7.8 Video Arcade

Writing and Graphing an Inequality in Two Variables

Objectives

In this lesson, you will:

- Write an inequality in two variables.
- Graph an inequality in two variables.

Key Terms

- linear inequality in two variables
- inequality symbol
- linear equation
- coordinate plane
- half-plane

SCENARIO Your cousin's graduation party is at a restaurant that has a large video arcade. Each person at the party receives a card with fifty points on it to play the games in the arcade. One of your favorite games, a driving game, uses twelve card points per game. Another game that you like, a basketball game, uses eight points per game.

Problem 1 Playing Games

A. Can you play three driving games and two basketball games and not go over the number of points on the card? Show your work.

B. Can you play two driving games and three basketball games and not go over the number of points on the card? Show your work.

C. Can you play one driving game and four basketball games and not go over the number of points on the card? Show your work.

D. Write an expression that represents the total number of points used by playing x driving games and y basketball games.

E. What restrictions must be placed on this expression so that you do not go over the number of points on the card? Use a complete sentence in your answer.

F. One form of a **linear inequality in two variables** can be written as $Ax + By \leq C$. Write an inequality in two variables that represents this problem situation.

Take Note

Recall that an **inequality** is a statement that is formed by placing an **inequality symbol** ($<$, $>$, $\leq$, $\geq$) between two expressions.

Take Note

The forms of a linear inequality in two variables are:

$Ax + By < C$
$Ax + By > C$
$Ax + By \leq C$
$Ax + By \geq C$

Investigate Problem 1

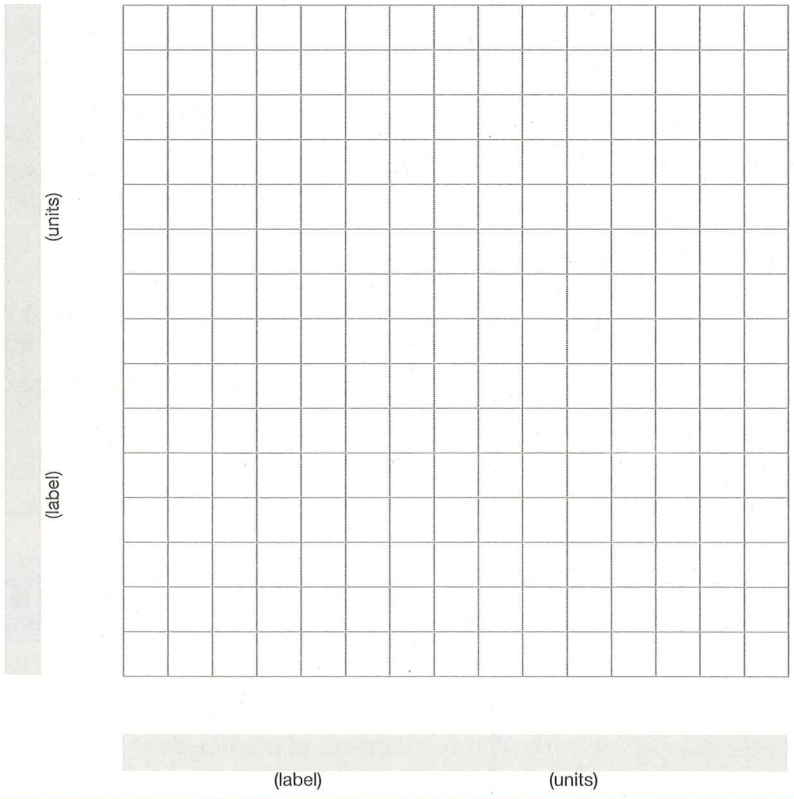
1. Complete the table on the next page that shows different numbers of driving and basketball games played and the numbers of points used.

Investigate Problem 1

Quantity Name	Driving games	Basketball games	Points used
Unit	games	games	points
	0	5	
	1	3	
	2	3	
	2	4	
	3	2	
	3	3	
	4	0	
	4	1	

2. Create a graph of the data in the table on the grid below. If the number of points used in a row does not exceed the card's points, draw a point for the numbers of games. If the number of points used does exceed the card's points, draw an "x" for the numbers of games. Use the bounds and intervals given below. Label your graph clearly.

