3.1: Solve Linear Systems by Graphing
3.2: Graph Systems of Linear Inequalities

Objectives:

1. To solve a system of linear equations by graphing
2. To classify a system of linear equations as consistent (independent and dependent) or inconsistent
3. To graph a system of linear inequalities

Vocabulary

As a group, define each of these without your book. Give an example of each word and leave a bit of space for additions and revisions.

System of Equations	Intersection

System of Equations

A **system of equations** is a collection of 2 or more equations, linear or not, with the same variables.

The **solution** to a system of equations is the set of all points (x, y) that satisfy $\underline{all}$ the equations in the system.

In general, for a system to be solvable, you need one equation for every variable in the system.

Linear System of Equations

We have a **linear system of equations** when the system consists of two variables, x and y.

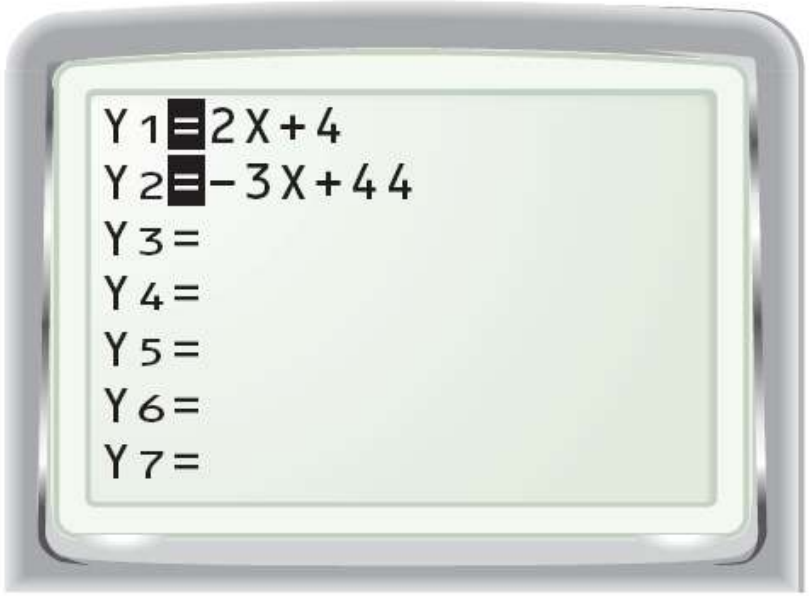
$$Ax + By = C \qquad \textbf{Equation 1}$$
$$Dx + Ey = F \qquad \textbf{Equation 2}$$

The **solution** to the system is the ordered pair (x, y) that satisfies both equations.

Investigation 1

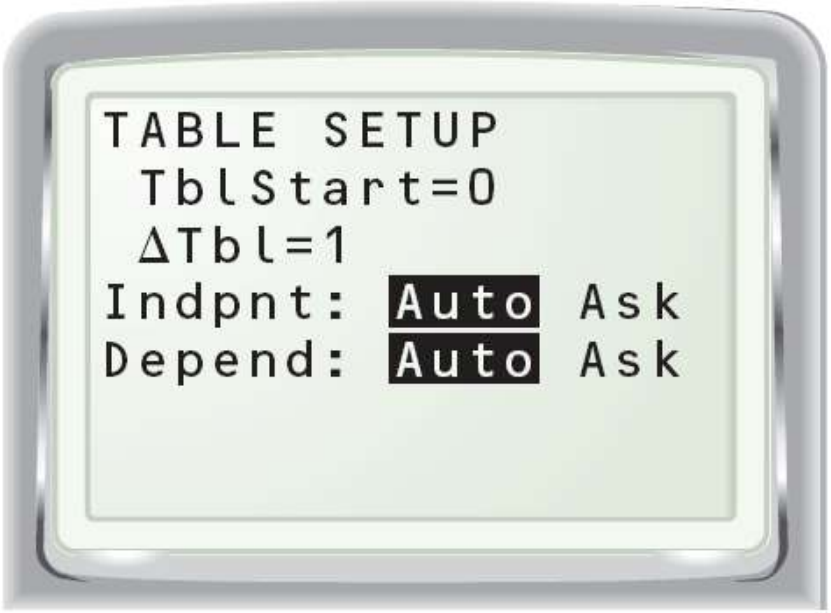
In this Investigation, we will use a table to solve a system of equations.

