5.7 Systems of Linear Inequalities

Do Now: Solve the system of equations using your choice of method.

$x + 3y = -27$
$13x - 6y = -36$

Example 1: Checking Solutions

Tell whether each ordered pair is a solution of the system of linear inequalities.

$y < 2x$
$y \geq x + 1$

a. (3 , 5)

b. (-2 , 0)

Graphing systems of linear inequalities.

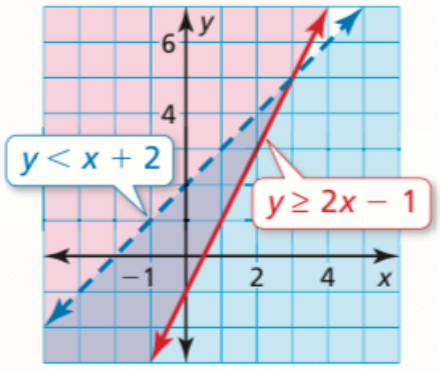
The graph of a system of linear inequalities is where both graphs OVERLAP solutions.

Core Concept

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.

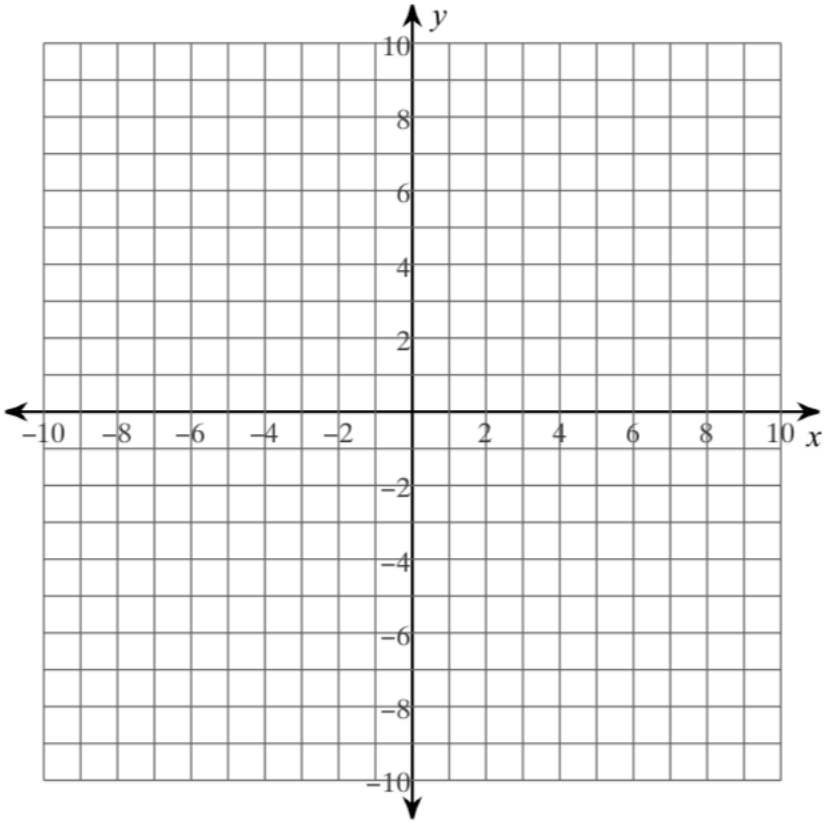


Example 2: Graphing a System of Linear Inequalities.

