Notes Section 6.2 –Systems of Inequalities in Two Variables

Lesson Objectives

1. Solve a linear inequality (in one variable) graphically.
2. Solve a linear inequality (in two variables) graphically.
3. Solve a system of 2 linear inequalities graphically.

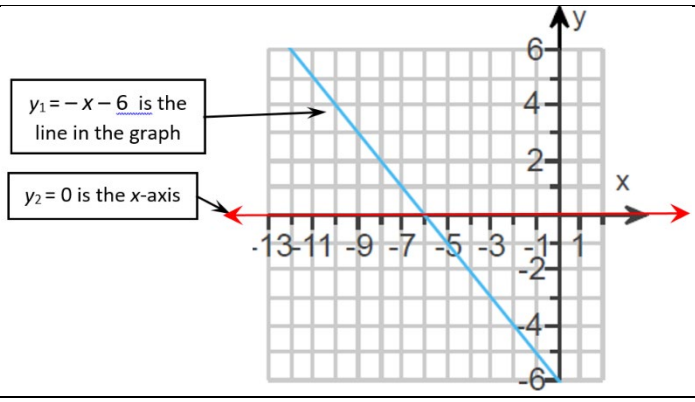
A. Solve a Linear Inequality (in One Variable) Graphically

- **EXAMPLE:** Use the given graph of $y = -x - 6$ to solve each equation and inequality in interval notation. [2.3.55]

(a) $-x - 6 = 0$ (b) $-x - 6 < 0$ (c) $-x - 6 \geq 0$

(a) The table below describes what's happening graphically in the equation $-x - 6 = 0$

LEFT side of the equation	symbol	RIGHT side of the equation
$-x - 6$	$=$	0
y_1	$=$	y_2
The line you're given	_____	the *x*-axis

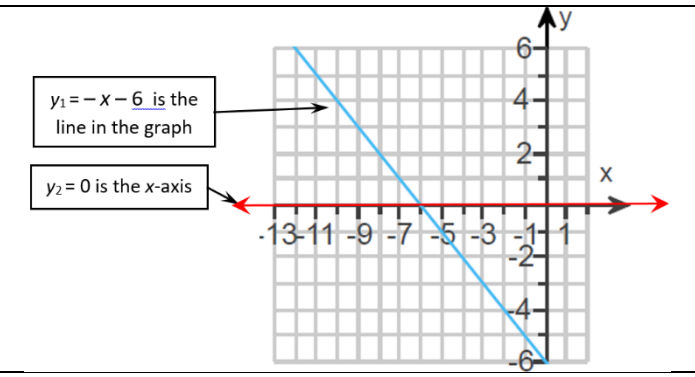


Big Idea: "_____ zero" (*something* = 0) means "_____ the *x*-axis."

WHERE (what value of *x*) is **the graph ON the *x*-axis**? The solution set is $x =$ _____.

(b) The table below describes what's happening graphically in the inequality $-x - 6 < 0$

LEFT side of the equation	symbol	RIGHT side of the equation
$-x - 6$	$<$	0
y_1	$<$	y_2
The line you're given	_____	the *x*-axis



Big Idea: "_____ than zero" (*something* < 0) means "_____ the *x*-axis."

WHERE (what values of *x*) is **the graph BELOW the *x*-axis**?

The graph is BELOW the *x*-axis if you go to the _____ of the intersection point, $x = -6$.

In English: to the RIGHT of $x = -6$ As inequality: _____ Interval Notation: _____

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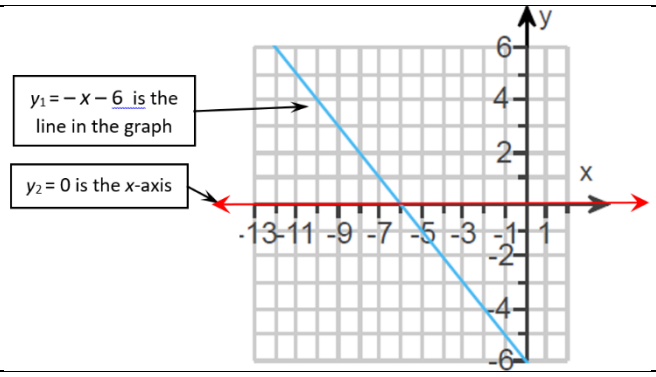
(c) The table below describes what's happening graphically in the inequality $-x - 6 \geq 0$