Step 1: Press "Y=" to enter the equations $y = 2x + 4$ and $y = -3x + 44$.

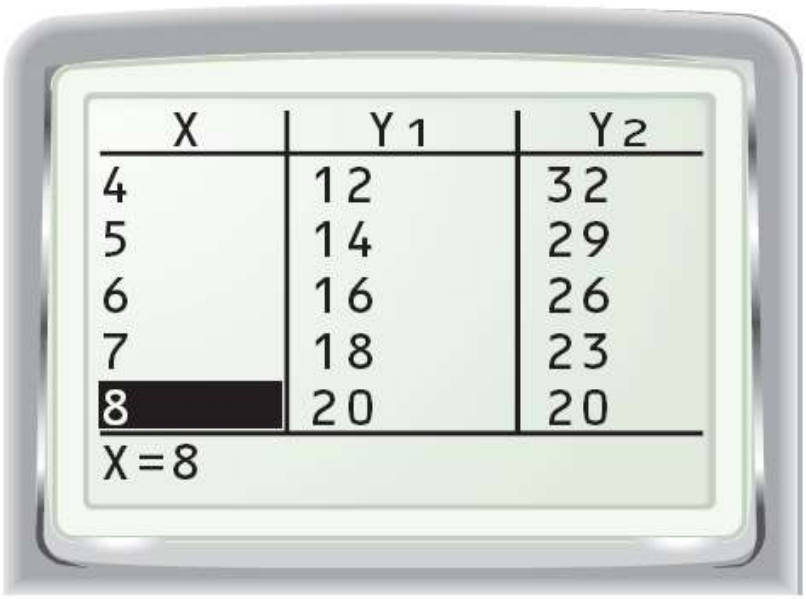


Investigation 1

Step 2: Press 2nd "TABLE" to access the Table Set menu. Set the starting x-value at 0 and the step value to 1. Now press the TABLE button.



Investigation 1



Step 3: Scroll through the table until you find the value of x for which Y1 = Y2. What is the solution to the system of equations?

Exercise 1

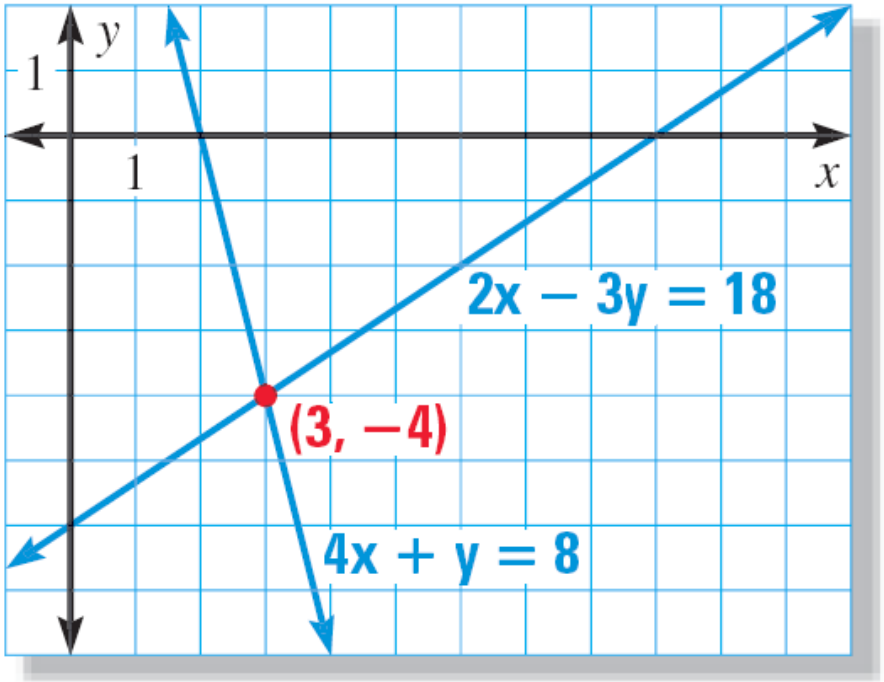
Use a table to solve the system.

