

Applications

- Ana has a car and a motorcycle. She wants to limit the combined mileage of the two vehicles to at most 500 miles per month.
 - Write an inequality to model this condition.
 - Draw a graph of all the (*car miles, motorcycle miles*) pairs that satisfy this condition.
 - What strategy did you use to draw your graph?
- A developer plans to build housing for at least 50 families. He wants to build some single-family houses and some four-family apartment buildings.
 - Write an inequality to model this situation.
 - Draw a graph to display the possible pairs of numbers of single-family houses and apartments the developer can build.
- The Simon family's car emits 0.75 pounds of CO₂ per mile. Their minivan emits 1.2 pounds of CO₂ per mile. The Simons want to limit their emissions to at most 400 pounds per month.
 - Write an inequality to model this condition.
 - Draw a graph of all the (*car miles, minivan miles*) pairs that satisfy this condition.
- Math Club members are selling games and puzzles. They make a profit of \$10 on a game and \$8 on a puzzle. They would like to make at least \$200.
 - What are some possibilities for the number of games and puzzles the Math Club can sell to reach its goal?
 - Write an inequality to model this situation.
 - Draw a graph of all the (*number of games, number of puzzles*) pairs that meet the goal.

For Exercises 5–7, find three (x, y) pairs that satisfy the inequality and three (x, y) pairs that do not. Then, draw a graph showing all the solutions.

5. $x - 4y \geq 8$

6. $4x - y \leq 8$

7. $x - 4y < 8$

8. In parts (a)–(d), graph the inequality.
- a. $x \geq 8 + 4y$ b. $x \geq 4$ c. $y < -2$ d. $2x - 4y \geq 8$
- e. What strategies did you use to draw the graphs?

9. Math Club members want to advertise their fundraiser each week in the school paper. They know that a front-page ad is more effective than an ad inside the paper. They have a \$30 advertising budget. It costs \$2 for each front-page ad and \$1 for each inside-page ad. The club wants to advertise at least 20 times.

- a. What are some possibilities for the numbers of front-page ads and inside-page ads the club can place?
- b. Write a system of linear inequalities to model this situation.
- c. Graph your system of inequalities. Be sure it is clear which region shows the solution.

10. The science club can spend at most \$400 on a field trip to a dinosaur exhibit. It has enough chaperones to allow at most 100 students to go on the trip. The exhibit costs \$3.00 for students 12 years and under and \$6.00 for students over 12.

- a. How many students 12 years and under can go if no students over 12 go?
- b. How many students over 12 can go if no students 12 or under go?
- c. Write a system of linear inequalities to model this situation.
- d. Graph your system of inequalities. Be sure it is clear which region shows the solution.



Find three (x, y) pairs that satisfy the system of inequalities and three (x, y) pairs that do not. Then, draw a graph showing all the solutions.

11.
$$\begin{cases} 4x + 6y \leq 24 \\ x + 5y \leq 10 \end{cases}$$

12.
$$\begin{cases} 2x - y \leq 4 \\ -x + y > -1 \end{cases}$$

**Homework
Help**  **online**
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For: Help with Exercise 9
Web Code: ape-7509

Connections

For Exercises 13 and 14, use a graph to solve the system of equations.

13.
$$\begin{cases} x + y = 18 \\ 3x - y = 10 \end{cases}$$

14.
$$\begin{cases} 80x + 40y = 400 \\ 20x + 80y = 420 \end{cases}$$


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Practice
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15. **Multiple Choice** What is the greatest whole-number value of x for which $4x < 14$?

- A. 11 B. 3 C. 4 D. 14

16. The parks commission in the town of Euclid decides to build a triangular park with one side that is 400 feet long.

a. What are some possibilities for the lengths of the other sides? Explain.

b. The city planner writes these inequalities.

$$x + y > 400 \qquad x + 400 > y \qquad y + 400 > x$$

The variables x and y represent possible lengths for the other two sides of the triangle. Why do these inequalities make sense? Why does the planner need all three inequalities to describe the situation?

c. Graph the three inequalities from part (b) on the same axes.

Describe the region that represents the possible lengths for the other sides of the park.

d. Give a pair of lengths for the other two sides of the park.

Explain how to find this answer by using your graph in part (c).

e. Give a possible pair of lengths that could not be the other two side lengths. Explain how to find this answer using your graph in part (c).

17. Robin wants to make a smoothie out of milk, strawberry yogurt, and ice. She finds this nutrition information:

- A cup of yogurt has 190 calories and 13 grams of protein.
- A cup of milk has 100 calories and 9 grams of protein.
- Ice has no calories and no protein.

Robin wants her smoothie to have about 335 calories and 24 grams of protein.

a. Write a system of equations to model the conditions for Robin's smoothie.

- b. Graph the equations from part (a).
- c. How much yogurt and milk should Robin use to make her smoothie? Explain.
- 18.** Kadian also wants a milk-and-yogurt smoothie. She wants her smoothie to have *at most* 400 calories and *at least* 20 grams of protein.
- a. Write a system of inequalities to model the conditions for Kadian's smoothie.
- b. Graph the system of inequalities. Be sure it is clear which region shows the solution.
- c. Use your graph for part (b) to describe some combinations of milk and yogurt amounts Kadian could use for her smoothie.



Extensions

- 19.** Carolina wants to make a smoothie out of milk, strawberry yogurt, and ice. (See the protein and calorie information in Exercise 17.) She finds this additional information:
- A cup of milk has 306 milligrams of calcium.
 - A cup of yogurt has 415 milligrams of calcium.
 - Ice has no calcium.
- She wants her smoothie to have at most 400 calories, at least 20 grams of protein, and at least 700 mg of calcium.
- a. Write a system of inequalities to model the conditions for Carolina's smoothie.
- b. Graph the system of inequalities. Be sure it is clear which region shows the solution.
- c. What are some (*milk, yogurt*) combinations Carolina might choose?
- 20.** Suppose you are making a smoothie. What nutrients are important to you? Would you like your smoothie to be a good source of vitamin C, calcium, fiber, protein, or calories? What ingredients would you like in your smoothie? Create guidelines for your smoothie. Using nutritional information about the ingredients, write a system of inequalities to help you decide how much of each item to include.