Name ____ Date ___________ Class ____________

LESSON **3-3**

Review for Mastery

Solving Systems of Linear Inequalities

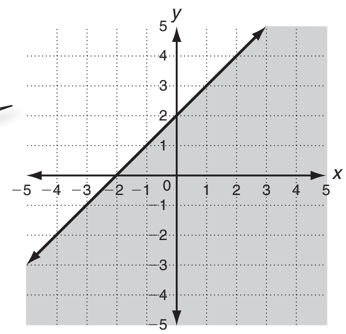
To use graphs to find the solution to a system of inequalities:

1. Draw the graph of the boundary for the first inequality. Remember to use a solid line for $\leq$ or $\geq$ and a dashed line for $<$ or $>$.
2. Shade the region above or below the boundary line that is a solution of the inequality.
3. Draw the graph of the boundary for the second inequality.
4. Shade the region above or below the boundary line that is a solution of the inequality using a different pattern.
5. The region where the shadings overlap is the solution region.

Graph $\begin{cases} y \leq x + 2 \\ x > 1 \end{cases}$ Graph $y \leq x + 2$.

Graph $y = x + 2$.

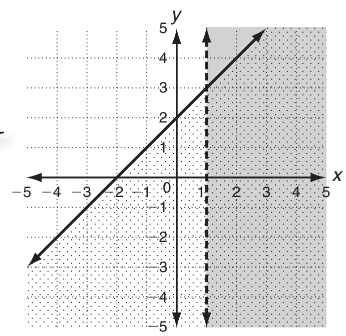
Use a solid line for the boundary.
Shade the region below the line.



On the same plane, graph $x > 1$.

Graph $x = 1$.

Use a dashed line for the boundary.
Shade the region to the right of the line.



Check: Test a point in the solution region in both inequalities.
Try $(2, 2)$.

$y \leq x + 2$ $\qquad$ $x > 1$

$2 \overset{?}{\leq} 2 + 2$ $\qquad$ $2 > 1$

$2 \leq 4$

Graph the system of inequalities.

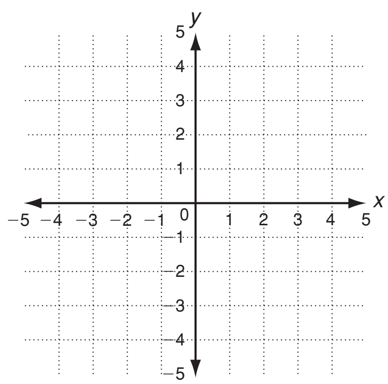
1. $\begin{cases} y > -x + 1 \\ y \leq 2 \end{cases}$

a. Shade ______________ the line for $y > -x + 1$.

b. Shade ______________ the line for $y \leq 2$.

c. Check: ___________________________________

d. Check: ___________________________________



Name ____ Date ___________ Class ____________

LESSON **3-3**

Review for Mastery

Solving Systems of Linear Inequalities (continued)

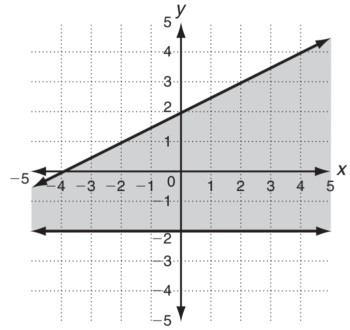
The solution of a system of inequalities may create a geometric figure.

Graph $\begin{cases} y \le \frac{1}{2}x + 2 \\ y \ge -2 \\ x \le 3 \\ x \ge -2 \end{cases}$

The graph of $y = -2$ is a horizontal line.
The graphs of $x = 3$ and $x = -2$ are vertical lines.

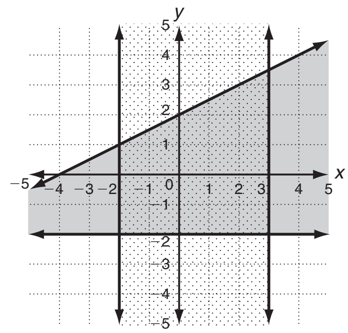
Graph $y \le \frac{1}{2}x + 2$ and $y \ge -2$.

