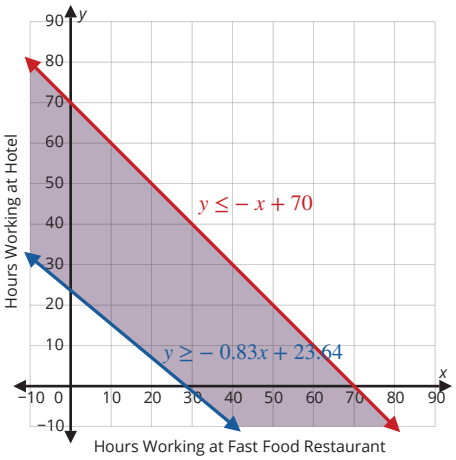


Figure 5.4.14: Solution Area

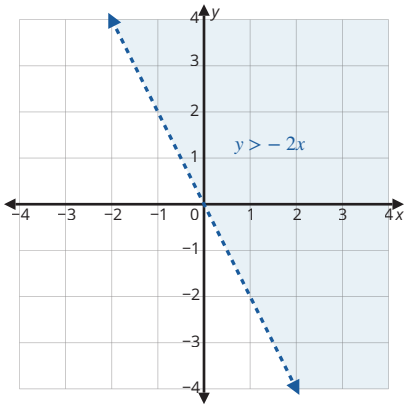
Notice that the area where the shaded regions overlap is the solution to the number of hour combinations that Elisha could work at the two jobs. We will only look at the first quadrant of the graph since, practically speaking, the number of hours that Elisha can work must be either 0 or positive.

Note that the point of intersection is included in the solution set and is graphed as a closed circle since both lines are solid. However, the point of intersection will not be shown in Figure 5.4.12, Figure 5.4.13, or Figure 5.4.14 since we are only focusing on the first quadrant.

Any point in the shaded area is a combination of hours that Elisha could work and meet his goal of earning $260 for the week. One such combination is the point (20, 50). This means that Elisha could work 20 hours at the fast-food restaurant and 50 hours at the hotel and meet his goal. In fact, 20 hours at the restaurant earns $182.20 and 50 hours at the hotel earns $550. This would put Elisha well past his goal at $732.20 for the week.

Skill Check Answers

1.



2. Closed circle at the point of intersection

5.4 Exercises

✔ CONCEPT CHECK

1. Inequality symbols are used between two expressions that are not strictly _____.

2. When graphing the solution of an inequality equation, the _____ separates the points that satisfy the inequality from those that do not.

3. When graphing an inequality equation, a _____ can be used to determine which half-plane to shade.

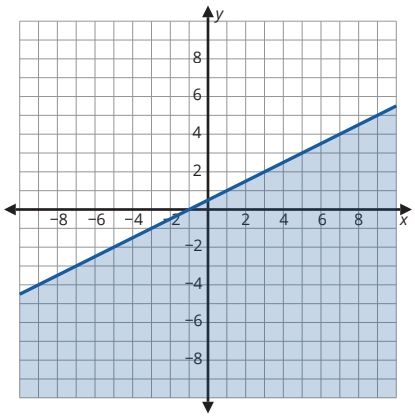
4. When solving a system of linear equations, the solution region for the system is the _____ of the shaded half-planes.

5. When graphing a system of linear equations, an open circle indicates that the intersection point is _____ in the solution set.

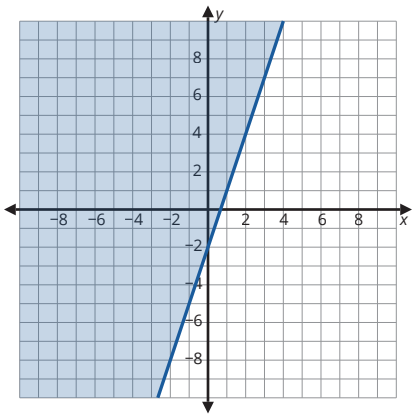
PRACTICE

Determine if the points given are part of the solution set for the linear inequality shown in the graph.