$$y = 2x + 5$$

$$y = -x + 2$$

Geometric Interpretation

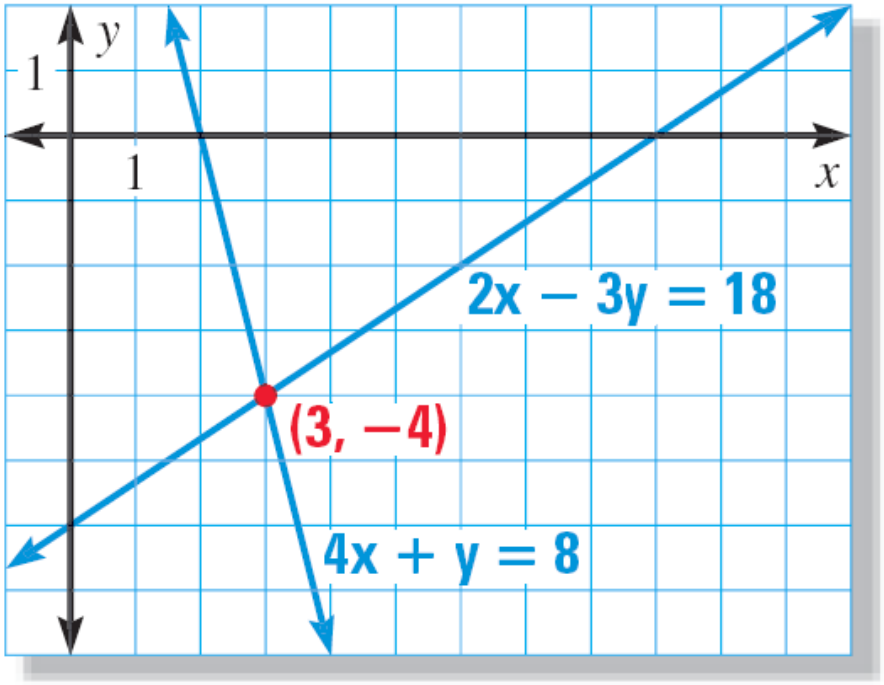
Geometrically, the solution to a system of equations occurs at the **intersection** of the graphs of the equations.



Geometric Interpretation

So a simple way to solve a system of equations is to:

1. Graph the equations.
2. Find the point of intersection



Exercise 2

Graph the linear system and find the solution. Then check the solution algebraically.

$$5x - 2y = -10$$

$$2x - 4y = 12$$

Exercise 3

Graph the linear system and find the solution. Then check the solution algebraically.

1. $3x + 2y = -4$

   $x + 3y = 1$

2. $8x - y = 8$

   $3x + 2y = -16$

Exercise 4

Graph the linear system and find the solution. Then check the solution algebraically.

1. $2x + 5y = 6$

   $4x + 10y = 12$

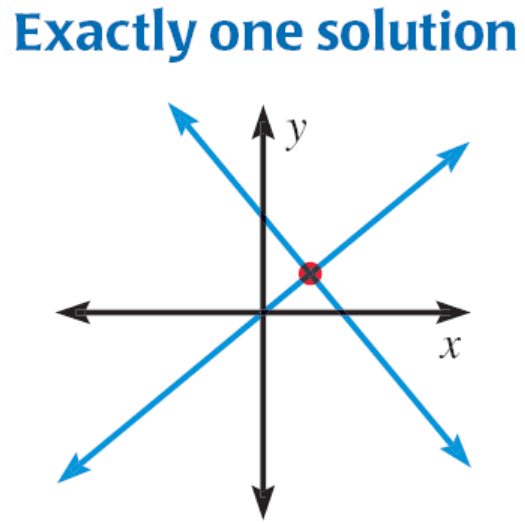
2. $3x - 2y = 10$

   $-3x + 2y = -2$

Classifying Systems

When solving a system of equations, there are three possible outcomes.

1. The system has exactly one solution
   - One point of intersection
   - Considered an **independent**, **consistent** system

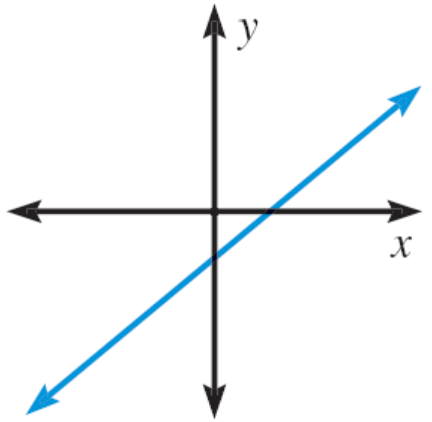


Classifying Systems

When solving a system of equations, there are three possible outcomes.