Use solid boundary lines.
Shade the region below $y \le \frac{1}{2}x + 2$ and above $y \ge -2$.



On the same plane, graph $x \le 3$ and $x \ge -2$.

Use solid boundary lines.
Shade the region to the left of $x \le 3$ and to the right of $x \ge -2$.



The figure created by the overlapping pattern is a quadrilateral with one pair of parallel sides. The figure is a trapezoid.

Graph the system of inequalities. Classify the figure created by the solution region.

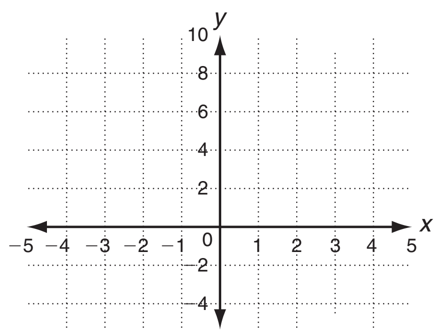
2. $\begin{cases} y \le 2x + 1 \\ y \ge -x + 1 \\ x \le 3 \end{cases}$

a. Shade ______________ the line for $y \le 2x + 1$.

b. Shade ______________ the line for $y \ge -x + 1$.

c. Shade to the ______________ of the line for $x \le 3$.

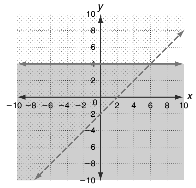
d. The figure is a ______________________.



LESSON 3-3 Practice A
Solving Systems of Linear Inequalities

Graph each system of inequalities.

1. $\begin{cases} y \le 4 \\ y > x - 2 \end{cases}$



a. In order to graph $y \le 4$, draw the line for $y = 4$.

b. Now shade the area below the line to show $y \le 4$.

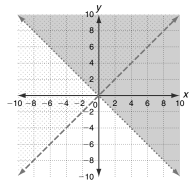
c. In order to graph $y > x - 2$, draw the line that represents $y = x - 2$. Make the line dashed since the line is not included in the inequality.

d. Shade the area above the line.

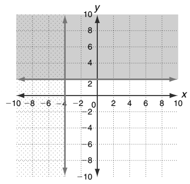
e. Describe the solution region of this system of inequalities.

Possible answer: The solution region is the area where the two shading patterns overlap.

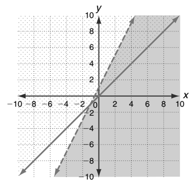
2. $\begin{cases} y > x \\ y > -x \end{cases}$



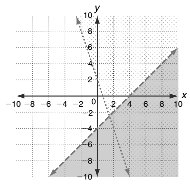
3. $\begin{cases} x \le -4 \\ y \ge 2 \end{cases}$



4. $\begin{cases} y < 2x + 1 \\ y \ge x \end{cases}$



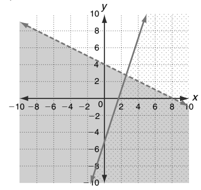
5. $\begin{cases} y < x - 4 \\ y > -3x + 2 \end{cases}$



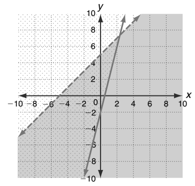
LESSON 3-3 Practice B
Solving Systems of Linear Inequalities

Graph each system of inequalities.

1. $\begin{cases} y \le 3x - 5 \\ y < -\frac{1}{2}x + 4 \end{cases}$

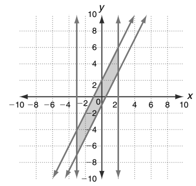


2. $\begin{cases} y < x + 5 \\ y \ge 4x - 2 \end{cases}$

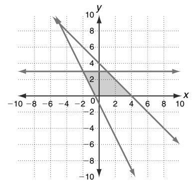


Graph the system of inequalities, and classify the figure created by the solution region.

