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:

$Ax + By < C$ $\qquad$ $Ax + By > C$

$Ax + By \leq C$ $\qquad$ $Ax + By \geq C$

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

For Example:

$x + y < 10$ 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 inequalitiy:

~ 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.

When we graph an inequalitiy, 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

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) NO

$3(2) + 4 \leq 7$

$10 \leq 7$ ✗

$4(2) - 2(4) \leq 8$

$0 \leq 8$ ✓

b.) (-3, 1) yes

$3(-3) + 1 \leq 7$

$-8 \leq 7$ ✓

$4(-3) - 2(1) \leq 8$

$-14 \leq 8$ ✓

Example 2: Graph the System of Inequalities

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

$-2x+y>5$

$y>2x+5$

Test: (0,0)

$0+0>5$

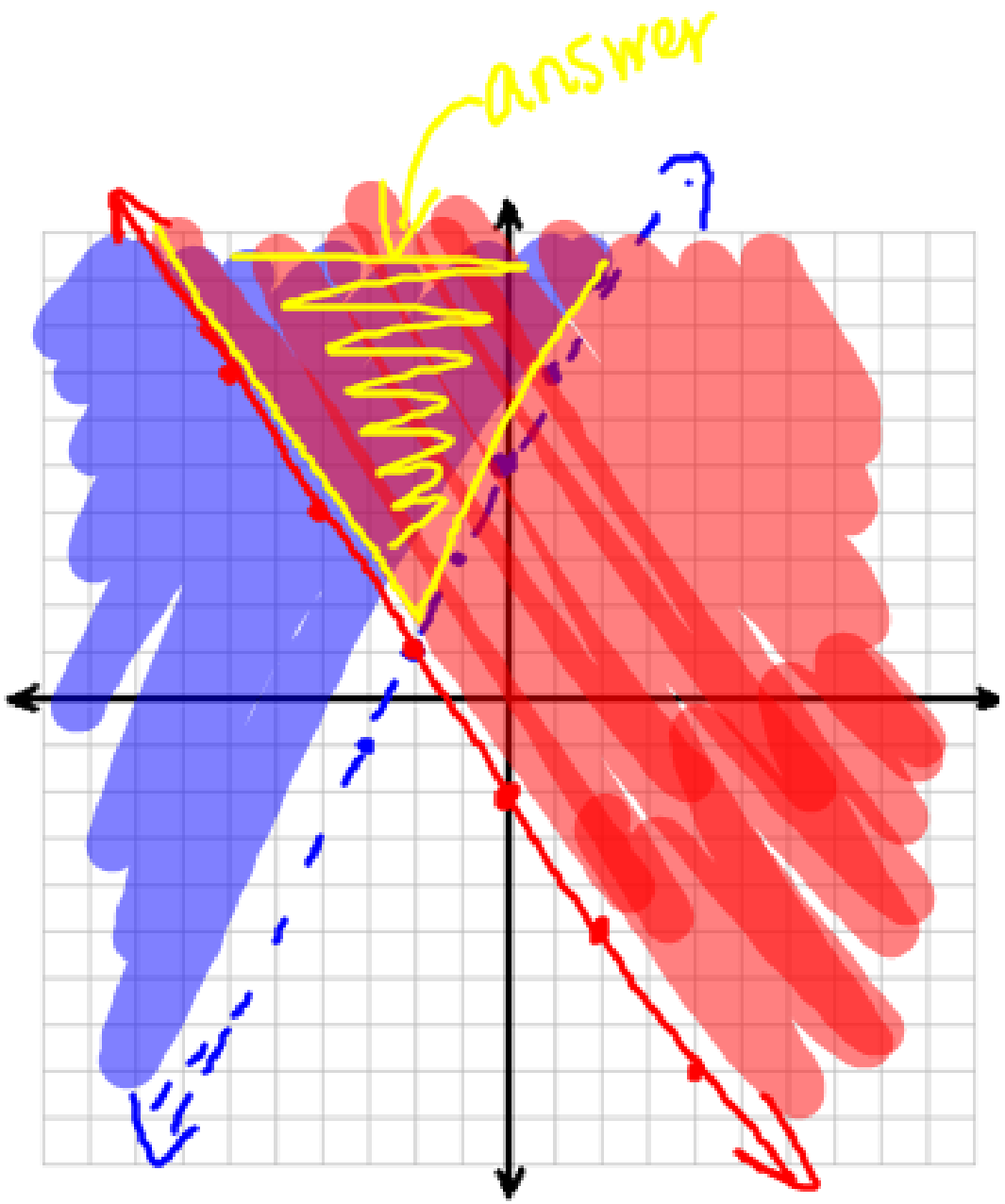
$0>5$ X

$\frac{2y}{2} \geq \frac{-3x-4}{2}$

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

Test: (0,0)

