $\dfrac{4x^3 + 5x^2 + 7x - 1}{(x^2 + x + 1)^2}$

5.4

In Exercises 25–35, solve each system by the method of your choice.

25. $\begin{cases} 5y = x^2 - 1 \\ x - y = 1 \end{cases}$

26. $\begin{cases} y = x^2 + 2x + 1 \\ x + y = 1 \end{cases}$

27. $\begin{cases} x^2 + y^2 = 2 \\ x + y = 0 \end{cases}$

28. $\begin{cases} 2x^2 + y^2 = 24 \\ x^2 + y^2 = 15 \end{cases}$

29. $\begin{cases} xy - 4 = 0 \\ y - x = 0 \end{cases}$

30. $\begin{cases} y^2 = 4x \\ x - 2y + 3 = 0 \end{cases}$

31. $\begin{cases} x^2 + y^2 = 10 \\ y = x + 2 \end{cases}$

32. $\begin{cases} xy = 1 \\ y = 2x + 1 \end{cases}$

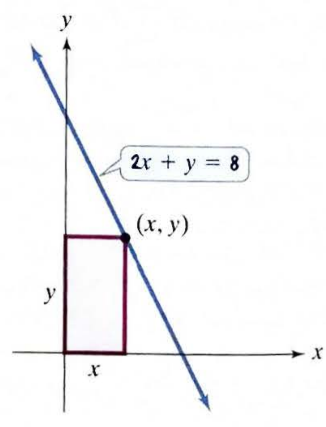
33. $\begin{cases} x + y + 1 = 0 \\ x^2 + y^2 + 6y - x = -5 \end{cases}$

34. $\begin{cases} x^2 + y^2 = 13 \\ x^2 - y = 7 \end{cases}$

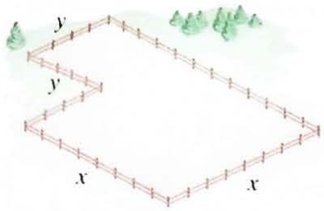
35. $\begin{cases} 2x^2 + 3y^2 = 21 \\ 3x^2 - 4y^2 = 23 \end{cases}$

36. The perimeter of a rectangle is 26 meters and its area is 40 square meters. Find its dimensions.

37. Find the coordinates of all points (x, y) that lie on the line whose equation is $2x + y = 8$, so that the area of the rectangle shown in the figure is 6 square units.



38. Two adjoining square fields with an area of 2900 square feet are to be enclosed with 240 feet of fencing. The situation is represented in the figure. Find the length of each side where a variable appears.



5.5

In Exercises 39–45, graph each inequality.

39. $3x - 4y > 12$

40. $y \le -\frac{1}{2}x + 2$

41. $x < -2$

42. $y \ge 3$

43. $x^2 + y^2 > 4$

44. $y \le x^2 - 1$

45. $y \le 2^x$

In Exercises 46–55, graph the solution set of each system of inequalities or indicate that the system has no solution.

46. $\begin{cases} 3x + 2y \ge 6 \\ 2x + y \ge 6 \end{cases}$

47. $\begin{cases} 2x - y \ge 4 \\ x + 2y < 2 \end{cases}$

48. $\begin{cases} y < x \\ y \le 2 \end{cases}$

49. $\begin{cases} x + y \le 6 \\ y \ge 2x - 3 \end{cases}$

50. $\begin{cases} 0 \le x \le 3 \\ y > 2 \end{cases}$

51. $\begin{cases} 2x + y < 4 \\ 2x + y > 6 \end{cases}$

52. $\begin{cases} x^2 + y^2 \le 16 \\ x + y < 2 \end{cases}$

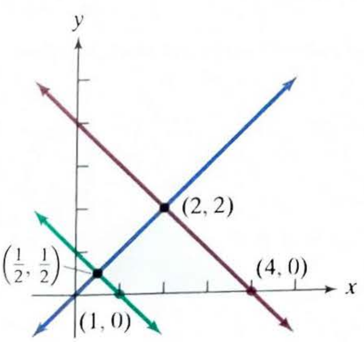
53. $\begin{cases} x^2 + y^2 \le 9 \\ y < -3x + 1 \end{cases}$

54. $\begin{cases} y > x^2 \\ x + y < 6 \\ y < x + 6 \end{cases}$

55. $\begin{cases} y \ge 0 \\ 3x + 2y \ge 4 \\ x - y \le 3 \end{cases}$

5.6

56. Find the value of the objective function $z = 2x + 3y$ at each corner of the graphed region shown. What is the maximum value of the objective function? What is the minimum value of the objective function?



In Exercises 57–59, graph the region determined by the constraints. Then find the maximum value of the given objective function, subject to the constraints.

57. Objective Function $z = 2x + 3y$
Constraints $\begin{cases} x \ge 0, y \ge 0 \\ x + y \le 8 \\ 3x + 2y \ge 6 \end{cases}$

58. Objective Function $z = x + 4y$
Constraints $\begin{cases} 0 \le x \le 5, 0 \le y \le 7 \\ x + y \ge 3 \end{cases}$

59. Objective Function $z = 5x + 6y$
Constraints $\begin{cases} x \ge 0, y \ge 0 \\ y \le x \\ 2x + y \le 12 \\ 2x + 3y \ge 6 \end{cases}$

60. A paper manufacturing company converts wood pulp to writing paper and newsprint. The profit on a unit of writing paper is \$500 and the profit on a unit of newsprint is \$350.

a. Let x represent the number of units of writing paper produced daily. Let y represent the number of units of newsprint produced daily. Write the objective function that models total daily profit.

b. The manufacturer is bound by the following constraints:

- Equipment in the factory allows for making at most 200 units of paper (writing paper and newsprint) in a day.
- Regular customers require at least 10 units of writing paper and at least 80 units of newsprint daily.

Write a system of inequalities that models these constraints.

c. Graph the inequalities in part (b). Use only the first quadrant, because x and y must both be positive. (*Suggestion:* Let each unit along the x- and y-axes represent 20.)

d. Evaluate the objective function at each of the three vertices of the graphed region.

e. Complete the missing portions of this statement: The company will make the greatest profit by producing _______ units of writing paper and _______ units of newsprint each day. The maximum daily profit is \$_______.

61. A manufacturer of lightweight tents makes two models whose specifications are given in the following table:

	Cutting Time per Tent	Assembly Time per Tent
Model A	0.9 hour	0.8 hour
Model B	1.8 hours	1.2 hours

Each month, the manufacturer has no more than 864 hours of labor available in the cutting department and at most 672 hours in the assembly division. The profits come to \$25 per tent for model A and \$40 per tent for model B. How many of each should be manufactured monthly to maximize the profit?