Variable quantity	Lower bound	Upper bound	Interval
Driving game	0	7.5	0.5
Basketball game	0	7.5	0.5



Investigate Problem 1

3. Write an equation that represents the number of driving games x and the number of basketball games y that can be played for exactly 50 points. Then add the graph of this equation to your graph in Question 2.

4. What do you notice about your graph? Use a complete sentence in your answer.

5. **Just the Math: Linear Inequality** Shade the side of the graph that contains all of the points. This graph is the graph of the *linear inequality* $12x + 8y \leq 50$. A linear inequality is the same as a linear equation except that an inequality symbol ($<$, $>$, $\leq$, or $\geq$) is used instead of an equals sign. How do the solutions of the linear equation $12x + 8y = 50$ differ from the solutions of the linear inequality $12x + 8y \leq 50$? Use complete sentences in your answer.

Take Note

A **linear equation** in two variables is an equation in which each of the variables is raised to the first power (such as x, rather than x^2) and, when in simplest form, each variable only appears once.

6. **Just the Math: Graphs of Linear Inequalities** The graph of a linear inequality is a **half-plane,** or half of a **coordinate plane**. A line, given by the inequality, divides the plane into two half-planes and the inequality symbol tells you which half-plane contains all the solutions. If the symbol is $\leq$ or $\geq$, the graph includes the line. If the symbol is $<$ or $>$, the graph does not include the line and is represented by a dashed line. For which inequalities below would you include the line? Which inequalities below would you represent by using a dashed line? Write your answers using complete sentences.

$y > -6 - x$ $\qquad$ $2x + 3y \geq 4$ $\qquad$ $x + 5y \leq 10$

$3x + 12y > 5$ $\qquad$ $y \geq -x + 2$ $\qquad$ $x - y < 3$

7

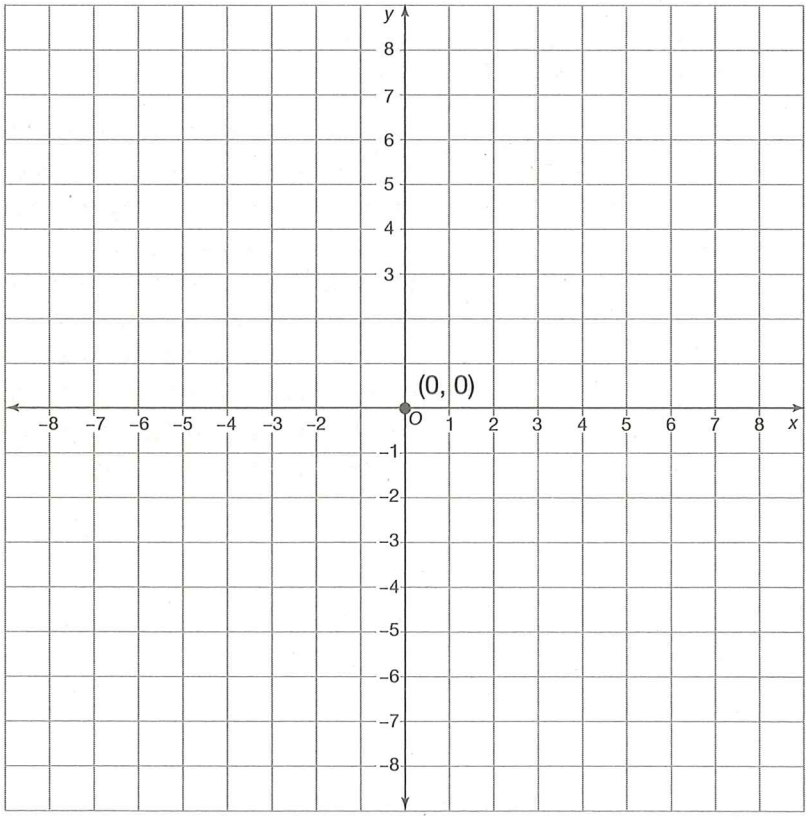
Investigate Problem 1

Consider the linear inequality $y < 4x + 3$. The line that divides the plane is given by $y = 4x + 3$. Should this line be a solid line or a dashed line? Use a complete sentence to explain. Then draw the correct type of line on the grid below.

