Unit 6 Day 1: Graphing Linear Inequalities

Graphing linear inequalities with two variables

Working with Inequalities and Absolute Values

A linear inequality can be written in the following forms:

$ax + by < c$ $\quad ax + by \leq c$ $\quad ax + by > c$ $\quad ax + by \geq c$

where (x, y) is an ordered pair that is a solution of the linear inequality, making the inequality true.

Is $(-2, 5)$ a solution of $2x - 6y > 12$?

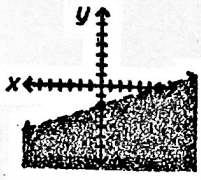
$2(-2) - 6(5) > 12$ Substitute the x and y values into the inequality.

$-4 - 30 > 12$

$-34 > 12$ Not true. Therefore, $(-2, 5)$ is not a solution.

To sketch a graph of a linear inequality, follow these simple steps.

1. Sketch the graph of the corresponding linear equation using a dashed line for $<$ or $>$ and a solid line for $\leq$ or $\geq$. Thus, separating the coordinate plane into two half planes.
2. Pick a point in each of the half planes and test each to find which one is a solution to the linear inequality.
3. Shade the half of the plane that contains the point that is a solution to the linear inequality.



The graph of the above example of $2x - 6y > 12$ is shown.

Note: Since $(-2, 5)$ was not a solution, choose another point on the other half of the plane to show what half needs to be shaded.

Write **yes** or **no** to state whether the given point is a solution of the inequality.

1. $2x - 3y \leq 7$; $(\overset{x}{5}, \overset{y}{-4})$

$2(5) - 3(-4) \leq 7$

$22 \leq 7$ ✗ False! Not a solution

2. $-x - y > 5$; $(\overset{x}{-2}, \overset{y}{-4})$

$-(-2) - (-4) > 5$

$6 > 5$ ✓ True! Solution!

3. $5x + 4y \geq 8$; $(\overset{x}{-2}, \overset{y}{6})$

$5(-2) + 4(6) \geq 8$

$14 \geq 8$ ✓ True! Solution!

4. $-7x + 8y < 12$; $(\overset{x}{-3}, \overset{y}{2})$

$-7(-3) + 8(2) < 12$

$37 < 12$ ✗ False! Not a solution

To graph a linear inequality, we need to know the slope and y-intercept. If the inequality does not have y by itself, you need to rewrite it.

The rules for graphing inequalities are as follows (once y is by itself!):

If your inequality has a $>$, you will draw a dotted line and shade above.

If your inequality has a $\geq$, you will draw a solid line and shade above.

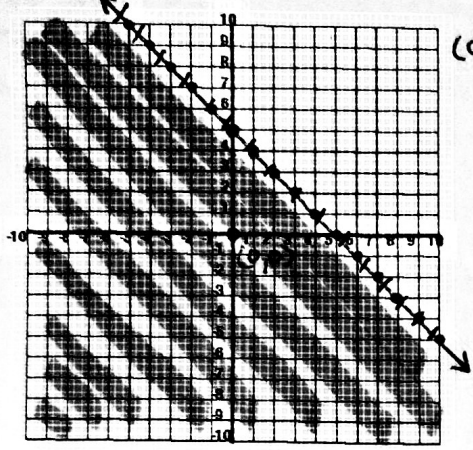
If your inequality has a $<$, you will draw a dotted line and shade under.

If your inequality has a $\leq$, you will draw a solid line and shade under.

Sketch the graph of each inequality.

5. $x + y < 5$ $\quad y < -x + 5$

$-x \quad -x$



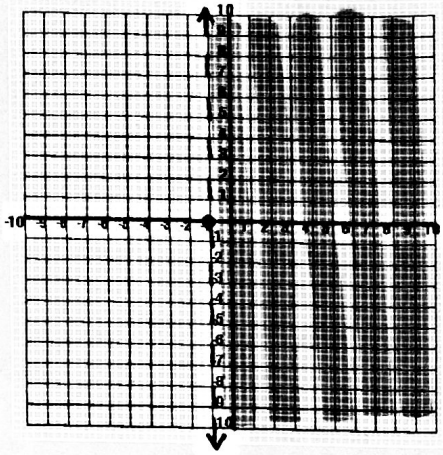
$(0) + (0) < 5$

$0 < 5$ ✓

True solution!

