CHAPTER

3

Linear Functions and Inequalities in Two Variables

3.7 Inequalities in Two Variables

Objective

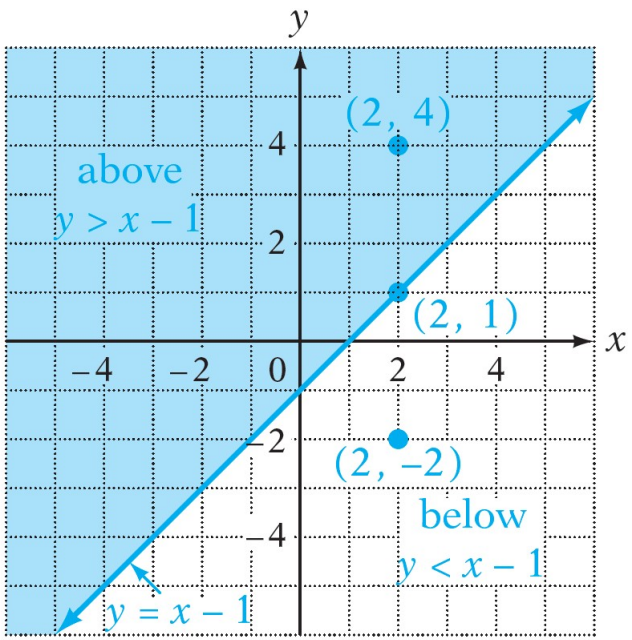
1. Graph the solution set of an inequality in two variables

Graph the solution set of an inequality in two variables

Graph the solution set of an inequality in two variables

The graph of the linear equation $y = x - 1$ separates the plane into three sets: the set of points on the line, the set of points above the line, and the set of points below the line.

The set of points on the line are the solutions of the equation $y = x - 1$. The set of points above the line are the solutions of the inequality $y > x - 1$. These points form a **half-plane.** The set of points below the line are solutions of the inequality $y < x - 1$. These points also form a half-plane.



Graph the solution set of an inequality in two variables

An inequality of the form $y > mx + b$ or $Ax + By > C$ is a **linear inequality in two variables.** (The inequality symbol could be replaced by ≥ , < , or ≤.) The solution set of a linear inequality in two variables is a half-plane.

If the inequality contains ≤ or ≥, the line belongs to the solution set and is shown by a *solid line*. If the inequality contains < or >, the line is not part of the solution set and is shown by a *dashed line*.

If the inequality contains > or ≥, shade the upper half-plane.
If the inequality contains < or ≤, shade the lower half-plane.

Graph the solution set of an inequality in two variables

As a check, use the ordered pair (0, 0) to determine whether the correct region of the plane has been shaded.

If (0, 0) is a solution of the inequality, then (0, 0) should be in the shaded region. If (0, 0) is not a solution of the inequality, then (0, 0) should not be in the shaded region.

Note: If the line passes through the point (0, 0), another point, such as (0, 1), must be used as a check.

Example 1

Graph the solution set of $x + 2y \leq 4$

Solution:

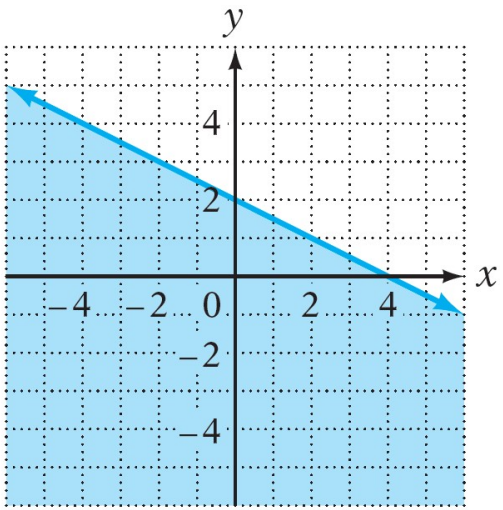
$$x + 2y \leq 4$$

Solve the inequality for y.

$$2y \leq -x + 4$$

$$y \leq -\frac{1}{2}x + 2$$

Because the inequality includes "equal to," graph $y = -\frac{1}{2}x + 2$ as a solid line.



Because the inequality is a "less than" inequality, shade the lower half-plane.