

LESSON 23 Applications of Systems of Linear Inequalities

REFRESH YOUR SKILLS

(Lesson 19) Find the intersection of the lines by solving the system of equations algebraically.

1. $x + y = 8$

$2x + 3y = 20$

2. $x + y = 6$

$6x + 3y = 30$

(Lesson 19) Solve.

3. Carson has at most \$30 to spend on cookies and muffins for his birthday party. A cookie costs \$2, and a muffin costs \$4. Write an inequality relating the number of cookies, x , and the number of muffins, y , that Carson can buy.
4. A farmer wants to build a rectangular pen using no more than 150 feet of fencing. Write an inequality relating the length of the pen, x , and the width of the pen, y .

SOLVING WORD PROBLEMS INVOLVING SYSTEMS OF LINEAR INEQUALITIES

Solving word problems involving inequalities is just like solving word problems involving equations, except for one thing: the given situation is modeled by an inequality, not by an equation. Look for key phrases that indicate inequalities. Be sure to identify all given conditions, then translate each given condition into an inequality.

→ **EXAMPLE** Pears cost \$2 each. Mangos cost \$3 each. Elijah wants to buy at least 8 pears and mangos combined, but he does not want to spend more than \$20. a) Write and graph a system of inequalities that models this situation. b) Can Elijah buy 5 pears and 4 mangos? c) What is the minimum number of pears Elijah must buy to satisfy the conditions described?

a. Let x = number of pears and y = number of mangos.

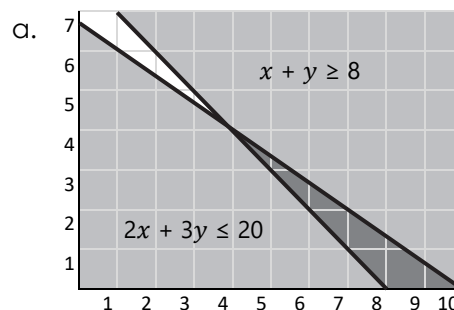
At least 8 pears and mangos combined, so $x + y \geq 8$.

A maximum of \$20 to spend, so $2x + 3y \leq 20$.

b. No, because (5, 4) does not satisfy the second inequality, or because (5, 4) is not in the solution region.

c. The lines intersect at (4, 4), as found in Problem 1.

The minimum x -value of the solution region is 4, so Elijah must buy at least 4 pears.



→ **TRY IT 5.** Walnuts sell for \$6 per pound. Cashews sell for \$3 per pound. Chris wants to make at least 6 pounds of a mixture of walnuts and cashews within his budget of \$30.

- a. Write and graph a system of inequalities that models this situation.
- b. Can Chris make a mixture consisting of 3 pounds of walnuts and 4 pounds of cashews?
- c. What is the maximum amount of walnuts Chris can use to satisfy the conditions described?

□ **EXERCISE YOUR SKILLS**

Solve. Note that your graphs do not have to be exact but label the intersections clearly.

6. A restaurant has a maximum capacity of 80 people. There are 2-seat tables and 6-seat tables. The owner wants to put at least 20 tables in the restaurant.
 - a. Write and graph a system of inequalities that models this situation.
 - b. Can the owner put 20 2-seat tables and 5 6-seat tables?
 - c. What is the minimum number of 2-seat tables that the owner must put?
 - d. What is the maximum number of 6-seat tables that the owner can put?
7. Jason is planting a garden of carrots and tomatoes. The garden has room for a maximum of 20 plants. Jason wants to plant more carrots than tomatoes.
 - a. Write and graph a system of inequalities that models this situation.
 - b. How many of each plant might Jason plant? List two possible combinations.
 - c. What is the maximum number of tomatoes Jason can plant? Be careful with inequalities with no equal sign.
8. A classroom can hold at most 30 students. In the classroom, there are at least twice as many boys as girls.
 - a. Write and graph a system of inequalities that models this situation.
 - b. How many boys and girls can be in the classroom? List two possible combinations.
 - c. What is the maximum number of girls that can be in the classroom?
 - d. If there are 5 girls in the classroom, what is the possible number of boys?
9. Josh and Carl are traveling across the country. They take turns driving a combined total of no more than 8 hours each day. Josh wants to drive at least 3 hours but no more than 5 hours.
 - a. Write and graph a system of inequalities that models this situation.
 - b. How many hours can each drive? List two possible combinations.
 - c. What is the maximum number of hours that Carl will drive?
10. (CHALLENGE) Ella has two part-time jobs. Job A pays \$15 per hour. Job B pays \$30 per hour, but she can work at that job only up to 4 hours per week. Ella wants to work no more than 10 hours per week and to earn at least \$150 per week.
 - a. Write and graph a system of inequalities that models this situation. Notice that there are more than two conditions.
 - b. How many hours can Ella work on each job? List two possible combinations.
 - c. In a certain week, Ella works 3 hours on job B. What is the minimum number of hours Ella must work on job A to meet her goal?