

Present Monday: #69, 77, 85

9:55 Kelly Bei., Leigha, Alexis, Ashley, Mae, Aspyn Bre.  
 11:00 Mykki Bor., Brittany, Lauren, Katie, Courtney, Sarah Had.

HW 8.8 #1, 3, 5, 9, 13, 17, 21, 23, 27, 35, 36

Present Tuesday: #21, 35, 36

9:55 Abby Bro., Kelly, Timothy, Cory, Kaitlin, Amber Eid.  
 11:00 Tyler Hec., Melissa, Sam, Courtney, Jennifer, Taylor Kru.

Exam 2 returned after class today.

Current grades have been posted to D2L's "News" section according to the last four digits of your student ID.

### Sec. 8.8: Linear Inequalities & Systems

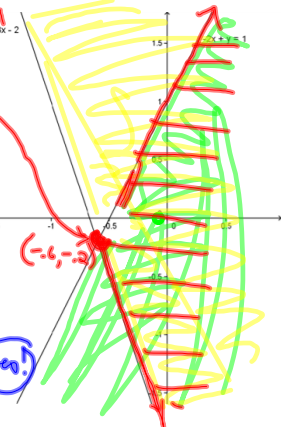
The system below is graphed in the figure:

$$\begin{aligned} 2x - y &= -1 \rightarrow 2x - (-3x - 2) = -1 \\ y &= -3x - 2 \end{aligned}$$

Now instead suppose the system was:

$$\begin{aligned} 2x - y &> -1 \\ y &\geq -3x - 2 \end{aligned}$$

$$\begin{aligned} (-1, 0) &\rightarrow 2x - y \geq -1 \\ &\quad -2 - 0 = -2 \not\geq -1 \\ (0, 0) &\rightarrow 2x - y \geq -1 \\ &\quad 0 - 0 \geq -1 \text{ (yes!)} \end{aligned}$$



### Solving Inequalities

The solution set for a linear inequality or system of inequalities is not just a single point, it is an entire region representing an infinite number of (x,y) pairs that satisfy the given inequalities.

To graph a single linear inequality in two variables:

1. Draw the boundary (dashed, unless "or equal to" present)
2. Choose a test point not on the line.
3. Shade the appropriate region.

To solve a linear system of inequalities:

1. Graph each inequality (as above).
2. Find the intersection of the two regions of the individual inequalities. This is the solution set of the system.

### Examples

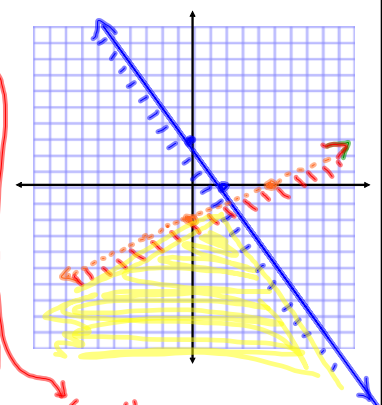
1. Solve the linear system:

- $3x + 2y \leq 6$  2
- $2x - 5y > 10$  -3

Solve for y:

$$\begin{aligned} 2y &\leq -3x + 6 \\ y &\leq -\frac{3}{2}x + 3 \end{aligned}$$

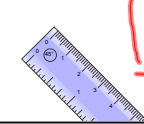
$$\begin{aligned} 2y &> -2x + 10 \\ y &> \frac{1}{2}x - 2 \end{aligned}$$



$$\begin{aligned} 6x + 4y &= 12 \\ -6x + 15y &= -30 \end{aligned}$$

$$\begin{aligned} 19y &= -18 \\ y &= -\frac{18}{19} \\ y &\approx -.95 \end{aligned}$$

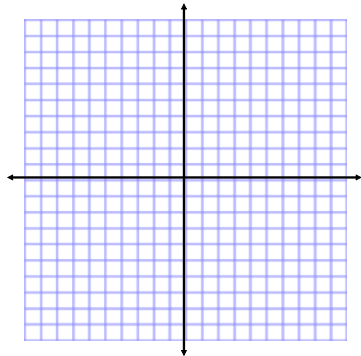
$$\begin{aligned} 3x + 2\left(-\frac{18}{19}\right) &= 6 \\ 19\left(3x - \frac{36}{19}\right) &= 6 \\ 57x - 36 &= 114 \\ 57x &= 150 \\ x &= \frac{150}{57} \approx 2.63 \end{aligned}$$



Examples

2. Solve the linear system:

- $2x + 3y \leq 6$
- $4x + y \leq 6$

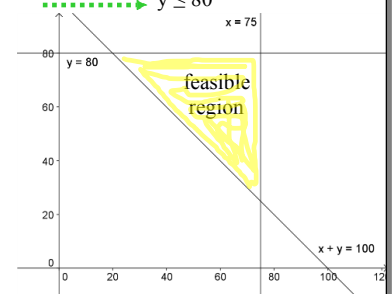


Linear Programming - OR - The Search for Optimal Solutions!

A total of <sup>at least</sup> 100 refrigerators must be shipped to warehouses x and y.  $x + y \geq 100$

Warehouse x can accept at most 75 refrigerators.  $x \leq 75$

Warehouse y can accept at most 80 refrigerators.  $y \leq 80$

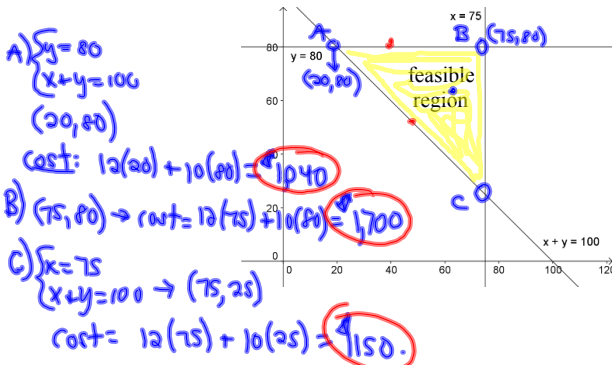


Linear Programming - OR - The Search for Optimal Solutions!

Now suppose:

It costs \$12 to ship a 'fridge to warehouse x.  $\left. \begin{matrix} \text{It costs \$10 to ship a 'fridge to warehouse y.} \\ \text{Cost} = 12x + 10y \end{matrix} \right\}$

How many should be shipped to x and y to minimize cost?



Option A is the cheapest option.

It turns out the optimal solution to systems like these must occur at one of the intersection points on the boundary of the feasible region. This is the key principle of **linear programming**.

For a very nice walkthru of these kinds of problems, see:  
<http://www.purplemath.com/modules/linprog.htm>

Example from the purplemath.com walkthru:

A calculator company produces a scientific calculator and a graphing calculator. Long-term projections indicate an expected demand of at least 100 scientific and 80 graphing calculators each day. Because of limitations on production capacity, no more than 200 scientific and 170 graphing calculators can be made daily. To satisfy a shipping contract, a total of at least 200 calculators must be shipped each day.

If each scientific calculator sold results in a \$2 loss, but each graphing calculator produces a \$5 profit, how many of each type should be made daily to maximize net profits?



x: number of scientific calculators produced  
y: number of graphing calculators produced  
P: profit if x scientific and y graphing calculators are sold

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