3. $\begin{cases} x \le 2 \\ x \ge -3 \\ y \le 2x + 2 \\ y \ge 2x - 1 \end{cases}$ **Parallelogram**



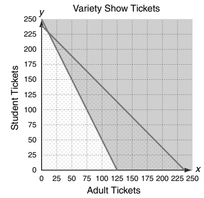
4. $\begin{cases} y \le -x + 4 \\ y \le 3 \\ y \ge 0 \\ y \ge -2x - 1 \end{cases}$ **Trapezoid**



Solve.

5. The Thespian Club is selling tickets to its annual variety show. Prices are $8 for an adult ticket and $4 for a student ticket. The club needs to raise $1000 to pay for costumes and stage sets. The auditorium has a seating capacity of 240. Write and graph a system of inequalities that can be used to determine how many tickets have to be sold for the club to meet its goal.

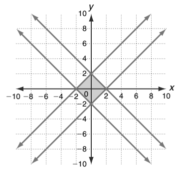
$\begin{cases} 8x + 4y \ge 1000 \\ x + y \le 240 \end{cases}$



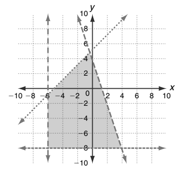
LESSON 3-3 Practice C
Solving Systems of Linear Inequalities

Graph the system of inequalities, and classify the figure created by the solution region.

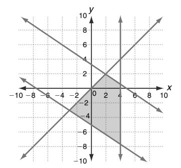
1. $\begin{cases} y \le -x + 2 \\ y \le x + 2 \\ y \ge -x - 2 \\ y \ge x - 2 \end{cases}$ **Square**



2. $\begin{cases} y < -3x + 4 \\ y > -8 \\ y < x + 5 \\ x > -6 \end{cases}$ **Quadrilateral**



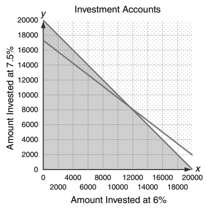
3. $\begin{cases} y \le -\frac{2}{3}x + 3 \\ y \le x \\ y \ge -\frac{2}{3}x - 5 \\ x \le 4 \end{cases}$ **Trapezoid**



Solve.

4. Anton wants to divide a maximum of $20,000 between two simple interest investment accounts. One pays 6% interest and the other pays 7.5% interest. Write and graph a system of inequalities that shows the amounts Anton can invest in each account and still earn at least $1300 per year.

$\begin{cases} x + y \le 20{,}000 \\ 0.06x + 0.075y \ge 1300 \end{cases}$



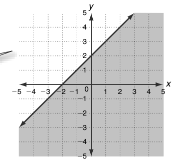
LESSON 3-3 Review for Mastery
Solving Systems of Linear Inequalities

To use graphs to find the solution to a system of inequalities:

1. Draw the graph of the boundary for the first inequality. Remember to use a solid line for $\le$ or $\ge$ and a dashed line for $<$ or $>$.
2. Shade the region above or below the boundary line that is a solution of the inequality.
3. Draw the graph of the boundary for the second inequality.
4. Shade the region above or below the boundary line that is a solution of the inequality using a different pattern.
5. The region where the shadings overlap is the solution region.

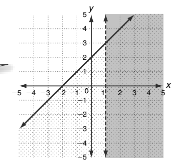
Graph $\begin{cases} y \le x + 2 \\ x > 1 \end{cases}$ Graph $y \le x + 2$.

Graph $y = x + 2$.
Use a solid line for the boundary.
Shade the region below the line.



On the same plane, graph $x > 1$.

Graph $x = 1$.
Use a dashed line for the boundary.
Shade the region to the right of the line.



Check: Test a point in the solution region in both inequalities.
Try $(2, 2)$.

$y \le x + 2$ $\quad$ $x > 1$

$2 \overset{?}{\le} 2 + 2$ $\quad$ $2 > 1$

$2 \le 4$

Graph the system of inequalities.