(should be dotted!)

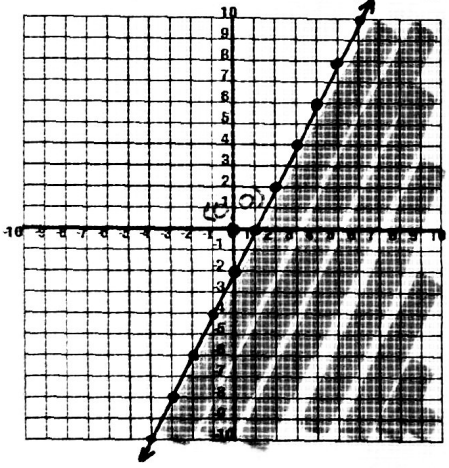
6. $x > -1$



7. $2x - y \geq 2$ $\quad y \leq 2x - 2$

$-2x \quad -2x$

$\frac{-y}{-1} \geq \frac{-2x}{-1} + \frac{2}{-1}$



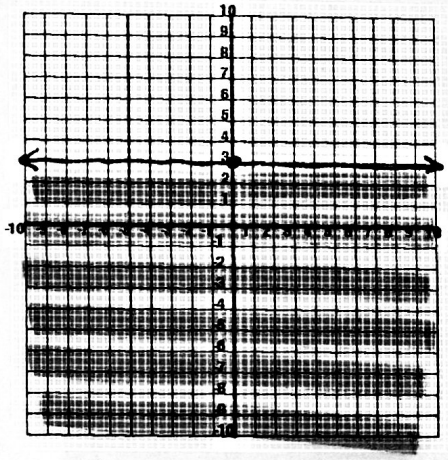
$2(0) - (0) \geq 2$

$0 \geq 2$

Not true!

Not a solution

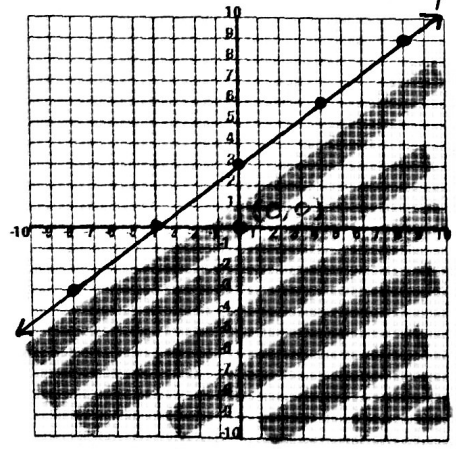
8. $y \leq 3$



9. $-3x + 4y \leq 12$ $\quad \frac{4y}{4} \leq \frac{3x}{4} + \frac{12}{4}$

$+3x \quad +3x$

$y \leq \frac{3}{4}x + 3$



$-3(0) + 4(0) \leq 12$

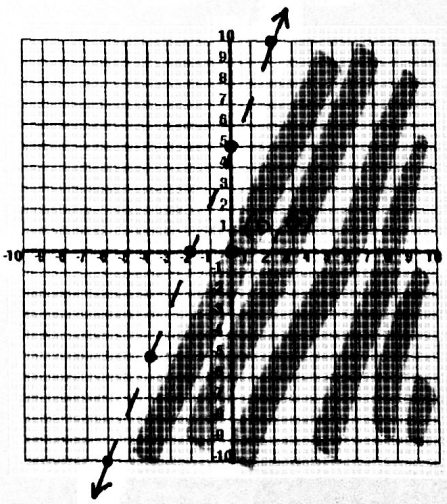
$0 \leq 12$ ✓

True solution

10. $5x - 2y > -10$ $\quad \frac{-2y}{-2} > \frac{-5x}{-2} - \frac{10}{-2}$

$-5x \quad -5x$

$y < \frac{5}{2}x + 5$



$5(0) - 2(0) > -10$

$0 > -10$

Day 1 Homework

rate whether each inequality would be a **solid** or a **dashed** line. Tell whether you would shade **bove** or **below** the line.