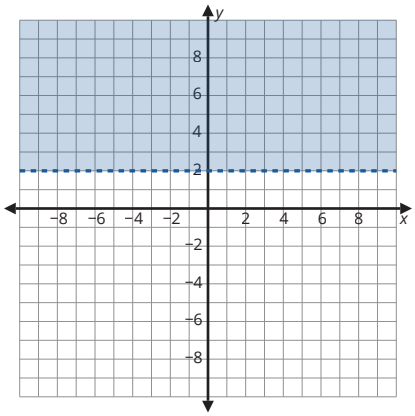
6. **a.** (1, 4)
b. (3, 8)
c. the origin



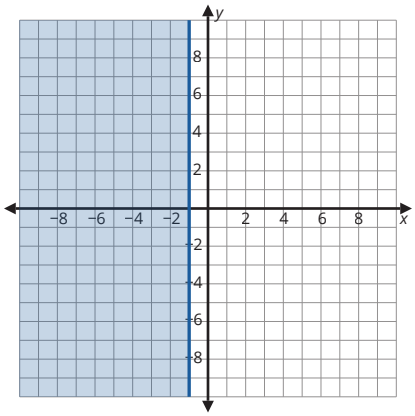
7. **a.** (−5, 5)
b. (5, 6)
c. the origin



8. **a.** (−3, 0)
b. (1, 8)
c. the origin



9. **a.** (−1, 5)
b. (1, 0)
c. the origin



Graph the solution set for each linear inequality given.

10. $6x + 5y < -30$

11. $4y - 6x > 12$

12. $-y - 2 \le 2x$

13. $-y + 4 \ge \frac{1}{2}x$

14. $8y + 6x \ge 8y + 12$

15. $y - 1 \le 0$

16. $6x + 8 < -6y + 8$

17. $4 - 6y > 22 - 6x$

18. $4x \ge -5y + 40$

19. $-3y \le -5x - 15$

20. $y + 4 < -x$

21. $\frac{4x + 5y}{20} > 1$

22. $\dfrac{2x-3y}{11} \le -1$

23. $\dfrac{2}{3}x-\dfrac{1}{6}y>4$

Determine if the point of intersection for the given system of linear inequalities should be an open circle or a closed circle on the graph.

24. $\begin{cases} x-4y>0 \\ \dfrac{1}{3}x-\dfrac{3}{2}y \le -1 \end{cases}$

25. $\begin{cases} y<5 \\ \dfrac{5}{6}x-7x>13 \end{cases}$

26. $\begin{cases} 7x+5y \le 21 \\ x+\dfrac{1}{5}y \ge 2 \end{cases}$

27. $\begin{cases} x \ge -17 \\ \dfrac{3x+y}{2} \le 8 \end{cases}$

Graph the solution set to each system of linear inequalities.

28. $\begin{cases} \dfrac{1}{4}x+y>10 \\ 7x+y \le -1 \end{cases}$

29. $\begin{cases} -x+3y>2 \\ 5x+\dfrac{1}{2}y>3 \end{cases}$

30. $\begin{cases} 2x>-1 \\ y \le 6 \end{cases}$

31. $\begin{cases} x-0.5y \le 1.3 \\ 3x+8y \le 24 \end{cases}$

32. $\begin{cases} 4x+6y \ge 12 \\ 2.8x+1.1y \ge 6.2 \end{cases}$

33. $\begin{cases} 7x-y \le 14 \\ \dfrac{x+y}{-3} \ge -5 \end{cases}$

APPLICATIONS

34. Suppose you make \$2400 per month. Your obligatory payments, such as rent, your cell phone bill, etc., are \$1140 each month. You spend the rest of the money on your daily needs. Assume there are 30 days in a month.

a. Model your expenses as a linear inequality. Let x be the amount you spend on average each day.

b. Can you meet you monthly budget if you spend \$45 per day?

c. Suppose the following table shows your expenses over the last six months. Graph the model of expenses created in part a along with the expenses per day on the same graph. (**Hint:** Let y represent the month.)