$0 \geq -4$ ✓



Example 3: Graph the System of Inequalities

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

$y > -2x + 2$

Test: (0,0)

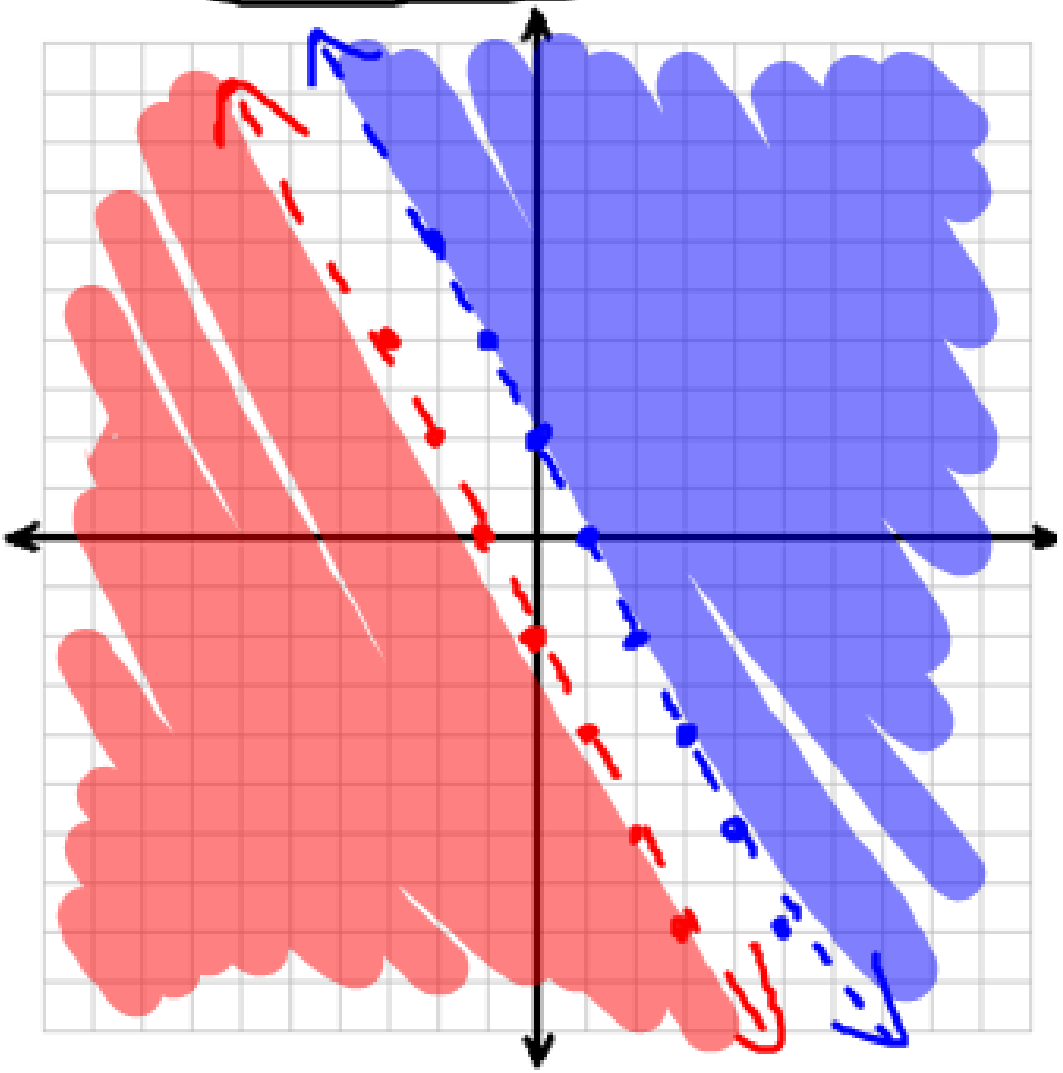
$0 > 2$ X

$y < -2x - 2$

Test: (0,0)

$0 < -2$ X

No Solution



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.)