2. The system has infinitely many solutions
   - Essentially the same line, intersects everywhere
   - Considered a **dependent**, **consistent** system

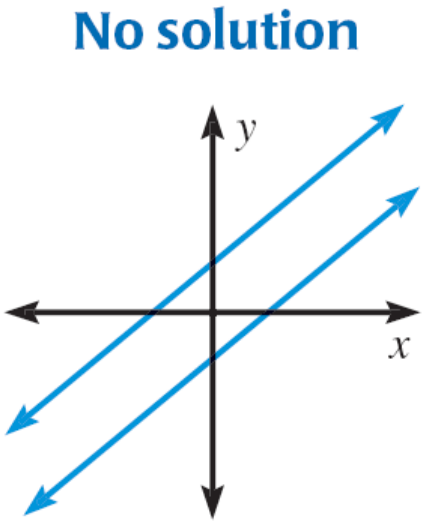
Infinitely many solutions



Classifying Systems

When solving a system of equations, there are three possible outcomes.

3. The system has no solution
   - Lines are parallel and never intersect
   - Considered an **inconsistent** system



Exercise 5

Solve the system. Then classify the system as consistent and independent, consistent and dependent, or inconsistent.

1. $3x + 2y = -4$

   $x + 3y = 1$

2. $8x - y = 8$

   $3x + 2y = -16$

Exercise 6

Solve the system. Then classify the system as consistent and independent, consistent and dependent, or inconsistent.

1. $2x + 5y = 6$

   $4x + 10y = 12$

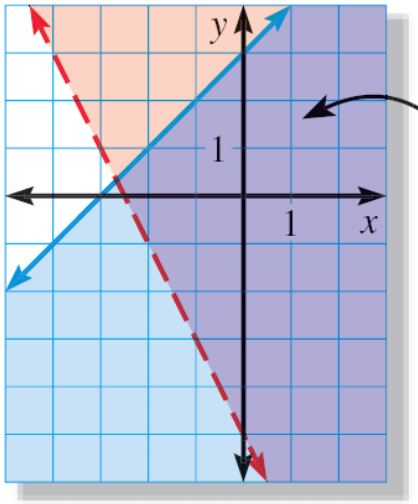
2. $3x - 2y = 10$

   $-3x + 2y = -2$

Exercise 7

A soccer league offers two options for membership planes. Option A includes an initial fee of $40 and costs of $5 for each game played. Option B costs $10 for each game played. After how many games will the total cost to the two options be the same?

Systems of Linear Inequalities



The graph of the system is the intersection of the red and blue regions.

A **system of linear inequalities** is a collection of 2 or more linear inequalities with the same variables.

A **solution** to a system of linear inequalities is the set of ordered pairs (x, y) that satisfy all the inequalities in the system.

Graphing a System of LIs

Another Texas dance (you can almost hear the crummy music):

Step 1: Graph each inequality in the system.

- Using map pencils, like in geography, makes this fun and, well, colorful.

Step 2: Identify the region that is common to all the inequalities in the system.

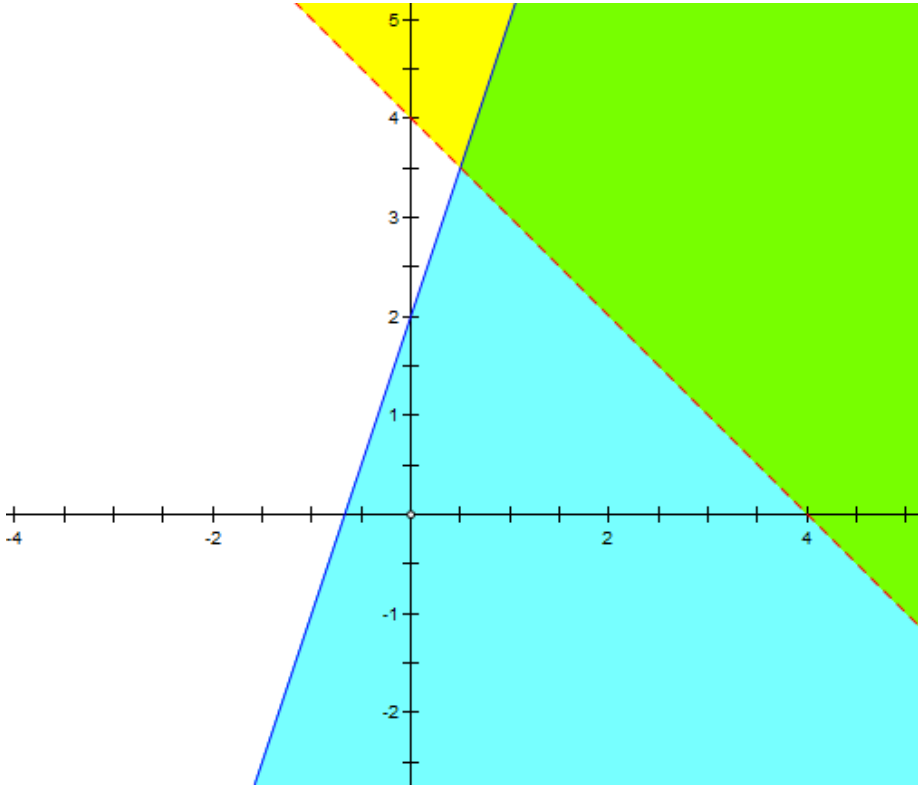
- This is the region that got colored with every map color.