LEFT side of the equation	symbol	RIGHT side of the equation
$-x - 6$	$\geq$	0
y_1	$\geq$	y_2
The line you're given	on or _____	the *x*-axis



Big Idea: "_____ than zero" (*something* > 0) means "_____ the *x*-axis."

WHERE (what values of *x*) is **the graph on or ABOVE the *x*-axis**?
The graph is BELOW the *x*-axis if you go to the _____ of the intersection point, $x = -6$, with the -6 _____.

In English: to the LEFT of $x = -6$ [included]

As inequality: _____

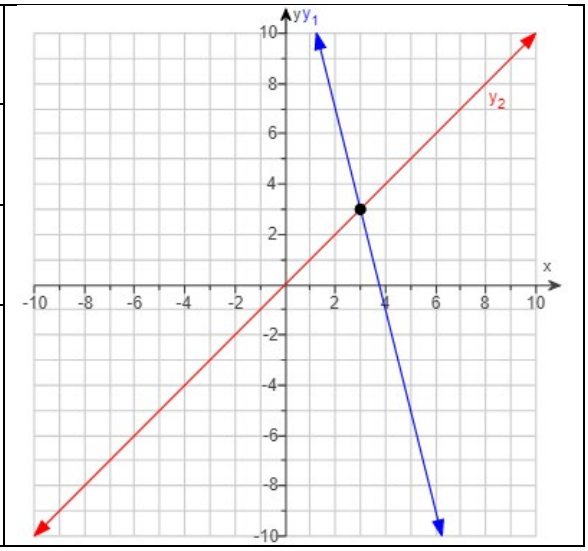
Interval Notation: _____

- **EXAMPLE:** Use the given graphs of y_1 and y_2 to solve each inequality. Write the solution set in interval notation. [2.3.73]

  (a) $y_1 = y_2$ (b) $y_1 > y_2$ (c) $y_1 \leq y_2$

(a) The table below describes what's happening graphically in the equation $y_1 = y_2$

(left side)	(symbol)	(right side)
y_1	=	y_2
blue line	=	red line
BLUE	_____	RED



WHERE (what value of *x*) is **BLUE ON RED**? The solution set for $y_1 = y_2$ is _____.

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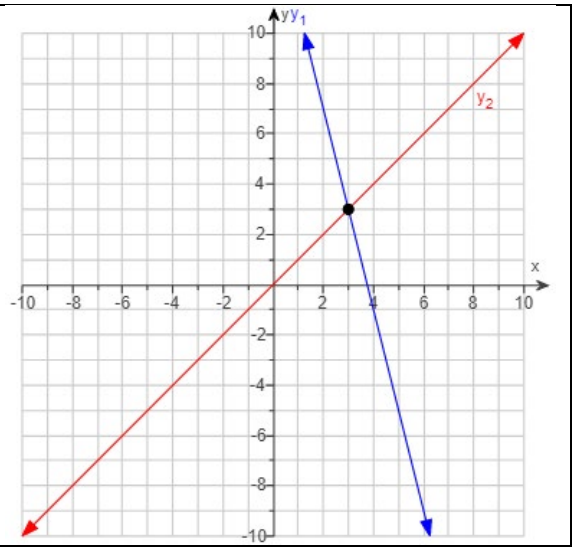
(b) The table below describes what's happening graphically in the equation $\boldsymbol{y_1 > y_2}$

(left side)	(symbol)	(right side)
y_1	$>$	y_2
blue line	$>$	red line
BLUE	_____	RED



