

## Lesson 4.6: Systems of Linear Inequalities

By the end of the lesson, we will be able to:

- ~ Determine whether an ordered pair is a solution to a system of linear inequalities.
- ~ Graph a system of linear inequalities.
- ~ Solve problems involving systems of linear inequalities.

Before we get into Systems of Inequalities, we are going to jump back to Lesson 3.4 and remind ourselves what an inequalities is and how to graph it.

# Review

## Lesson 3.4: Linear Inequalities

Linear Inequalities in two variables are in one of the following forms:

$$Ax + By < C$$

$$Ax + By > C$$

$$Ax + By \leq C$$

$$Ax + By \geq C$$

If we replace the inequality sign with an equal sign, we obtain the equation of a line,  $Ax + By = C$ . The line separates the  $xy$ -plane into two regions called **half planes**.

## Lesson 3.4: Linear Inequalities

A linear inequality in two variables  $x$  and  $y$  is satisfied by an ordered pair  $(a, b)$  if, when  $x$  is replaced by  $a$  and  $y$  is replaced by  $b$ , a true statement results.

For Example:

$$x + y < 10 \text{ for } (3, 5)$$

We replace  $x$  with 3 and  $y$  with 5.

$$3 + 5 < 10 ?$$

$8 < 10$  TRUE. The point  $(3, 5)$  satisfies the inequality.

## Lesson 3.4: Linear Inequalities

### To graph an inequality:

- ~ We treat the inequality like a line (=) to graph.
- ~ A **nonstrict** inequality ( $\leq$ ,  $\geq$ ) will be a solid line
- ~ A **strict** inequality ( $<$ ,  $>$ ) will be a dashed line.

## Lesson 3.4: Linear Inequalities

### When we graph an inequality, we follow these steps:

1. Graph the boundary (the line) - Determine whether it's a solid line ( $\leq$ ,  $\geq$ ) or dashed line ( $<$ ,  $>$ ).
2. Test a point in each region (half-plane).
3. Shade the region whose ordered pair result in a true inequality.