Exercise 8

Graph the system of inequalities.

$y \leq 3x + 2$

$y > -x + 4$

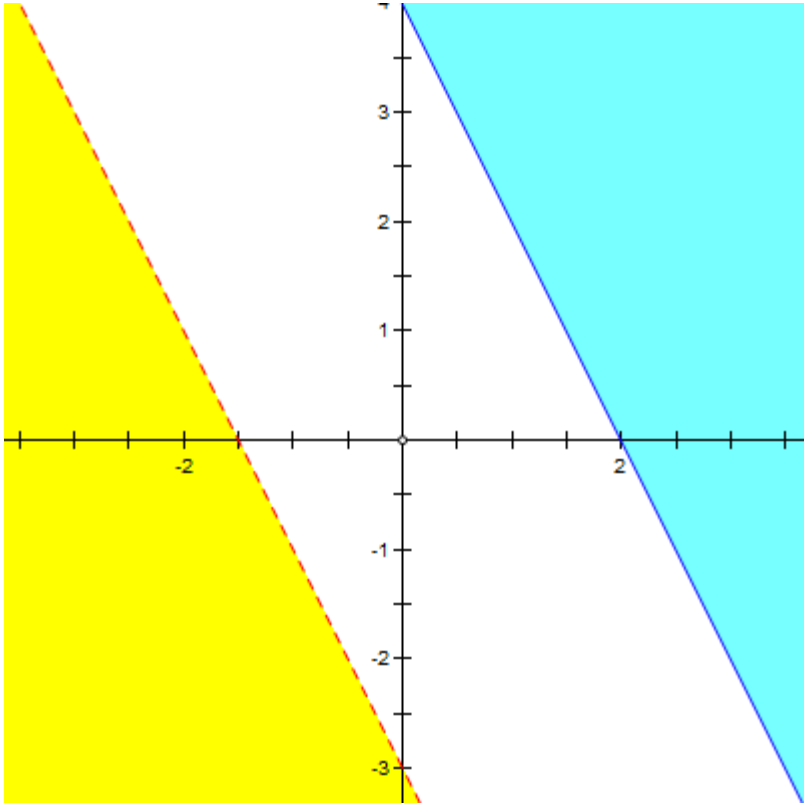


Exercise 9

Graph the system of inequalities.