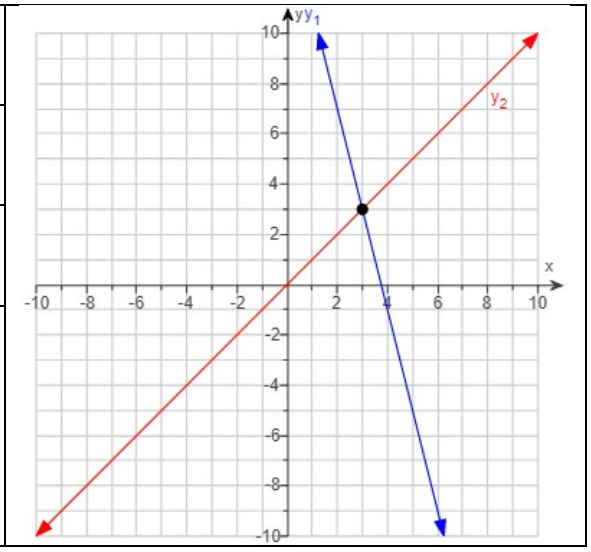
WHERE (what values of *x*) is **BLUE ABOVE RED**?

To the _____ of $x = 3$. Inequality: _____

The solution set (in interval notation) for $y_1 > y_2$ is: _____

(c) The table below describes what's happening graphically in the equation $\boldsymbol{y_1 \leq y_2}$

(left side)	(symbol)	(right side)
y_1	$\leq$	y_2
blue line	$\leq$	red line
BLUE	on or _____	RED



WHERE (what values of *x*) is **BLUE on or BELOW RED**?

To the _____ of $x = 3$ (included). Inequality: _____.

The solution set (in interval notation) for $y_1 \leq y_2$ is: _____

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B. Solve a Linear Inequality (in Two Variables) Graphically

How to graph a linear inequality in two variables:

Step 1	(If possible) Get your inequality into _____-_____ form. (Be ready to REVERSE the inequality, if needed!)			
Step 2	Graph the _____ of boundary line →	_____ line (without equals)		
		_____ line (with equals)		
Step 3	Choose _____ of shading →		shade _____ (greater-than type)	shade _____ (less-than type)
	*exception: for _____ lines ($x = a$)		shade _____	shade _____

- **EXAMPLE:** Graph the inequality $7x + y > 1$

  Use the graphing tool to graph the inequality. [6.2.11]

  - **Step 1.** To graph a linear inequality, you need to convert it to _____**-INTERCEPT** form first.

    $7x + y > 1$ (Subtract 7*x*)

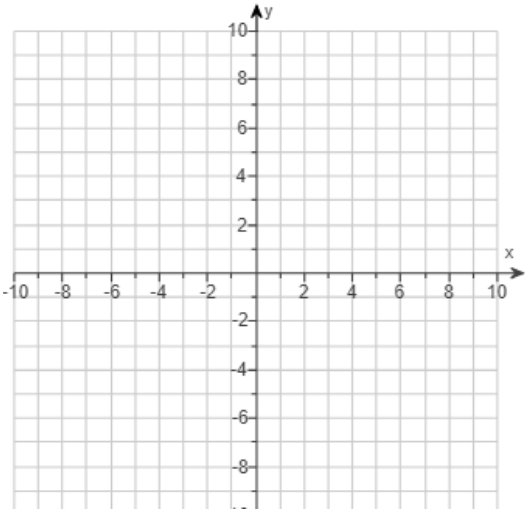
    (Simplify)

    Graph the boundary line: $y =$

    y-intercept: $(0, \ )$ slope: $\frac{rise}{run} = \frac{}{} = \frac{}{}$

    The symbol used: $>$ (_____-than)

  - **Step 2.** Type of line: _____ (missing equals)
  - **Step 3.** Direction to shade: _____



The boundary line and shaded area describe the **solution**.

Note: to verify this solution, we use a _____ _____ that is _____ on the line. Often the origin (,) is best to use. If the origin is on the boundary line, then test some other point.

