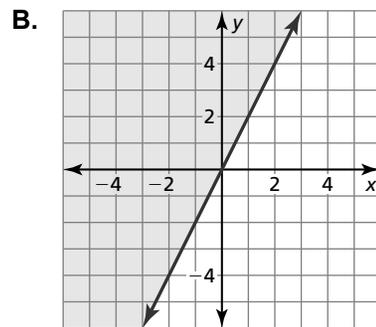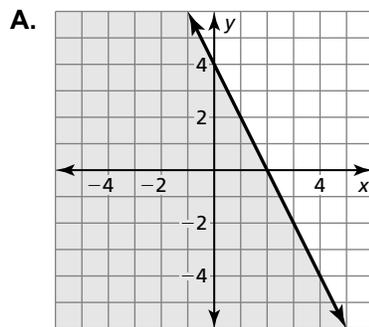Name _____ Date _____

Essential Question   How can you graph a system of linear inequalities?

1 EXPLORATION: Graphing Linear Inequalities

Work with a partner. Match each linear inequality with its graph. Explain your reasoning.

$$2x + y \leq 4 \qquad \text{Inequality 1}$$
$$2x - y \leq 0 \qquad \text{Inequality 2}$$

A.

B.

2 EXPLORATION: Graphing a System of Linear Inequalities
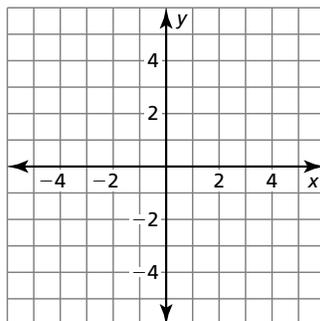
Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. Consider the linear inequalities given in Exploration 1.

$$2x + y \leq 4 \qquad \text{Inequality 1}$$
$$2x - y \leq 0 \qquad \text{Inequality 2}$$

a. Use two different colors to graph the inequalities in the same coordinate plane. What is the result?

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2 **EXPLORATION:** Graphing a System of Linear Inequalities (continued)

   b. Describe each of the shaded regions of the graph. What does the unshaded
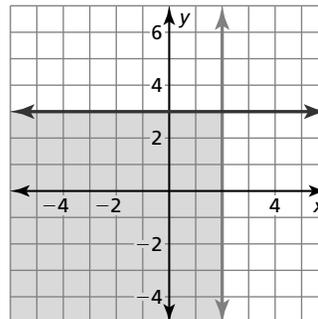   region represent?

Communicate Your Answer

   3. How can you graph a system of linear inequalities?

   4. When graphing a system of linear inequalities, which region represents the
   solution of the system?

   5. Do you think all systems of linear inequalities have a solution? Explain your
   reasoning.

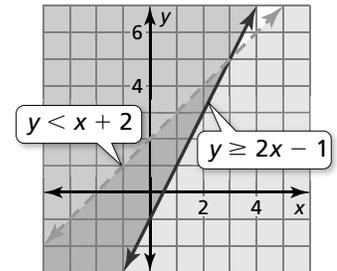   **6.** Write a system of linear inequalities
   represented by the graph.

Name_____ Date _____

Core Concepts

Graphing a System of Linear Inequalities

Step 1 Graph each inequality in the same coordinate plane.

Step 2 Find the intersection of the half-planes that are solutions of the inequalities. This intersection is the graph of the system.

$y < x + 2$

$y \geq 2x - 1$

Notes:

Worked-Out Examples

Example #1

Graph the system of linear inequalities.
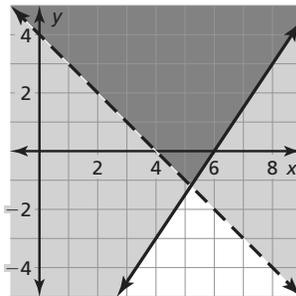
$x + y > 4$

$y \geq \frac{3}{2}x - 9$

Graph the system.

$x + y > 4$

$x - x + y > 4 - x$

$\qquad y > -x + 4$

$y \geq \frac{3}{2}x - 9$

Example #2

Write a system of linear inequalities represented by the graph.

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

Inequality 2: The slope of the other boundary line is 1, and the y-intercept is -2. So, an equation of this line is $y = x - 2$. Because the shaded region is above this dashed boundary line, the inequality is $y > x - 2$.

So, the system of linear inequalities represented by the graph is $y \leq 5x + 1$ and $y > x - 2$.

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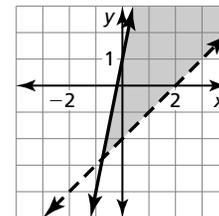
Practice A

In Exercises 1–4, tell whether the ordered pair is a solution of the system of linear inequalities.

1. $(0, 0)$; $y > 2$
$\quad\quad\quad y < x - 2$
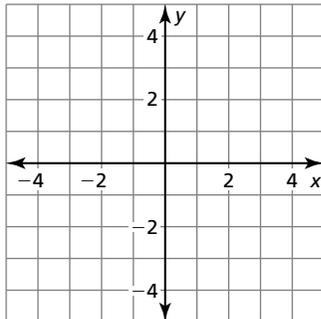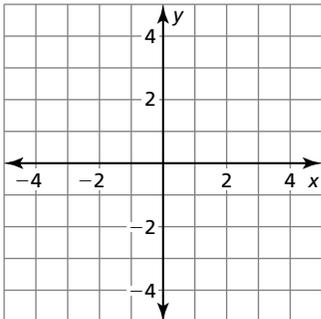
2. $(-1, 1)$; $y < 3$
$\quad\quad\quad\quad y > x - 4$

3. $(2, 3)$; $y \geq x + 4$
$\quad\quad\quad y \leq 2x + 4$

4. $(0, 4)$; $y \leq -x + 4$
$\quad\quad\quad\quad y \geq 5x - 3$

In Exercises 5–8, graph the system of linear inequalities.