	Expenses per Day
Month 1	\$46
Month 2	\$42
Month 3	\$44
Month 4	\$34
Month 5	\$38
Month 6	\$39

d. What daily spending amount should you aim for to meet your monthly budget? Do you think you should feel confident that you will be able to meet your budget?

35. Shelly's business sells handmade chocolate. She rents a small shop that costs her $1200 per month, including taxes. She sells two sets of sweets, a standard set for $14, and a premium set for $22. The cost of making a standard set is $6, and the cost of making a premium set is $10.

a. Model Shelly's monthly profit as a linear inequality. Let x be the number of standard sets sold and y be the number of premium sets sold.

b. Can Shelly make any profit if she sells 94 standard sets and 26 premium sets in a month?

c. Suppose the following table shows Shelly's sales over the last six months. Graph the model of monthly profit created in part a along with the sets sold day on the same graph.

d. Do you think she should feel confident that her business is profitable?

	Standard Sets Sold	Premium Sets Sold
Months 1	87	42
Months 2	94	35
Months 3	102	32
Months 4	76	44
Months 5	98	36
Months 6	83	36

36. Suppose you have a budget of $500 for the flight and hotel for your vacation. The hotel you found is $60 a night and your flight is $150. Let x be the number of nights you stay.

a. Write the modeling inequality for your accommodation and flight vacation budget.

b. Graph the inequality.

c. What is the maximum number of nights you can afford to stay in the accommodation?

d. How many points on the graph are solutions to the inequality and an appropriate number of nights to stay for your vacation. Explain your reasoning.

37. The city charges $250 for a permit to use a city park for a function. To pay for the permit, a club is charging a fee of $0.75 for each member and $1.25 for each guest who is not a member. Let x be the number of members attending and y be the number of nonmembers attending.

a. Write the modeling inequality for the number of guests needed so that the park permit is paid for.

b. Graph the inequality.

c. Would the permit be covered if only 300 members and no non-members attended?

d. how many nonmembers must attend if no members attend.

e. Identify one possible combination of member and nonmember guest counts that would cover the cost of the permit.

38. Oliver supplements his income by driving for a shared-ride company and driving for a food delivery app. On average, he makes $17.50 an hour driving for the shared-ride and $15 an hour for the delivery app. Oliver has set a goal of making a minimum of $50 a day by driving for these companies. Let x be the number of hours driving for the shared-ride company and y be the number of hours driving for the food delivery app.

a. Write the modeling inequality for the number of hours Oliver needs to drive for each company so that he reaches his daily goal.

b. Graph the inequality.

c. If Oliver drove 2 hours for each company in one day, would he meet his goal for the day?

d. Identify one way Oliver could meet his goal of supplementing his income by at least $50 by driving for the two companies.

e. Is the point (15, 10) a solution to the inequality? If so, is it possible for Oliver to meet his supplement goal using this solution? Explain your reasoning.

39. A shipping company delivers glass vases. The company is paid $0.80 for each safely delivered vase and is fined $4.50 for each broken vase. The company expects to earn at least $1500 in a delivery. Let x be the number of unbroken vases delivered and y be the number of broken vases.

a. Write the modeling inequality for the shipping company's delivery earnings.

b. Graph the inequality.

c. Use the graph in part a to determine the minimum number of unbroken vases that must be delivered in order to earn $1500.

d. Identify one possible combination of safely delivered vases and broken vases that allows the company to earn $1500 given that at least one vase gets broken.

e. Explain why the point (1500, –100) is in the solution set for the inequality but is not a plausible solution for the shipping company.