$4x + 2y \geq 8$

$y < -2x - 3$

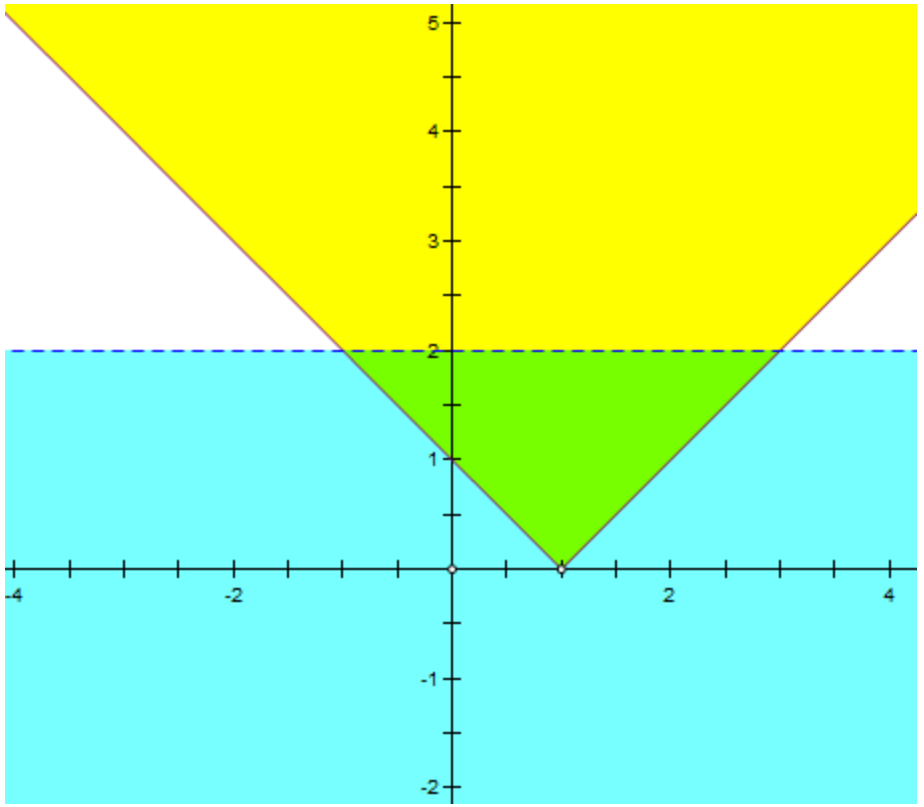


Exercise 10

Graph the system of inequalities.

$y < 2$

$y \geq |x - 1|$



Exercise 11

Graph the system of inequalities.

1. $y \leq 3x - 2$

   $y > -x + 2$

2. $2x - (1/2)y \geq 4$

   $4x - y \leq 5$

3. $y \leq 4$

   $y \geq |x - 5|$

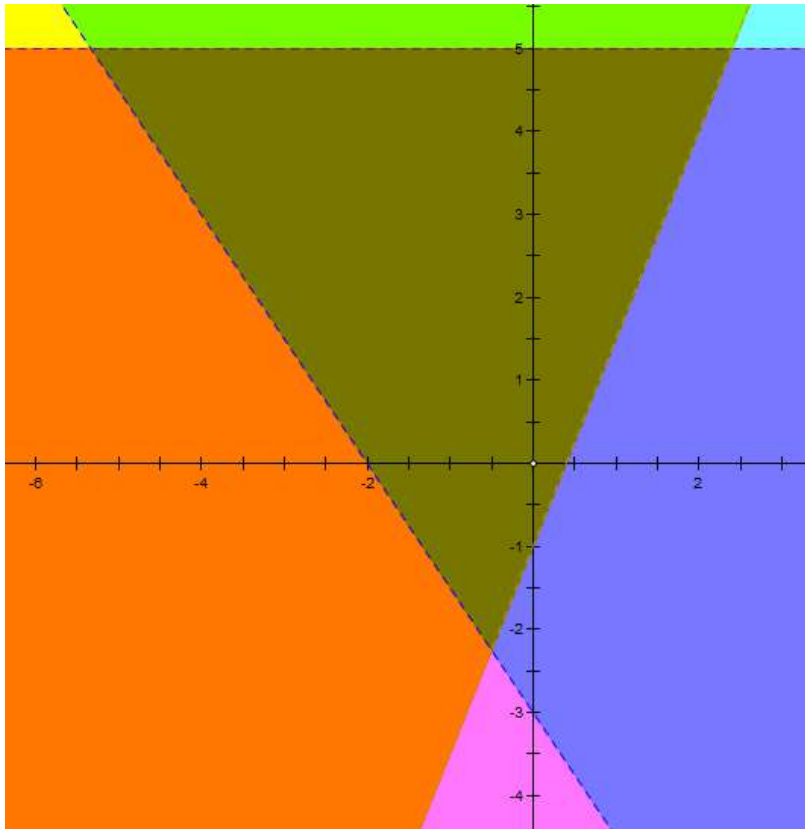
Exercise 12

Graph the system of inequalities.

$3x + 2y > -6$

$-5x + 2y > -2$

$y < 5$



Assignment

- P. 156-158: 1, 2-30 even, 31-34, 36, 41, 42
- P. 171-173: 1, 6-33 M3, 38, 41, 42
- PSAT Presentation, Math Question Types