$y \leq -x + 5$

Test: (0,0)

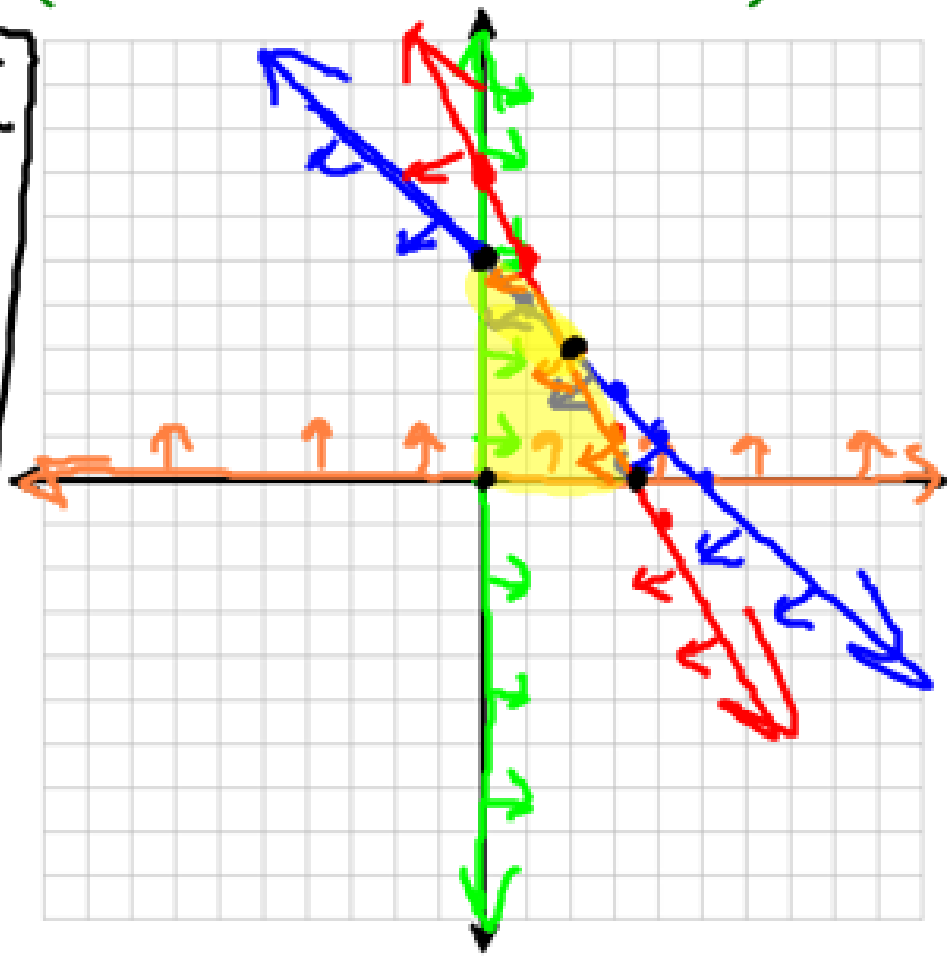
$0 \leq 5$ ✓

$y \leq -2x + 7$

Test: (0,0)

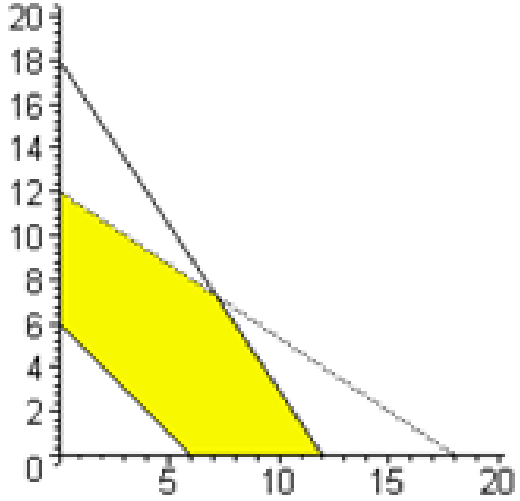
$0 \leq 7$ ✓

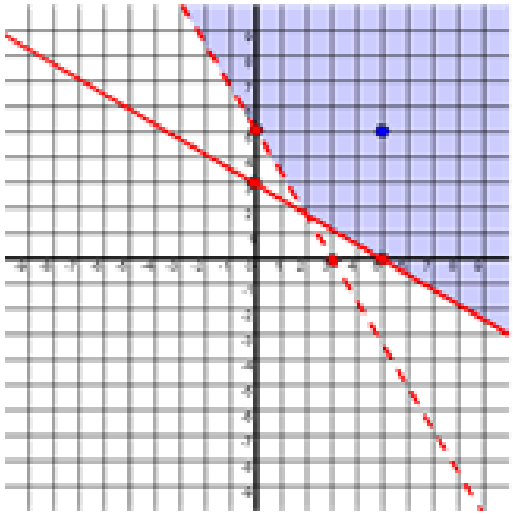
Corner pts
(0,0)
(0,5)
(2,3)
(3.5,0)



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.





