Concepts
Linear Inequalities in Two Variables

Based on power point presentations by Pearson Education, Inc.
Revised by Ingrid Stewart, Ph.D.

Learning Objectives

1. Recognize linear inequalities in two variables.
2. Graph linear inequalities in two variables by hand.

NOTE: This lesson contains some examples. You can find more examples in the “Examples” document also located in the appropriate MOM Learning Materials folder.

1. Definition of Linear Inequalities in Two Variables

Linear inequalities in TWO variables are much like linear equations in TWO variables, however, they differ from linear equalities because they DO NOT contain an equal sign. Instead, they contain inequality signs.

Examples:

Linear Equation in Two Variables:

$6x - 15y = 3$ (not in general form)

Four different Linear Inequalities in Two Variables:

$6x - 15y \geq 3$

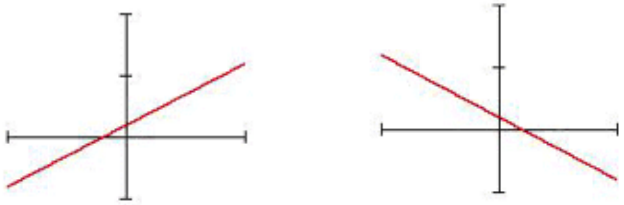
$6x - 15y > 3$

$6x - 15y \leq 3$

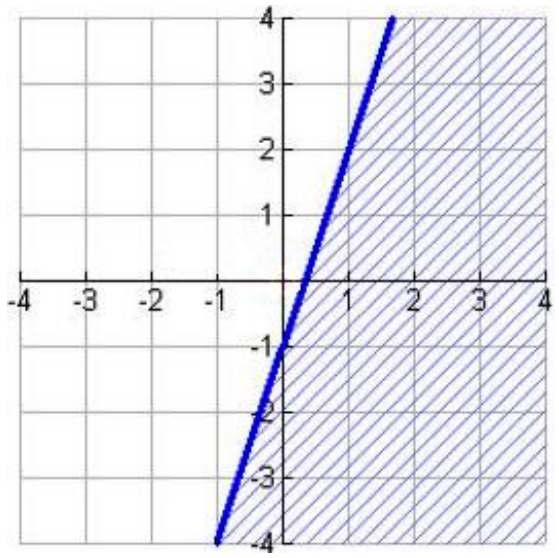
$6x - 15y < 3$

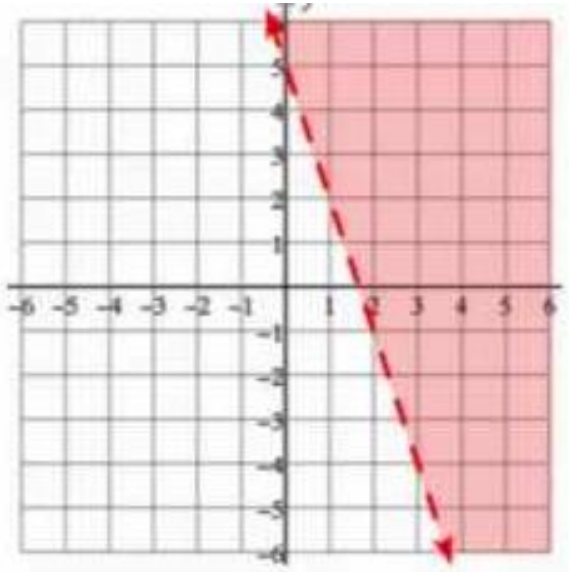
2. Graphs of Linear Inequalities in Two Variables (1 of 7)

The graphs of linear EQUATIONS in two variables consist of straight lines. For example,



On the other hand, the graphs of linear INEQUALITIES in two variables consist of plane regions. For example,





The solid dark blue line and the dashed red line are called **boundary lines**. The graphs of linear inequalities consist of the boundary lines and the shaded plane regions.

Graphs of Linear Inequalities in Two Variables (2 of 7)

Graphing Linear Inequalities in two variables by hand:

Step 1 – Replace the inequality sign with an equal sign.

