

6.6 Notes

GOAL Solve systems of linear inequalities in two variables.

Vocabulary

A **system of linear inequalities** in two variables, or simply a *system of inequalities*, consists of two or more linear inequalities in the same variables.

A **solution of a system of linear inequalities** is an ordered pair that is a solution of each inequality in the system.

The **graph of a system of linear inequalities** is the graph of all solutions of the system.

Common Student Errors

- Incorrectly graphing the intersection of the half-planes

Tip Colored pencils may help distinguish different half-planes. The intersection is the region that has been shaded with every color.

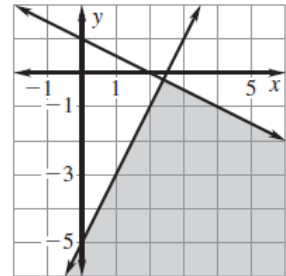
- Forgetting to use a dashed line for an inequality involving $<$ or $>$

Tip Remind students to use dashed lines for $<$ or $>$ and solid lines for \leq or \geq .

Example: Graph $y \geq 2x - 5$

$$y < -\frac{1}{2}x + 1.$$

Student graph:



EXAMPLE 1 Graph a system of two linear inequalities

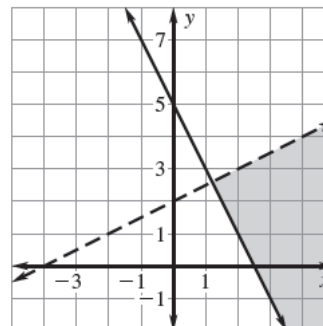
Graph the system of inequalities.

$$y < \frac{1}{2}x + 2 \quad \text{Inequality 1}$$

$$y \geq -2x + 5 \quad \text{Inequality 2}$$

Solution

Graph both inequalities in the same coordinate plane. The graph of the system is the intersection of the two half-planes, which is shown as the shaded region.



CHECK Choose a point in the shaded region, such as (2, 2). To check this solution, substitute 2 for x and 2 for y into each inequality.

Inequality 1

$$y < \frac{1}{2}x + 2$$

$$2 \stackrel{?}{<} \frac{1}{2}(2) + 2$$

$$2 < 3 \checkmark$$

Inequality 2

$$y \geq -2x + 5$$

$$2 \stackrel{?}{\geq} -2(2) + 5$$

$$2 \geq 1 \checkmark$$

EXAMPLE 2 Graph a system of three linear inequalities

Graph the system of inequalities.

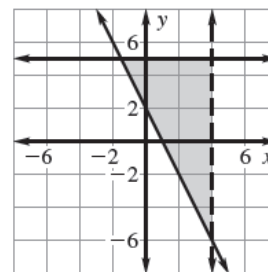
$$y \leq 5 \quad \text{Inequality 1}$$

$$x < 4 \quad \text{Inequality 2}$$

$$y \geq -2x + 2 \quad \text{Inequality 3}$$

Solution

Graph all three inequalities in the same coordinate plane. The graph of the system is the triangular region shown.



Exercises for Examples 1 and 2

Graph the system of linear inequalities.

1. $y > 3x - 2$

$$y \leq \frac{2}{3}x + 1$$

2. $x > -2$

$$y > -3$$

$$y \leq \frac{3}{4}x + 2$$

3. $y > 2$

$$y < 8$$

$$y \geq 4x - 1$$

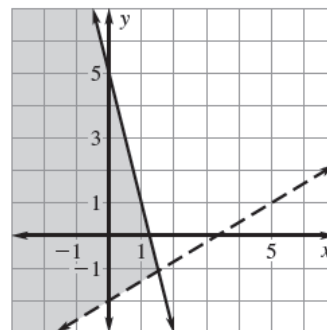
EXAMPLE 3

Write a system of linear inequalities

Write a system of inequalities for the shaded region.

Solution

Inequality 1 One boundary for the shaded region has a slope of -4 and a y -intercept of 5 . So, its equation is $y = -4x + 5$. Because the shaded region is *below* the *solid line*, the inequality is $y \leq -4x + 5$.



Inequality 2 Another boundary line for the shaded region has a slope of $\frac{3}{5}$ and a y -intercept of -2 . So, its equation is $y = \frac{3}{5}x - 2$. Because the shaded region is *above* the *dashed line*, the inequality is $y > \frac{3}{5}x - 2$.

The system of inequalities for the shaded region is: $y \leq -4x + 5$ Inequality 1

$$y > \frac{3}{5}x - 2 \quad \text{Inequality 2}$$

Exercises for Example 3

Write a system of inequalities that defines the shaded region.