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

(x) b = bratwurst

(y) h = hamburger

Example 5: Cont.

$$\begin{cases} 4b + 3h \le 70 \\ b + h \le 20 \\ b \ge 0 \\ h \ge 0 \end{cases}$$

x y

Test: (0,0)
0 ≤ 20

4x + 3y ≤ 70
x + y ≤ 20

x-int: (20,0) y-int: (0,20)

4x + 3y ≤ 70

x-int: (17.5, 0)

4x ≤ 70

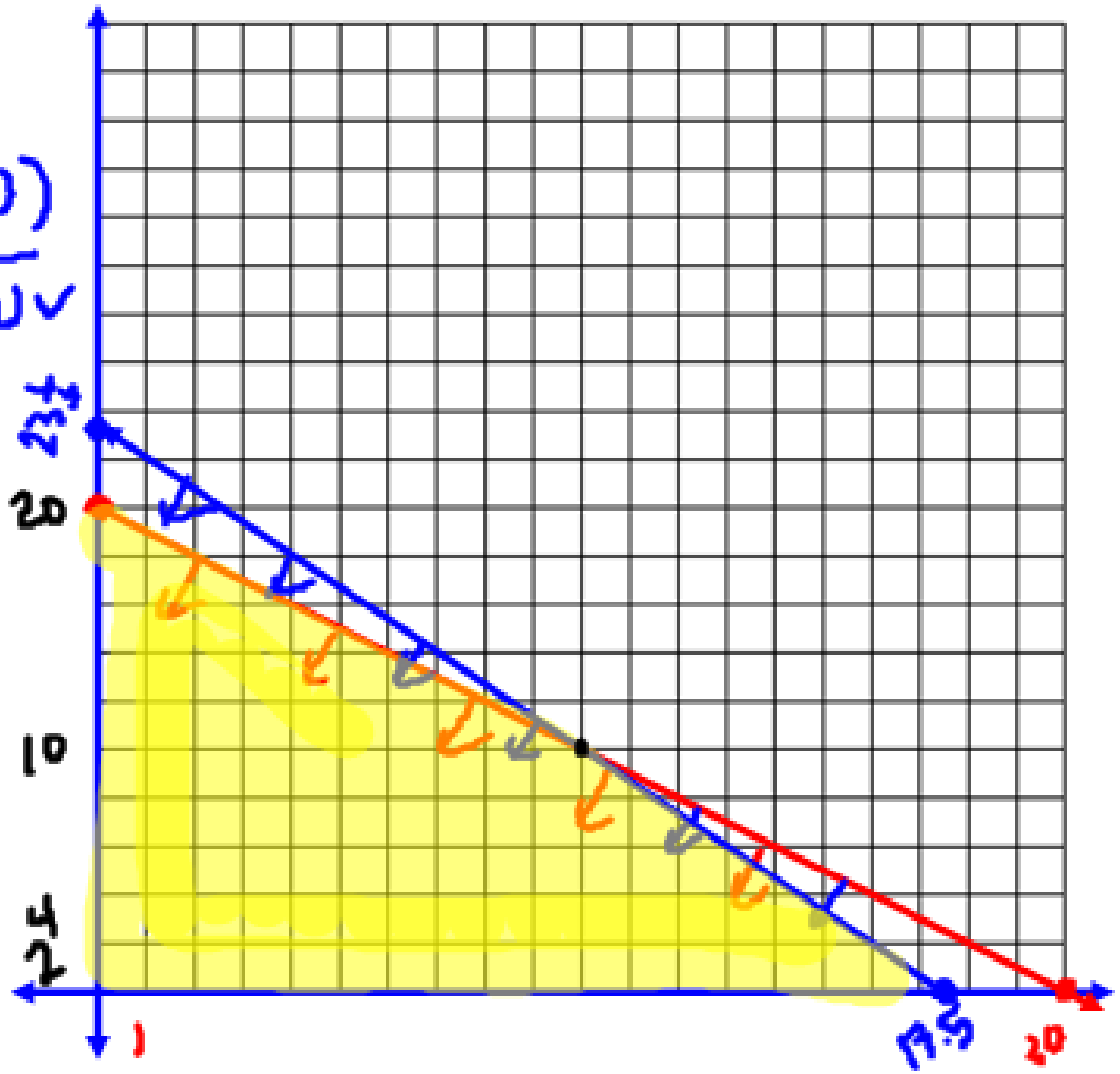
x ≤ 17.5

y-int: $(0, 23\frac{1}{3})$

3y ≤ 70

Test: (0,0)

0 ≤ 70 ✓



Corner Points:
(0,0), (0,20), (17.5,0), (10,10)

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.

Remember: Solutions to an inequality is the shaded region.

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.