5. $y > -2$
$\quad y \leq 3x$

6. $y < 3$
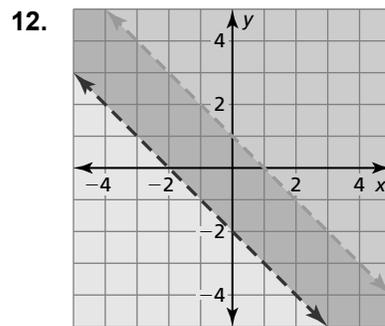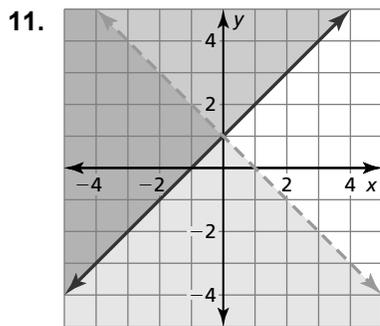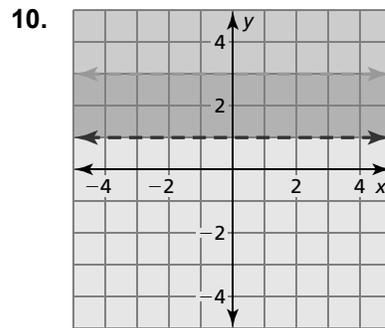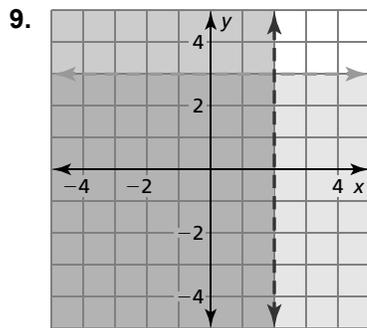$\quad x < 2$

Name_____ Date _____

7. $y \geq x - 2$
$y < -x + 2$
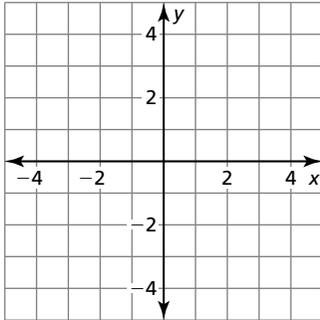
8. $2x + 3y < 6$
$y - 1 \geq -2x$
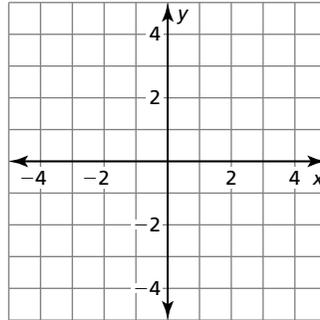
In Exercises 9–12, write a system of linear inequalities represented by the graph.

9.

10.

11.

12.

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Practice B

In Exercises 1 and 2, tell whether the ordered pair is a solution of the system of linear inequalities.

1. $(2, 0);\ y > x - 5$
$\qquad\quad y \leq 2x + 1$

2. $(1, 4);\ y < 2x + 2$
$\qquad\quad y \geq -3x + 4$

In Exercises 3–8, graph the system of linear inequalities.

3. $x + y \leq 2$
$\quad\ y \leq 1$

4. $3x + y > 4$
$\quad\ y < -3x + 1$

5. $x - y < 3$
$\quad\ -x - y \geq -1$

6. $y \leq \frac{1}{3}x + 2$
$\quad\ y > -\frac{1}{2}x + 5$
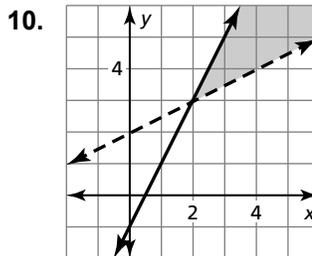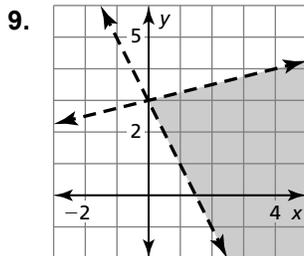
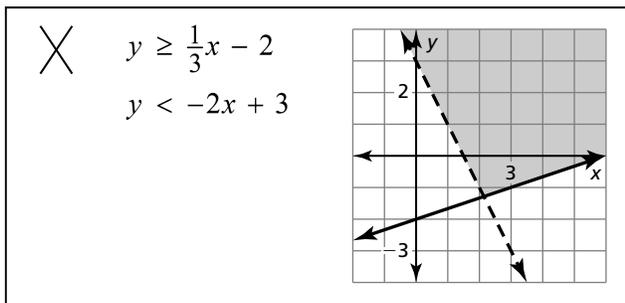**7.** $x > -2$
$\quad\ y < 3$
$\quad\ y \geq 2x - 1$

8. $x + y > 4$
$\quad\ x - y < -1$
$\quad\ y > 7$

In Exercises 9 and 10, write a system of linear inequalities represented by the graph.

9.

10.

11. Describe and correct the error in graphing the system of inequalities.

$\qquad \times \quad y \geq \frac{1}{3}x - 2$

$\qquad\qquad\ y < -2x + 3$

12. The points $(1, 2), (5, 5), (1, 6)$ are the vertices of a shaded triangle.

    a. Write a system of linear inequalities represented by the shaded triangle.

    b. Find the area of the triangle.