End of Review

Lesson 4.6: Systems of Linear Inequalities

**Example 1:** Determine whether the ordered pair is a solution to a system of linear inequalities.

$$\begin{cases} 3x + y \leq 7 \\ 4x - 2y \leq 8 \end{cases}$$

a.)  $(2, 4)$

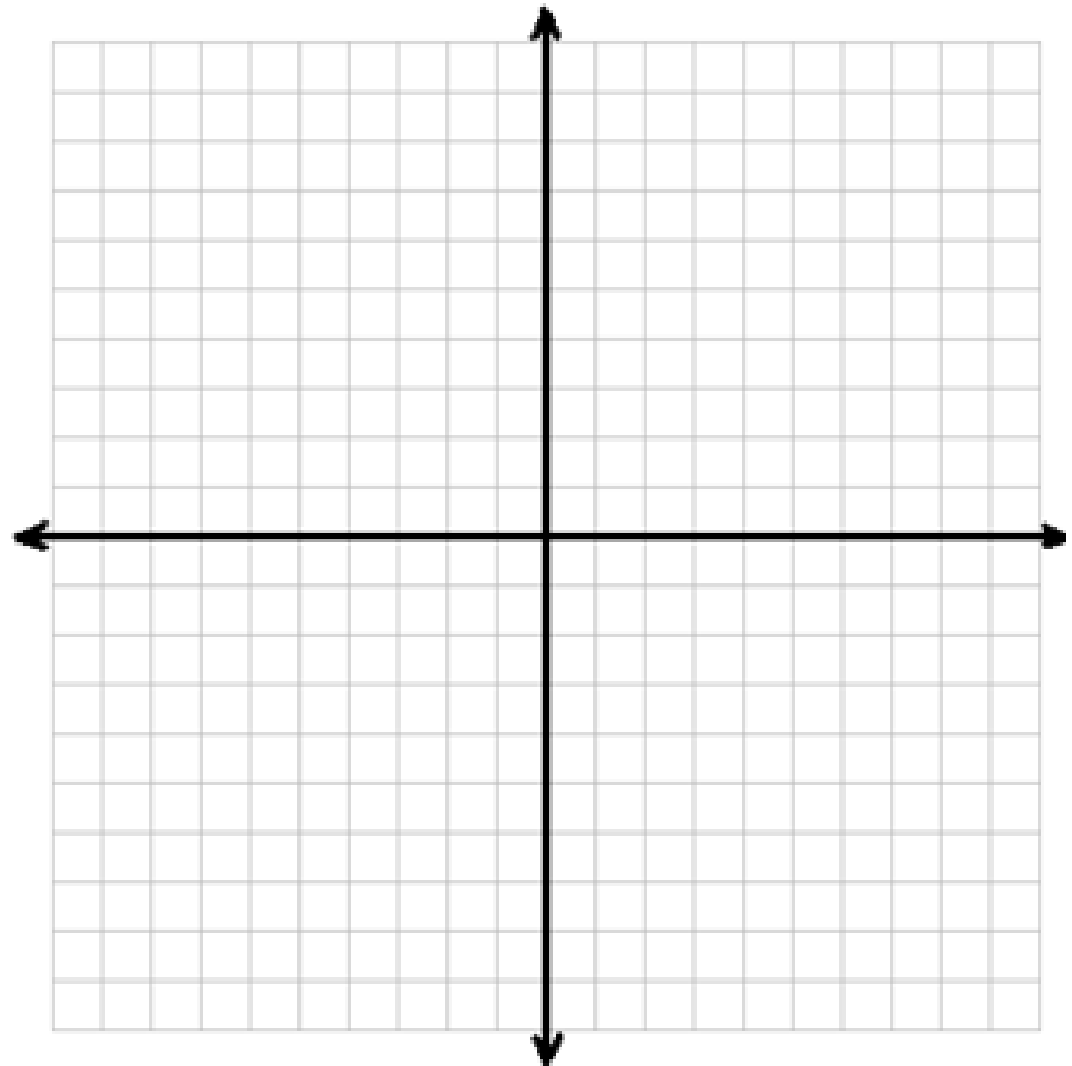
b.)  $(-3, 1)$



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**Example 2:** Graph the System of Inequalities

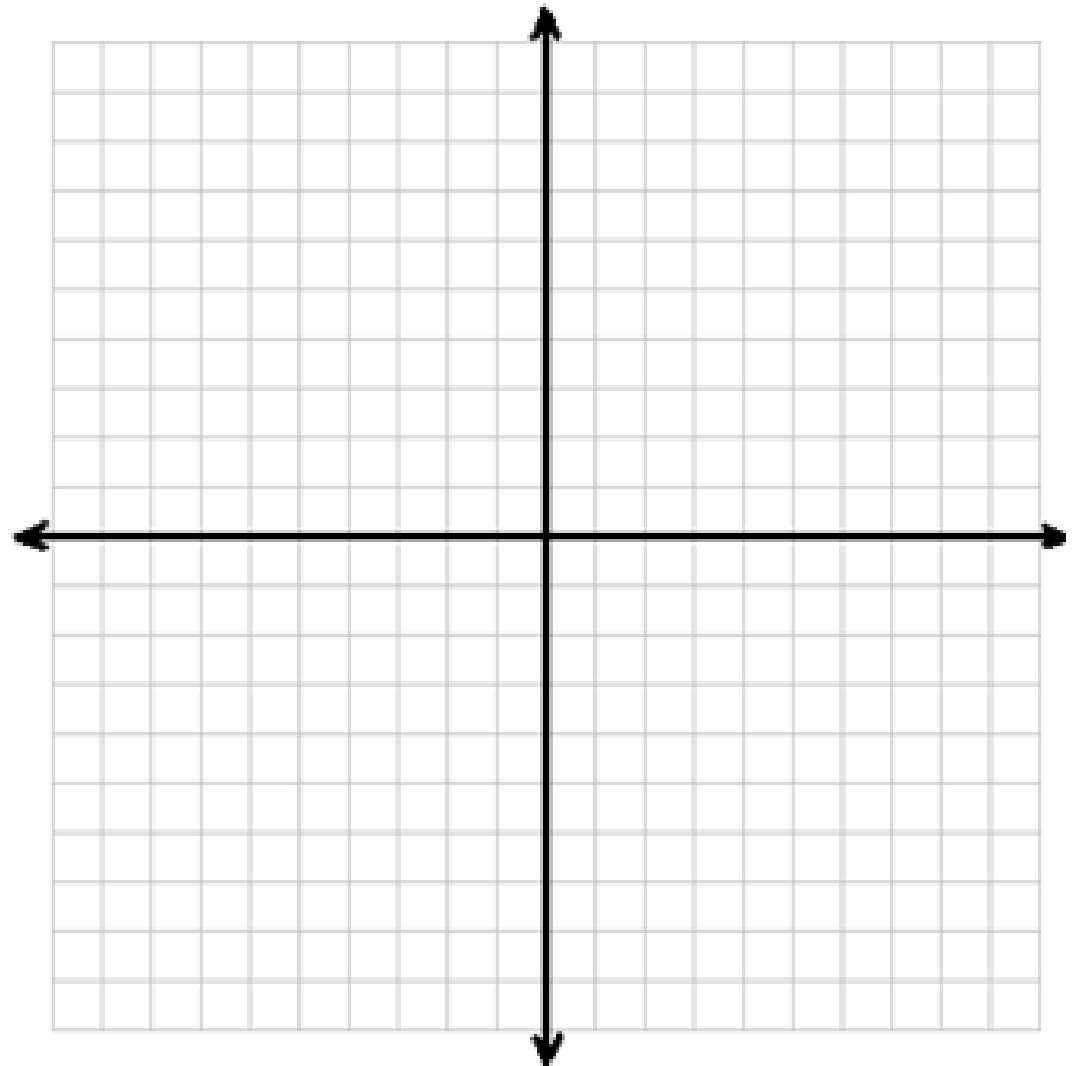
$$\begin{cases} -2x + y > 5 \\ 3x + 2y \geq -4 \end{cases}$$