Test it with the inequality: $7x + y > 1$ $7\ (\ \ )+\ \ > 1$ $>$ (_____)

Since testing the origin (0,0) is _____, that means that the (0,0) region _____ be shaded – the other side will be.

Big Idea! Test point _____ = shade it; Test point _____ = don't shade it

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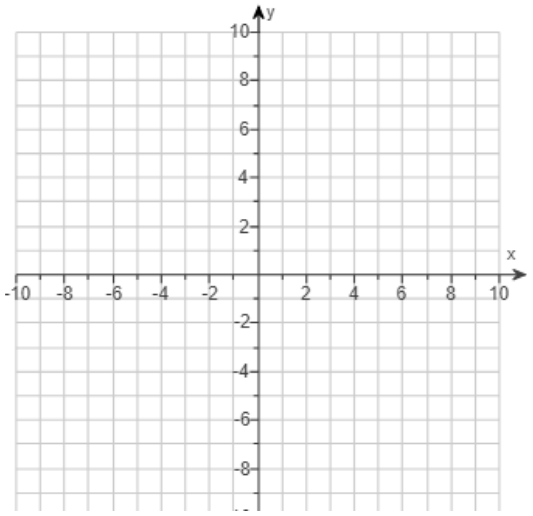
- **EXAMPLE:** Use the graphing tool to graph the given inequality.

$x \geq 6$ [6.2.7]



- **Step 1.** Can't get this into slope-intercept form because this is a _____ line.

Graph the boundary line: _____
Vertical line passing through the ___-axis at 6

The symbol used: _____
(_____-than or equal to)

- **Step 2.** Type of line: _____ (it has equals)
- **Step 3.** Direction to shade: _____

The boundary line and shaded area describe the **solution.**

Test point (0,0) into $x \geq 6$: ____ ≥ 6 (_____) So, shaded region will _____ contain (0,0).

C. Solve a System of 2 Linear Inequalities Graphically

- **EXAMPLE:** Graph the solution set to the system of inequalities.
  Use the graph to identify one solution. Use the graphing tool to graph the system.

$$\begin{cases} 2x + y < 3 \\ x + y < 1 \end{cases}$$ [6.2.23]

- **Step 1.** Convert each to **SLOPE-INTERCEPT** form:

$2x + y < 3$ (subtract 2x) (simplify)

$x + y < 1$ (subtract x) (simplify)

Graph the boundary line: $y_1 =$
y-intercept: (0,)

slope: $m = \frac{\quad}{\quad} = \frac{\quad}{\quad}$

The symbol used: _____
(_____-than)

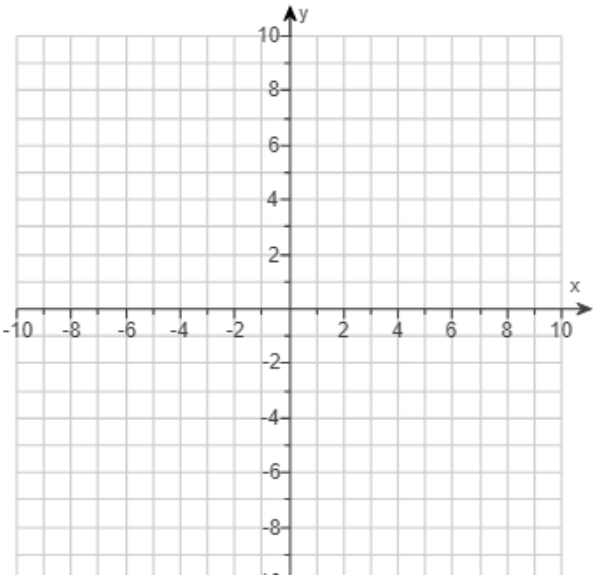
- **Step 2.** Type of line: _____ (no equals)
- **Step 3.** Direction to shade: _____

Graph the boundary line: $y_2 =$
y-intercept: (0,)

slope: $m = \frac{\quad}{\quad} = \frac{\quad}{\quad}$

The symbol used: _____
(_____-than)

- **Step 2.** Type of line: _____ (no equals)
- **Step 3.** Direction to shade: _____



Use small arrows on the _____ of each to show the direction of the shading.
The region with _____ arrows is the solution.