Example 1:

Graph the linear inequality $2x - y \geq 4$ by hand.

We replace the inequality sign with and equal sign to get $2x - y = 4$. This is a linear equation in two variables.

Graphs of Linear Inequalities in Two Variables (3 of 7)

Step 2 – Find and graph the **boundary line** which is the graph of the equation from Step 1.

- Draw a solid line if the original inequality contains a ≤ or ≥ symbol.
- Draw a dashed line if the original inequality contains a < or > symbol

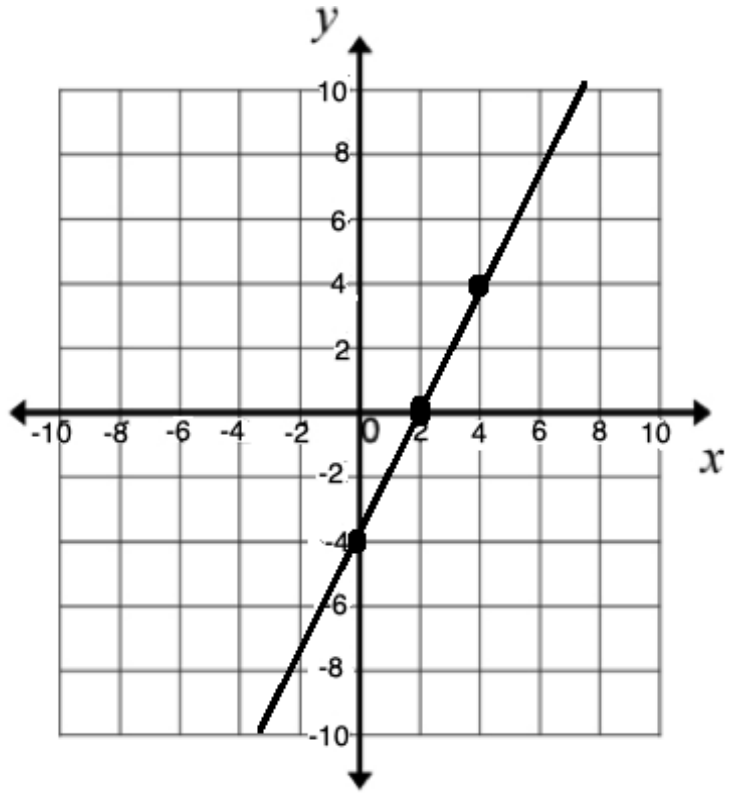
Example 1 continued:

Given ≥ (greater than or equal) in $2x - y \geq 4$, we have a solid boundary line.

Graphs of Linear Inequalities in Two Variables (4 of 7)

Example 1 continued:

Following is the graph of $2x - y = 4$. This is the boundary line of the graph of $2x - y \geq 4$.



Graphs of Linear Inequalities in Two Variables (5 of 7)

Step 3 – Find the portion of the coordinate plane to be included in the graph.

a. Choose a "test point" to produce a "True" or a "False" statement in the inequality. The "test point" CANNOT lie on the boundary line!!! Substitute the coordinates of the test point into the inequality.

Example 1 continued:

We will use the point created by the ordered pair (– 4, 2) since it does not lie on the boundary line. See graph in previous slide.

Then, we place (– 4, 2) into $2x - y \geq 4$:

$2(-4) - (2) \stackrel{?}{\geq} 4$

$-10 \stackrel{?}{\geq} 4$ which is a **FALSE statement** since – 10 is neither equal to nor greater than 4!

Graphs of Linear Inequalities in Two Variables (6 of 7)

b. If the calculations in Step 3 result in a “False” statement, shade the side of the boundary line NOT containing the test point. This is the graph of the linear inequality in two variables.

   If the calculations in Step 3 result in a “True” statement, shade the side of the boundary line containing the test point. This is the graph of the linear inequality in two variables.

Graphs of Linear Inequalities in Two Variables (7 of 7)

Example 1 continued:

Following is the graph of $2x - y \geq 4$. Since we produced a "False" statement using the test point $(-4, 2)$, we shaded the side of the boundary line NOT containing the test point