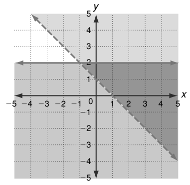
1. $\begin{cases} y > -x + 1 \\ y \le 2 \end{cases}$

a. Shade **Above** the line for $y > -x + 1$.

b. Shade **below** the line for $y \le 2$.

c. Check: **possible answer: (1, 3)**

d. Check: **possible answer: (4, 0)**



LESSON 3-3 Review for Mastery
Solving Systems of Linear Inequalities (continued)

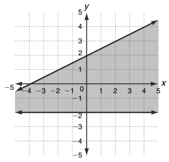
The solution of a system of inequalities may create a geometric figure.

Graph $\begin{cases} y \le \frac{1}{2}x + 2 \\ y \ge -2 \\ x \le 3 \\ x \ge -2 \end{cases}$

The graph of $y = -2$ is a horizontal line.
The graphs of $x = 3$ and $x = -2$ are vertical lines.

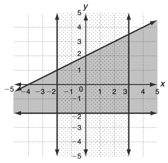
Graph $y \le \frac{1}{2}x + 2$ and $y \ge -2$.

Use solid boundary lines.
Shade the region below $y \le \frac{1}{2}x + 2$ and above $y \ge -2$.



On the same plane, graph $x \le 3$ and $x \ge -2$.

Use solid boundary lines.
Shade the region to the left of $x \le 3$ and to the right of $x \ge -2$.



The figure created by the overlapping pattern is a quadrilateral with one pair of parallel sides. The figure is a trapezoid.

Graph the system of inequalities. Classify the figure created by the solution region.

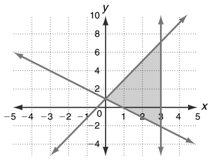
2. $\begin{cases} y \le 2x + 1 \\ y \ge -x + 1 \\ x \le 3 \end{cases}$

a. Shade **Below** the line for $y \le 2x + 1$.

b. Shade **above** the line for $y \ge -x + 1$.

c. Shade to the **left** of the line for $x \le 3$.

d. The figure is a **triangle**.

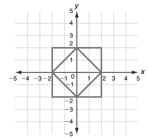


LESSON 3-3 Challenge
Systems of Absolute-Value Inequalities

The absolute value function is known for the V-shape of its graph. Some systems of absolute value inequalities have graphs that form geometric figures.

Use the system $\begin{cases} |x| \le 2 \\ |y| \le 2 \end{cases}$ for Exercises 1-5.

1. Graph the system on the grid at right.



2. What geometric figure is formed by the system? **square**

3. a. Make a conjecture about how the graph of $|x| + |y| \le 2$ compares to the graph of the given system.

Possible answer: The original square is rotated 45°.

b. Verify your conjecture by graphing $|x| + |y| \le 2$ on the same grid.

4. What geometric figure would be formed if the constant terms of the system were not equal? **rectangle**

5. What transformation(s) will change the original figure into the figure formed by each of the following systems?

a. $\begin{cases} |x - 3| \le 2 \\ |y| \le 2 \end{cases}$ **horizontal translation 3 units to the right**

b. $\begin{cases} |x| \le 2 \\ |y + 3| \le 2 \end{cases}$ **vertical translation 3 units down**

c. $\begin{cases} |2x| \le 2 \\ |y| \le 2 \end{cases}$ **horizontal compression by a factor of $\frac{1}{2}$**

Write the coordinates of the vertices of the figure determined by the given system.

6. $\begin{cases} |x - 3| \le 4 \\ |y + 2| \le 2 \end{cases}$ **$(-1, 0), (-1, -4), (7, -4), (7, 0)$**

7. $\begin{cases} |x + 3| \le 2 \\ |y - 2| \le 4 \end{cases}$ **$(-5, -2), (-5, 6), (-1, 6), (-1, -2)$**

8. $\begin{cases} |2x| \le 4 \\ |y| \le 4 \end{cases}$ **$(-2, \pm4), (2, \pm4)$**

Write a system of inequalities to represent the specified geometric figure.