Graph the system of linear inequalities

$y \leq 3$
$y > x + 2$

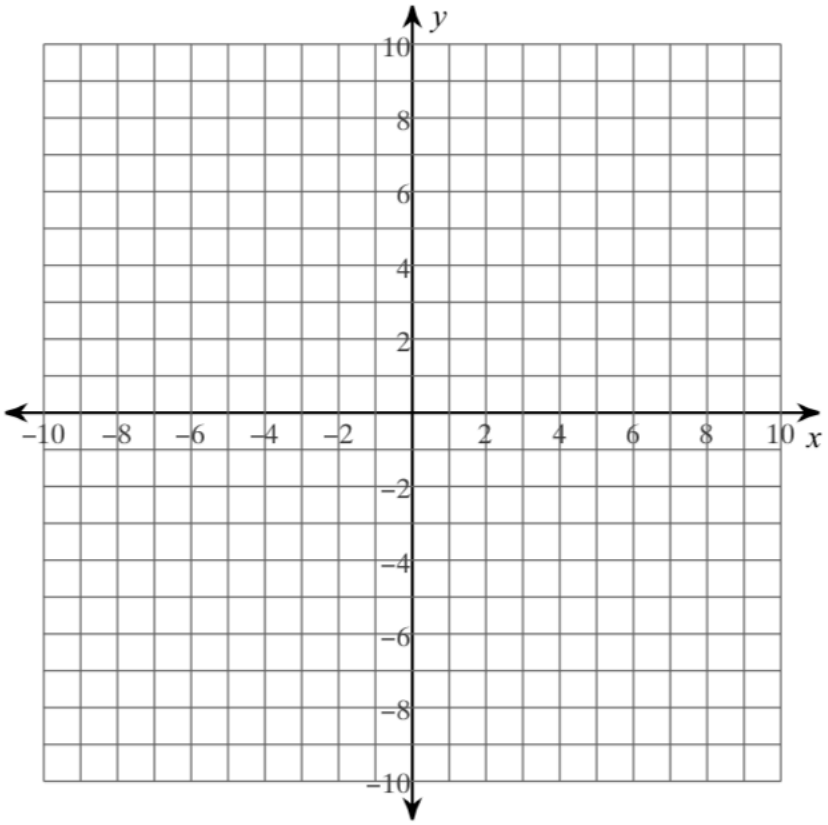
Pick a solution point and test it.



Example 3: Graphing a System of Linear Inequalities.

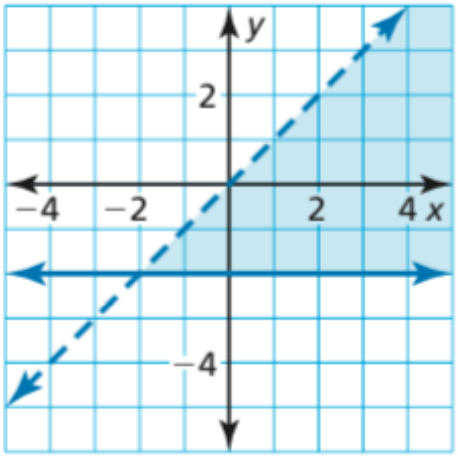
$2x + y < -1$
$4x + 2y > 6$

Pick a solution point and test it.



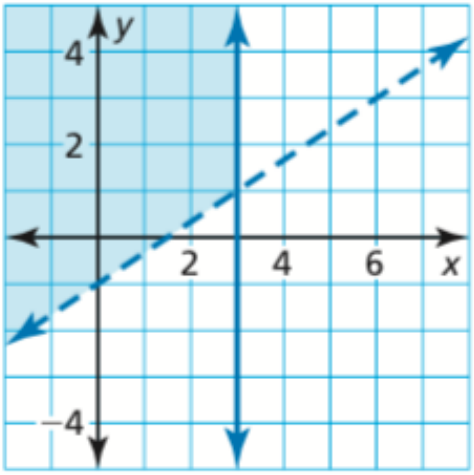
Example 4: Writing a system of linear inequalities

Write a system of linear inequalities represented by the graph.