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**Example 3:** Graph the System of Inequalities

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

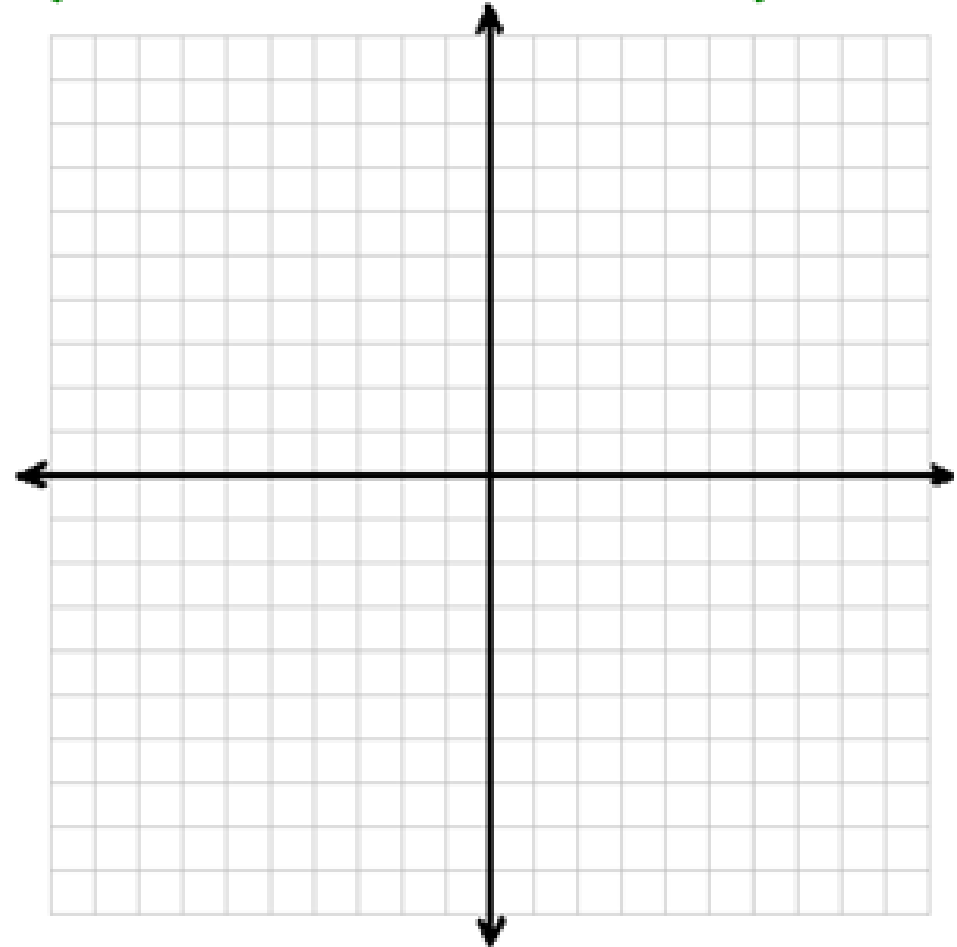


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**Example 4:** Graph the System of Inequalities and find the Corner Points.

$$\begin{cases} x + y \leq 5 \\ 2x + y \leq 7 \\ x \geq 0 \\ y \geq 0 \end{cases}$$

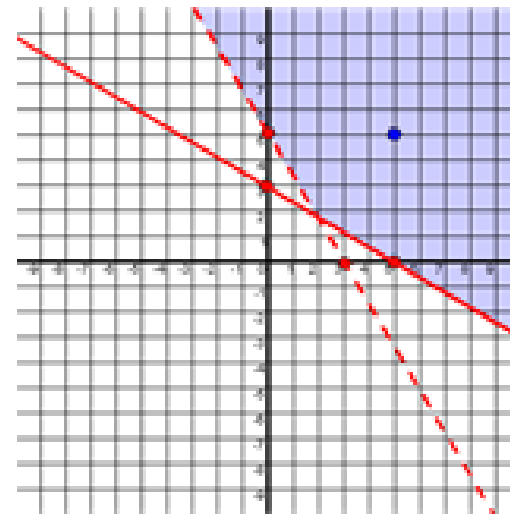
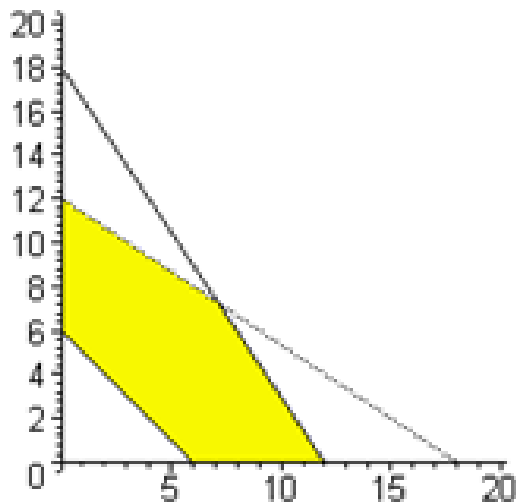
**Corner Points:** the points of intersection between two boundary lines in the system. (Also called Vertices.)



## Lesson 4.6: Systems of Linear Inequalities

The Graph from Example 4 is said to be **BOUNDED** because it can be contained in a circle.

Graphs that cannot be contained in a circle are called **UNBOUNDED** because the solution set (shaded region) extends indefinitely.



## Lesson 4.6: Systems of Linear Inequalities

**Example 5:** Kevin and Chase are planning a tailgate party and plan to buy bratwurst for \$4/lb and hamburger patties for \$3/lb. They have a budget of at most \$70 and think they should have no more than 20 pounds of meat. Write a system of inequalities that represents the possible combination of pounds of bratwurst and hamburger that Kevin and Chase can purchase. Graph the system and find the corner points.

