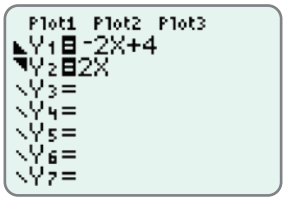


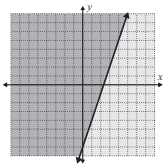
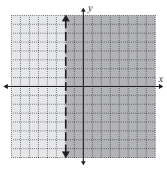
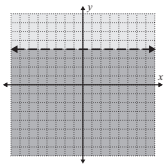
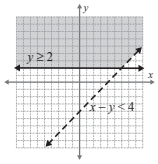
Steps 2 and 3: Press the Y= key and enter both functions and the corresponding symbols as they appear here.

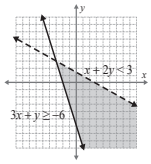
Remember: To shade your graphs, position the cursor over the slash next to Y1 (or Y2) and hit GRAPH repeatedly until the appropriate shading is displayed.

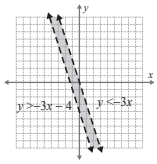
Step 4: Press ENTER. The display should appear as follows. The solution is the cross-hatched region and the points on the line $2x - y = 0$.

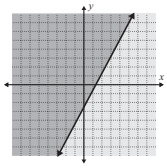
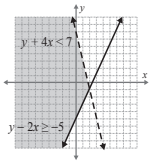
Now work margin exercise 8.

Margin Exercise Answers

1. 
2. 
3. 
4. 

5. 

6. 

7. 
8. 

3.7 Exercises

Concept Check

Fill-in-the-Blank. Complete the sentences using information found in this section.

1. To determine which half-plane is a solution of a linear inequality (and therefore should be shaded), _____ any point clearly on one side of the boundary line.

2. If a point is tested on one side of the boundary line and it _____ the inequality, shade that side of the boundary line. The shaded region is the solution set.

3. If a boundary line is not included in the solution set, the solution is a/an _____ half-plane.

4. A straight line that separates two half-planes is called a _____ line.

5. If the boundary lines are parallel, there are ___ possible types of solutions.

6. The solution set of a system of two linear inequalities consists of the points in the _____ of the two half-planes and portions of the boundary lines.

True/False. Determine whether each statement is true or false. If a statement is false, explain how it can be changed so the statement will be true. (**Note:** There may be more than one acceptable change.)

7. A solid boundary line indicates that the points on that line are included in the solution.

8. If the solution set is an open half-plane, then the boundary line is included in the solution.

9. When boundary lines are parallel, the system of linear inequalities has no solution.

10. Half-planes are the graphs of linear inequalities.

Practice

Graph the solution set of each of the linear inequalities. See Examples 1 through 4.

1. $x + y \le 7$

2. $x - y > -2$

3. $x - y > 4$

4. $x + y \le 6$

5. $y < 4x$

6. $y < -2x$

7. $y \ge -3x$

8. $y > x$

9. $x - 2y > 8$

10. $x + 3y \le 3$

11. $4x + y \ge 2$

12. $5x - y < 4$

13. $y \le 5 - 3x$

14. $y \ge 8 - 2x$

15. $2y - x \le 0$

16. $x + y > 0$

17. $x + 4 \ge 0$

18. $x - 5 \le 0$

19. $y \ge -2$

20. $y + 3 < 0$

21. $4x < -3y + 9$

22. $3x < 2y - 4$

23. $3y > 4x + 6$

24. $5x < 2y - 6$

25. $x + 3y < 7$

26. $3x + 4y > 11$

27. $\frac{1}{2}x - y > 1$

28. $\frac{1}{3}x + y \ge 3$

29. $\frac{2}{3}x + y \ge 4$

30. $2x - \frac{4}{3}y > 8$

Solve the system of two linear inequalities graphically. See Examples 4 through 6.