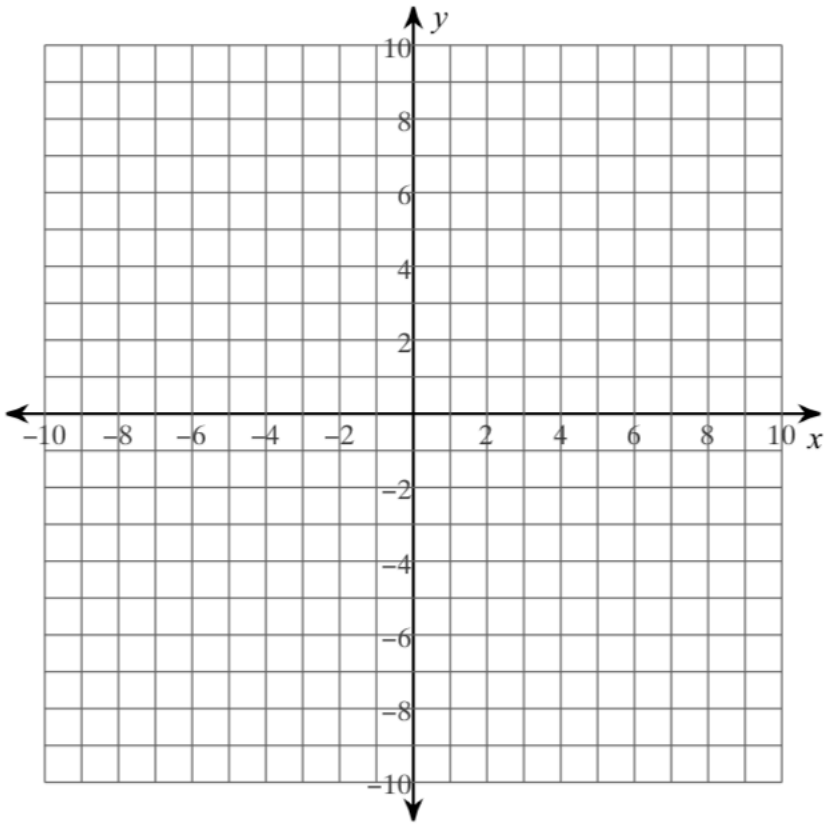
Example 5: Writing a system of linear inequalities

Write a system of linear inequalities represented by the graph.



Example 6: Modeling with mathematics

Jessica has at most 8 hours to spend at the mall and at the beach. She wants to spend at least 2hrs at the mall and more than 4hrs At the beach. Write and graph a system that represents the situation.



Classwork / Homework
3-6, 8, 9, 11, 14, 15, 24, 26, 29,

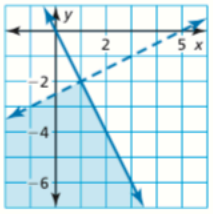
5.7 Exercises

Dynamic Solutions available at *BigIdeasMath.com*

Vocabulary and Core Concept Check

1. **VOCABULARY** How can you verify that an ordered pair is a solution of a system of linear inequalities?

2. **WHICH ONE DOESN'T BELONG?** Use the graph shown. Which of the ordered pairs does *not* belong with the other three? Explain your reasoning.

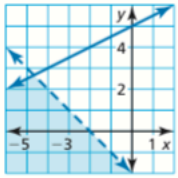


$(1, -2)$ $(0, -4)$ $(-1, -6)$ $(2, -4)$

Monitoring Progress and Modeling with Mathematics

In Exercises 3–6, tell whether the ordered pair is a solution of the system of linear inequalities.

3. $(-4, 3)$
4. $(-3, -1)$
5. $(-2, 5)$
6. $(1, 1)$



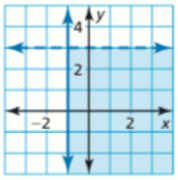
In Exercises 7–10, tell whether the ordered pair is a solution of the system of linear inequalities. *(See Example 1.)*

7. $(-5, 2)$; $y < 4$, $y > x + 3$
8. $(1, -1)$; $y > -2$, $y > x - 5$
9. $(0, 0)$; $y \leq x + 7$, $y \geq 2x + 3$
10. $(4, -3)$; $y \leq -x + 1$, $y \leq 5x - 2$

In Exercises 11–20, graph the system of linear inequalities. *(See Examples 2 and 3.)*

11. $y > -3$, $y \geq 5x$
12. $y < -1$, $x > 4$
13. $y < -2$, $y > 2$
14. $y < x - 1$, $y \geq x + 1$
15. $y \geq -5$, $y - 1 < 3x$
16. $x + y > 4$, $y \geq \frac{3}{2}x - 9$
17. $x + y > 1$, $-x - y < -3$
18. $2x + y \leq 5$, $y + 2 \geq -2x$
19. $x < 4$, $y > 1$, $y \geq -x + 1$
20. $x + y \leq 10$, $x - y \geq 2$, $y > 2$

In Exercises 21–26, write a system of linear inequalities represented by the graph. *(See Examples 4 and 5.)*

21.