The boundary line and shaded area describe the **solution.**

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- **EXAMPLE:** Graph the system of inequalities. Which graph is the solution of the system?

$$\begin{cases} x + y \le 1 \\ x - y \le 3 \end{cases}$$ [6.2.17]

- **Step 1.** Convert each to **SLOPE-**_____ form.

$x + y \le 1$ (subtract *x*) (simplify)

$x - y \le 3$ (subtract *x*) (simplify) (divide by –1)

$\_\_ \le \_\_ + \_\_$

_____!

Graph the boundary line:

$y_1 =$

y-intercept: $(0, \quad)$

slope: $m = \frac{\_}{\_} = \_\_\_$

The symbol used: _____

(_____-than or equal to)

- **Step 2.** Type of line: _____ (has equals)
- **Step 3.** Direction to shade: _____

Graph the boundary line:

$y_2 =$

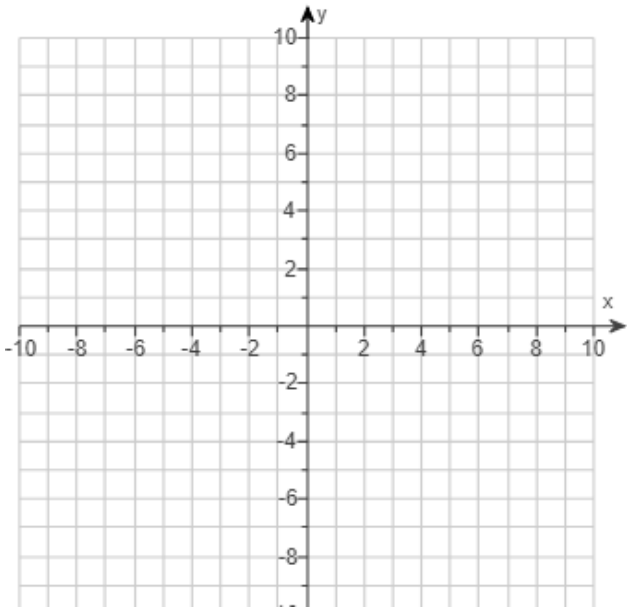
y-intercept: $(0, \quad)$

slope: $m = \frac{\_}{\_} = \_\_\_$

The symbol used: _____

(_____-than or equal to)

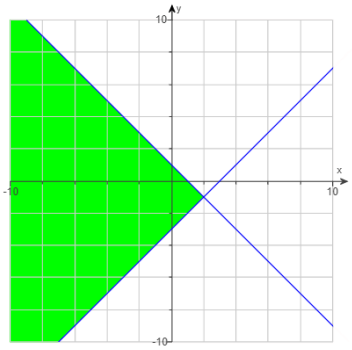
- **Step 2.** Type of line: SOLID (has equals)
- **Step 3.** Direction to shade: _____



Use small _____ on the ends of each line to show direction of shading. The region with TWO arrows is the _____.

The boundary line and shaded area describe the **solution**. Answer is ____.

A.



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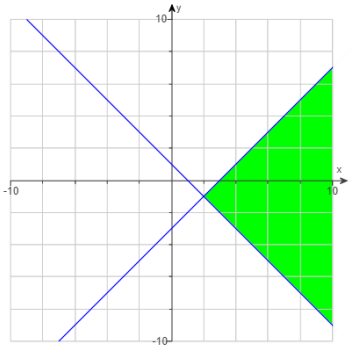
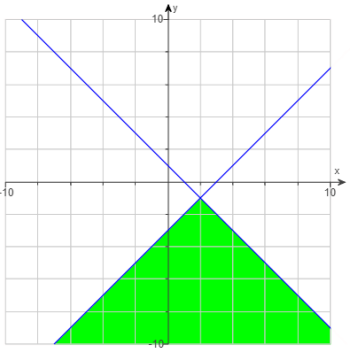


C.



D.