40. Kashton is opening a fitness center for an apartment complex. As manager, he would like a full schedule of hot yoga classes as well as aerobic exercise classes. Each yoga class requires a time slot of $1\frac{1}{2}$ hours while aerobic exercise classes require 1 hour. Kashton would like to have at least 20 hours of classes scheduled each week. Yoga instructors are paid \$35 per class and instructors for the aerobic exercise classes earn \$30 per class. Kashton has a budget of \$1000 per week to spend on instructors for the fitness classes. Let x be the number of yoga classes and y be the number of aerobic classes.

a. Write two inequalities—one that represents the number of hours of classes the manager wants to have and one to represent the instructor pay required for the classes.

b. Graph the solution set for the system of inequalities.

c. Identify at least one combination of classes that meets Kashton's requirements.

d. If Kashton wants to offer the same amount of yoga and aerobic classes each week, what is the maximum number of each that he is able to offer and stay in his budget?

41. Because of her class schedule, Fern can work at most 13 hours per week. She would like to make at least \$60 a week. She makes \$15 an hour tutoring and \$8.50 an hour proofreading essays. She tutors in whole hours only but does proofreading by the half-hour. Let x be the number of hours she tutors per week and y be the number of hours she does proof reading.

a. Write two inequalities—one that represents the number of hours Fern tutors and one to represent her pay.

b. Graph the solution set for the system of inequalities.

c. What is the minimum number of hours Fern can tutor without any proofreading work and make her goal?

d. What is the minimum amount of proofreading that Fern can do and make her goal if she doesn't tutor at all in the week?

e. Identify at least one combination that Fern can work and meet her goal if she does some of each type of work.

42. A nutrition plan requires that at lunch you eat a minimum of 35 gram of protein and have at most 21 grams of fat. A suggested meal includes steak and eggs. Strip steak contains 7 grams of protein and 1.9 grams of fat per ounce and eggs contain 6 grams of protein and have 4.5 grams of fat each. Let x be number of ounces of strip steak and y be number of eggs.

a. Write two inequalities—one that represents the required amounts of protein and one to represent the fat.

b. Graph the solution set for the system of inequalities.

c. What is the maximum number of eggs allowed at lunch on the nutrition plan?

d. Identify an amount of steak and eggs that is allowed if the most precise you can be with measuring the steak is to the nearest half an ounce?

43. The last page in the newspaper is reserved for ads that can be purchased. There are two types of ads. The first type is a 215-character short ad, and the second type is a 380-character long ad. The page can contain at most 4000 characters. The cost of placing a short ad is $110, and the cost of placing a long one is $200. The newspaper wants to earn at least $1400 on the ads. Graph the solution set to the corresponding inequality and determine the number of ads the newspaper needs to place to fit the page and earn the required amount. Find at least one combination of how many of each type of ad would meet the goal.

44. To lose weight more effectively, a trainer recommended Charlie add cardio trainings to his weight loss plan. He should burn at least 3500 additional calories per week. Charlie chose two types of cardio exercises, running and cycling. When running he will burn about 670 calories per hour, and when cycling he will burn 530 calories per hour. He also figured that he could not devote more than seven hours a week to this. Graph the solution set to determine the time Charlie needs to spend on each type of exercise to fit the trainer's expectations and the time constraints. Find at least one combination of hours Charlie should spend on each type of exercise to meet the goal.

45. A factory produces two types of glue, regular and increased adhesiveness. Only one type of glue can be produced at a time, and the factory operates 24 hours per day. The factory can produce 500 liters of regular glue or 420 liters of advanced glue in an hour, and they need to make at least 9000 liters each day. Graph the solution set to determine the time the factory should work producing each type of glue to implement the production plan. Find at least one combination of hours the factory should spend making each type of glue to meet the goal.

46. Andy is traveling to another city by bus and will not be able to charge his phone. He will have to spend at least fourteen hours on the road. To pass the time, he plans to listen to music and watch videos. The battery capacity of his phone is 2800 mAh (milliamperes/hour). Listening to music uses 43 mA per hour and watching videos uses 165 mA per hour. Graph the solution set to determine how long Andy should use his phone in each mode so that it doesn't run out of power along the way. Find at least one combination of hours spent on each activity that meets the goal.