31. $\begin{cases} y > 2 \\ x \ge -3 \end{cases}$

32. $\begin{cases} 2x + 5 < 0 \\ y \ge 2 \end{cases}$

33. $\begin{cases} x < 3 \\ y > -x + 2 \end{cases}$

34. $\begin{cases} y \le -5 \\ y \ge x - 5 \end{cases}$

35. $\begin{cases} x \le 3 \\ 2x + y > 7 \end{cases}$

36. $\begin{cases} 2x - y > 4 \\ y < -1 \end{cases}$

37. $\begin{cases} x - 3y \le 3 \\ x < 5 \end{cases}$

38. $\begin{cases} 3x - 2y \ge 8 \\ y \ge 0 \end{cases}$

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

40. $\begin{cases} y \geq x-2 \\ x+y \geq -2 \end{cases}$

41. $\begin{cases} 3x+y \leq 10 \\ 5x-y \geq 6 \end{cases}$

42. $\begin{cases} y > 3x+1 \\ -3x+y < -1 \end{cases}$

43. $\begin{cases} 3x+4y \geq -7 \\ y < 2x+1 \end{cases}$

44. $\begin{cases} 2x-3y \geq 0 \\ 8x-3y < 36 \end{cases}$

45. $\begin{cases} x+y < 4 \\ 2x-3y < 3 \end{cases}$

46. $\begin{cases} 2x+3y < 12 \\ 3x+2y > 13 \end{cases}$

47. $\begin{cases} x+y \geq 0 \\ x-2y \geq 6 \end{cases}$

48. $\begin{cases} y \geq 2x+3 \\ y \leq x-2 \end{cases}$

49. $\begin{cases} x+3y \leq 9 \\ x-y \geq 5 \end{cases}$

50. $\begin{cases} x-y \geq -2 \\ x+2y < -1 \end{cases}$

51. $\begin{cases} y \leq x+3 \\ x-y \leq -5 \end{cases}$

52. $\begin{cases} y \geq 2x-5 \\ 3x+2y > -3 \end{cases}$

53. $\begin{cases} y \leq -2x \\ y > -2x-6 \end{cases}$

54. $\begin{cases} y > x-4 \\ y < x+2 \end{cases}$

Use a graphing calculator to graph each of the linear inequalities. See Example 7.

55. $y > \frac{1}{2}x$

56. $2x \geq -6y$

57. $x-y \leq 5$

58. $x+2y > 8$

59. $y \geq -3$

60. $y \leq -4$

61. $2x+y \leq 6$

62. $x-3y \geq 9$

63. $3x+2y \geq 12$

Use a graphing calculator to solve the systems of linear inequalities. See Example 8.

64. $\begin{cases} y \geq 0 \\ 3x-5y \leq 10 \end{cases}$

65. $\begin{cases} y \leq 0 \\ 3x+y \leq 11 \end{cases}$

66. $\begin{cases} 4x-3y \geq 6 \\ 3x-y \leq 3 \end{cases}$

67. $\begin{cases} 3x+2y \leq 15 \\ 2x+5y \geq 10 \end{cases}$

68. $\begin{cases} 3x-4y \geq -6 \\ 3x+2y \leq 12 \end{cases}$

69. $\begin{cases} 3y \leq 2x+2 \\ x+2y \leq 11 \end{cases}$

70. $\begin{cases} x+y \leq 8 \\ 3x-2y \geq -6 \end{cases}$

71. $\begin{cases} x+y \leq 7 \\ 2x-y \leq 8 \end{cases}$

72. $\begin{cases} y \leq x \\ y < 2x+1 \end{cases}$

Applications

Solve.

73. The grade for a 1-credit-hour survey class is based on an exam and a project, which are worth a maximum of 50 points each. The sum of the two scores must be at least 75 points for a student to earn a passing grade.

a. Let the amount of points earned on the exam be represented by the variable x and the amount of points earned on the project be represented by the variable y. Create a linear inequality to describe the solution set for a passing grade.

b. Graph the linear inequality from part **a.**

c. A student earns 45 points on their final exam and 22 points on their project. Plot this point on the graph. Did this student earn a passing grade?

d. Are there any points in the solution set which do not make sense for this situation?

74. A fail-safe is installed on a device with two electrical inputs. If the sum of the inputs is greater than 250 kilowatts, the fail-safe will activate and cause the machine to switch off.

a. If one electrical input is represented by the variable x and the other is represented by the variable y, create a linear inequality to describe the values that will activate the fail-safe.

b. Graph the linear inequality.

c. The device has electrical inputs of 95 kilowatts and 145 kilowatts. Plot this point on the graph. Will the fail-safe activate and switch off the device? Explain why.

75. Barbara's Bombtastic Bakery sells cookie bouquets where the price depends on the arrangement. Each completed bouquet arrangement needs to weigh less than 5 pounds for shipping purposes. The small cookies weigh 0.1 pounds and the large cookies weigh 0.3 pounds. The flower pot and Styrofoam weigh 1.2 pounds. The cost of each arrangement needs to be less than \$30. The small cookies cost \$1 each and the large cookies cost \$2 each. (The cost of the flower pot and foam are included in the cookie prices.)

a. Write two linear inequalities to describe the situation. Use the variable x to represent the number of small cookies and the variable y to represent the number of large cookies in a bouquet.

b. Graph the two linear inequalities on the same coordinate plane.

c. Describe the solution set for the situation.

d. Do any of the values in the solution set not make sense in the context of the problem? Explain why or why not.

76. Robin is planning a charity ball to raise money for her favorite charity. There are two different ticket options. The VIP option includes dinner, dancing, and cocktails for \$150 per ticket. The regular option includes dancing and cocktails for \$75 per ticket. Robin wants to make at least \$14,000 in ticket sales. The ballroom that is being used for the charity event has a maximum capacity of 150 people.

a. Write two linear inequalities to describe the situation. Let the variable x represent the number of VIP tickets sold and let the variable y represent the number of regular tickets sold.

b. Graph the two linear inequalities on the same coordinate plane.

c. Describe the solution set for the situation.

d. Can Robin reach her sales goal if she only sells tickets for the regular option? Explain why or why not.

Writing & Thinking

77. Explain in your own words how to test to determine which side of the graph of an inequality should be shaded.

78. Describe the difference between a closed and an open half-plane.