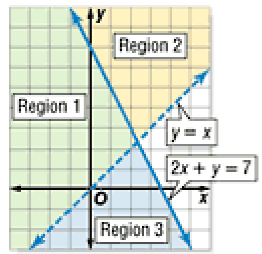
Lesson 3–3

Example 1 **Intersecting Regions**

Solve each system of inequalities by graphing.

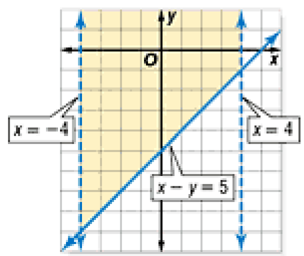
a. $y > x$
$2x + y \le 7$



solution of $y > x$ → Regions 1 and 2
solution of $2x + y \le 7$ → Regions 1 and 3

The intersection of these regions is Region 1, which is the solution of the system of inequalities. Notice that the solution is a region containing an infinite number of ordered pairs.

b. $x - y \le 5$
$|x| < 4$



The inequality $|x| < 4$ can be written as $x < 4$ and $x > -4$.

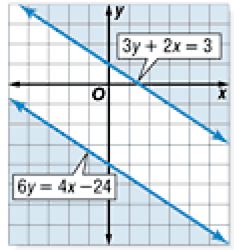
Graph all of the inequalities on the same coordinate grid and shade the region or regions that are common to all.

Example 2 **Separate Regions**

Solve the system of inequalities by graphing.

$3y + 2x \geq 3$

$6y \leq -4x - 24$



Graph both inequalities. The graphs do not overlap, so the solutions have no points in common. The solution set is Ø.

Example 3 **Write and Use a System of Inequalities**

The U.S. Postal Service allows packages up to 70 pounds with a combined length and girth not over 108 inches to be mailed under the classification of Priority Mail. Write and graph a system of inequalities that represents the range of weights and combined length and girth measures for Priority Mail. **Source:** The World Almanac

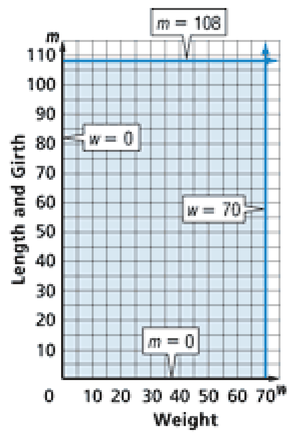
Let w represent the weight of packages in pounds. The acceptable weights are 0 to 70 pounds. We can write this information as two inequalities.

$0 \leq w$ and $w \leq 70$

Let m represent the combined length and girth of a package. The acceptable measures can also be written as two inequalities.

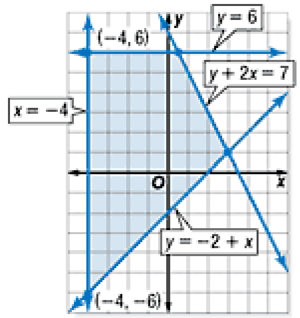
$0 \leq m$ and $m \leq 108$

Graph all of the inequalities. Any ordered pair in the intersection of the graphs is a solution of the system.



Example 4 Find Vertices

Find the coordinates of the vertices of the figure formed by $y \le 6$, $x \ge -4$, $y \ge x - 2$, and $y + 2x \le 7$.



Graph each inequality. The intersection of the graphs forms a quadrilateral.

The coordinates (–4, 6) and (–4, –6) can be determined from the graph. To find the coordinates of the other two vertices, you need to solve two systems.

System 1

$y = 6$

$y + 2x = 7$

Substitute 6 for y into the second equation.

$y + 2x = 7$	Second equation
$6 + 2x = 7$	Replace y with 6.
$2x = 1$	Subtract 6 from each side.
$x = \frac{1}{2}$	Divide each side by 2.

The third vertex is $\left(\frac{1}{2}, 6\right)$.

System 2

$y + 2x = 7$

$y = -2 + x$

Rewrite the equations and subtract to eliminate y.

$$\begin{array}{rrcl} & y + 2x & = & 7 \\ (-) & y - x & = & -2 \\ \hline & 3x & = & 9 \\ & x & = & 3 \end{array}$$

Subtract the equations.

Divide each side by 3.

Now find y by substituting 3 for x in the first equation.

$y + 2x = 7$	First equation
$y + 2(3) = 7$	Substitute 3 for x.
$y + 6 = 7$	Multiply.
$y = 1$	Subtract 6 from each side.

The fourth vertex is (3, 1).

The vertices of the quadrilateral are (–4, 6), (–4, –6), $\left(\frac{1}{2}, 6\right)$, and (3, 1).