**Step 1: Identify**

**Step 2: Name**

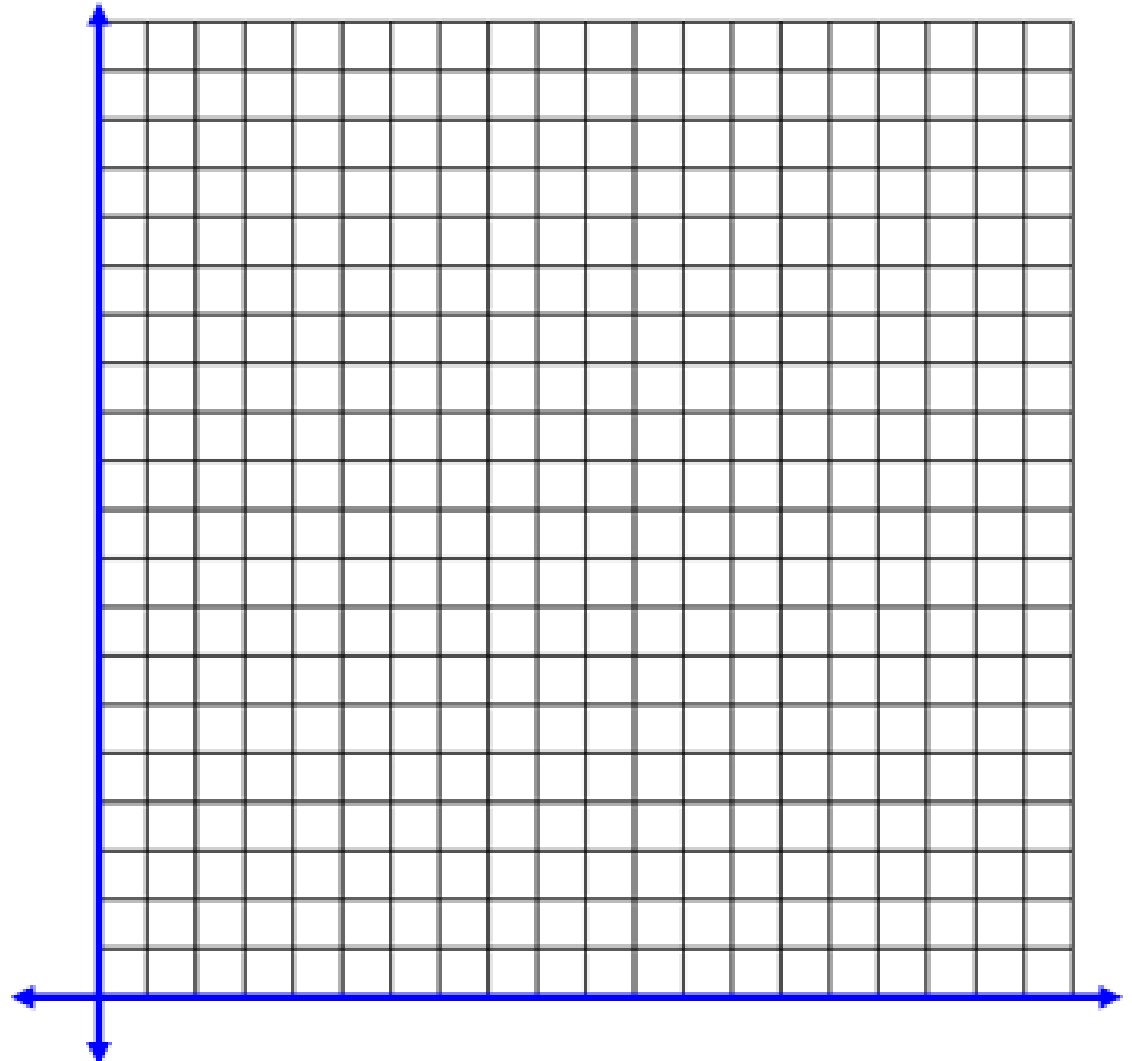
b = bratwurst

h = hamburger

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**Example 5: Cont.**

$$\begin{cases} 4b + 3h \leq 70 \\ b + h \leq 20 \\ b \geq 0 \\ h \geq 0 \end{cases}$$



## Lesson 4.6: Systems of Linear Inequalities

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**Remember:** Solutions to an inequality is the shaded region.

Lesson 4.6: Systems of Linear Inequalities

Homework:

Pg. 325- 327: #'s 9, 11, 13, 15, 19,  
29, 31, 37, 39;

AND

Pg. 330-332: #'s 21, 31, 35, 39, 41

Hint: #37 Graph by 5,000 on x and y.

Remember: Solutions to an inequality is the shaded region.