After you draw the correct type of line, you need to decide which half-plane contains all the solutions, because this is the half-plane that you will shade. To make your decision, consider the point (0, 0). If (0, 0) is a solution, then the half-plane that contains (0, 0) contains all the solutions and should be shaded. If (0, 0) is not a solution, then the half-plane that does not contain (0, 0) contains all the solutions and should be shaded.

Is (0, 0) a solution? Show your work.

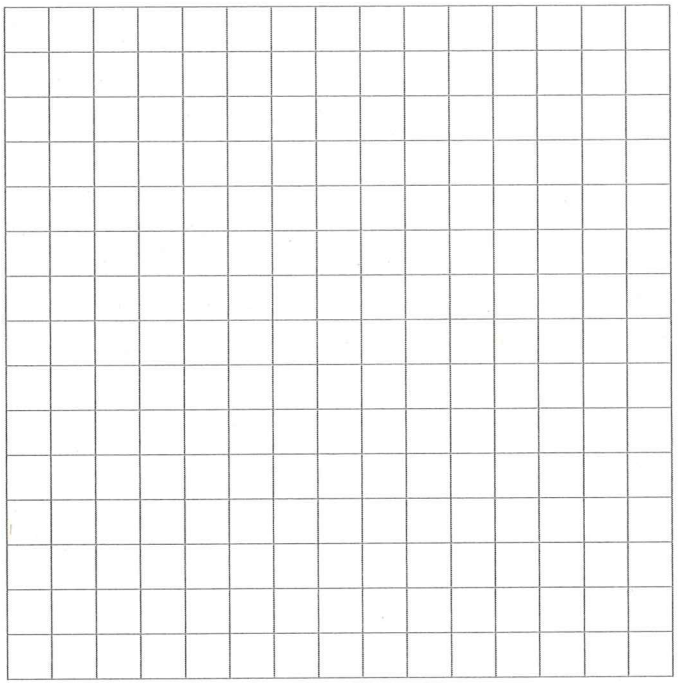
Now shade the correct half-plane on the grid below.



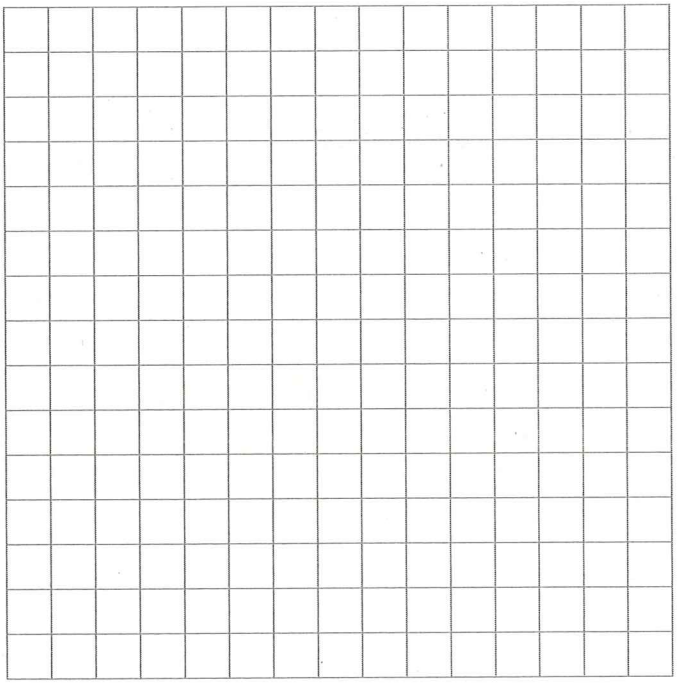
Investigate Problem 1

7. Graph each linear inequality.

$y > x + 2$



$y \leq -x + 3$



7