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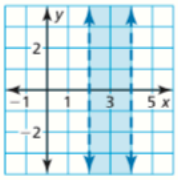

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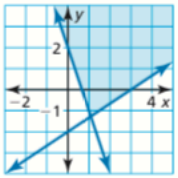

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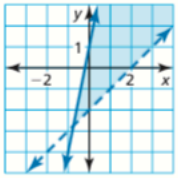

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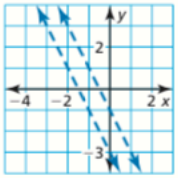

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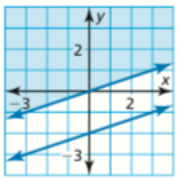
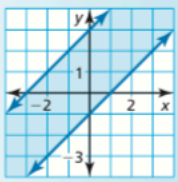


ERROR ANALYSIS **In Exercises 27 and 28, describe and correct the error in graphing the system of linear inequalities.**

27.

$y \leq x - 1$

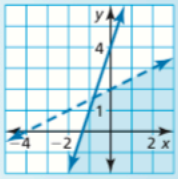
$y \geq x + 3$



28.

$y \leq 3x + 4$

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



29. **MODELING WITH MATHEMATICS** You can spend at most \$21 on fruit. Blueberries cost \$4 per pound, and strawberries cost \$3 per pound. You need at least 3 pounds of fruit to make muffins. *(See Example 6.)*

a. Write and graph a system of linear inequalities that represents the situation.

b. Identify and interpret a solution of the system.

c. Use the graph to determine whether you can buy 4 pounds of blueberries and 1 pound of strawberries.

30. **MODELING WITH MATHEMATICS** You earn \$10 per hour working as a manager at a grocery store. You are required to work at the grocery store at least 8 hours per week. You also teach music lessons for \$15 per hour. You need to earn at least \$120 per week, but you do not want to work more than 20 hours per week.

a. Write and graph a system of linear inequalities that represents the situation.

b. Identify and interpret a solution of the system.

c. Use the graph to determine whether you can work 8 hours at the grocery store and teach 1 hour of music lessons.

31. **MODELING WITH MATHEMATICS** You are fishing for surfperch and rockfish, which are species of bottomfish. Gaming laws allow you to catch no more than 15 surfperch per day, no more than 10 rockfish per day, and no more than 20 total bottomfish per day.

a. Write and graph a system of linear inequalities that represents the situation.

b. Use the graph to determine whether you can catch 11 surfperch and 9 rockfish in 1 day.

surfperch

rockfish

32. **REASONING** Describe the intersection of the half-planes of the system shown.

$$x - y \leq 4$$
$$x - y \geq 4$$

33. **MATHEMATICAL CONNECTIONS** The following points are the vertices of a shaded rectangle.

$(-1, 1), (6, 1), (6, -3), (-1, -3)$

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

b. Find the area of the rectangle.

34. **MATHEMATICAL CONNECTIONS** The following points are the vertices of a shaded triangle.

$(2, 5), (6, -3), (-2, -3)$

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

b. Find the area of the triangle.

35. **PROBLEM SOLVING** You plan to spend less than half of your monthly \$2000 paycheck on housing and savings. You want to spend at least 10% of your paycheck on savings and at most 30% of it on housing. How much money can you spend on savings and housing?

36. **PROBLEM SOLVING** On a road trip with a friend, you drive about 70 miles per hour, and your friend drives about 60 miles per hour. The plan is to drive less than 15 hours and at least 600 miles each day. Your friend will drive more hours than you. How many hours can you and your friend each drive in 1 day?