9. $x = \pm5$ when $y = \pm 5$ **$\begin{cases} |x| \le 5 \\ |y| \le 5 \end{cases}$**

10. $x = 2$ or -8 when $y = 4$ or 6 **$\begin{cases} |x + 3| \le 5 \\ |y - 5| \le 1 \end{cases}$**

11. $x = \pm0.5$ when $y = 0$ or 2 **$\begin{cases} |2x| \le 1 \\ |y - 1| \le 1 \end{cases}$**

LESSON 3-3 Problem Solving
Solving Systems of Linear Inequalities

Marshall and Zack plan a hike-and-canoe vacation in a national park. They plan to hike for *m* hours at a steady 3 miles per hour and canoe for *n* hours at 6 miles per hour. They want to travel no more than 8 hours and cover at least 40 miles in a day.

1. Marshall makes a table to find the number of hours they can hike and canoe and still meet their goal.

a. Complete the table.

b. What different options do they have in whole numbers of hours of hiking and canoeing while still meeting their goal?

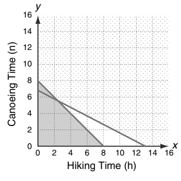
Hiking Time (m)	Canoeing Time (n)	Total Miles per day
1	7	**45**
2	6	**42**
3	5	**39**
4	4	**36**
5	3	**33**

They can hike for 1 h and canoe for 7 h, or they can hike for 2 h and canoe for 6 h.

2. a. Write a system of inequalities to model the conditions.

$\begin{cases} 3m + 6n \ge 40 \\ m + n \le 8 \end{cases}$

b. Graph the boundary lines. Shade the areas to show the inequalities and the overlapping region.



c. Describe how the overlapping shaded region relates to the solution to the inequalities.

Possible answer: Where the shadings overlap is the region containing all possible solutions of the inequalities.

d. Name a point within the solution region.

Possible answer: (0, 8)

Choose the letter for the best answer.

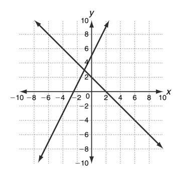
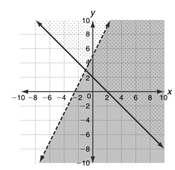
3. Which point is NOT in the region that satisfies the goals?

(A) (4, 4)
B (2, 6)
C (1, 6.75)
D (0, 7)

4. How could you interpret the point of intersection of the boundary lines?

A They will travel exactly the same number of hours hiking as canoeing.
B This represents the only possible solution.
C It is the only impossible combination of hiking hours and canoeing hours.
(D) They will travel exactly 40 miles in exactly 8 hours.

LESSON 3-3 Reading Strategies
Compare and Contrast

A system of linear equations has one solution, which is an ordered pair.	A system of linear inequalities has an infinite number of ordered pair solutions.
$\begin{cases} y = 2x + 5 \\ y = -x + 2 \end{cases}$	$\begin{cases} y < 2x + 5 \\ y \ge -x + 2 \end{cases}$
The system can be solved by graphing. The solution is the point where the lines intersect.	The system can be solved by graphing. The solution is the region where the shadings overlap.
	

Answer each question.

1. Describe the process to determine if a given ordered pair is a solution to a system of inequalities.
Possible answer: Substitute the *x*- and *y*-coordinates for *x* and *y* in the two inequalities. Both inequalities must be satisfied for that ordered pair to be a solution of the system.

2. How can you check to see if (3, 2) is a solution to the system $\begin{cases} x + y \ge 4 \\ 2x - y < -1 \end{cases}$?
Substitute 3 for *x* and 2 for *y* in both inequalities; no, it is not a solution.

3. How is solving a system of inequalities like solving a system of equations?
Possible answer: In both cases, you are finding the ordered pair or pairs that satisfy the equations or inequalities by graphing.

4. How is solving a system of inequalities different from solving a system of equations?
Possible answer: The lines in a system of inequalities can be solid or dashed, and it is also necessary to shade areas above or below the lines.

5. Describe the solution set of a system of inequalities.
Possible answer: It is the region of intersection of two shaded areas on the graph.

6. When would you use a dashed line in graphing an inequality? When you would use a solid line? What is the difference?
Possible answer: You use a dashed line when the symbol is < or > but a solid line when the symbol is ≤ or ≥. The solid line has points included in the solution, but the points on a dashed line are not included in the solution.