1. $3x - y \leq 7$
   Solid!

2. $6x - y < 10$
   dotted!

3. $y \leq 2x - 8$
   Solid!

4. $4x + 5y > 2$
   dotted!

5. $x + y \geq -5$
   Solid!

6. $y < 9x + 1$
   dotted!

7. Check whether the ordered pairs are solutions of: $x - 4y < 1$

   a.) (5, 1): $(5) - 4(1) < 1$, $1 < 1$

   b.) (0, 0): $(0) - 4(0) < 1$, $0 < 1$

   Answer: a.) NO b.) Yes!

8. Check whether the ordered pairs are solutions of: $4x + 5y \leq 12$

   a.) (-3, 5): $4(-3) + 5(5) \leq 12$, $-12 + 25 \leq 12$, $13 \leq 12$

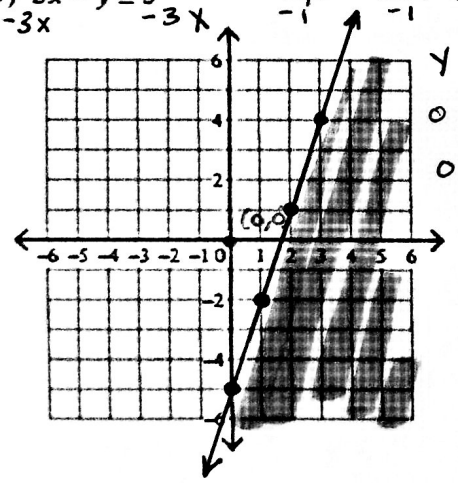
   b.) (6, -8): $4(6) + 5(-8) \leq 12$, $24 + -40 \leq 12$, $-16 \leq 12$

   Answer: a.) No b.) YES!

9) $3x - y \geq 5$

$-3x \quad -3x$

$\frac{-y}{-1} \geq \frac{-3x}{-1} + \frac{5}{-1}$



$y \leq 3x - 5$

$0 \leq 3(0) - 5$

$0 \leq -5$

Not true!

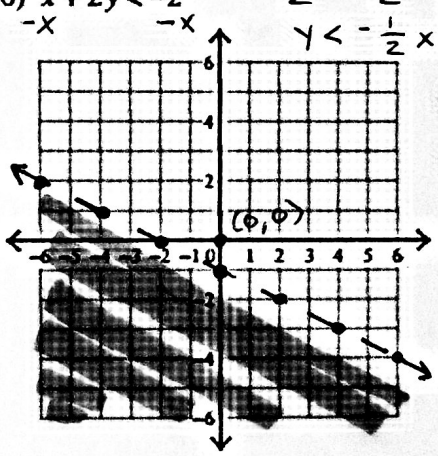
Not a solution

10) $x + 2y < -2$

$-x \quad -x$

$\frac{2y}{2} < \frac{-x}{2} - \frac{2}{2}$

$y < -\frac{1}{2}x - 1$



$0 < -\frac{1}{2}(0) - 1$

$0 < -1$

Not true!

Not a solution

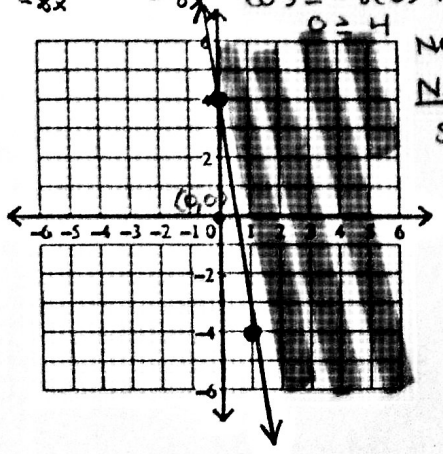
11) $8x + y \geq 4$

$-8x \quad -8x$

$y \geq -8x + 4$

$(0) \geq -8(0) + 4$

$0 \geq 4$



Not true!

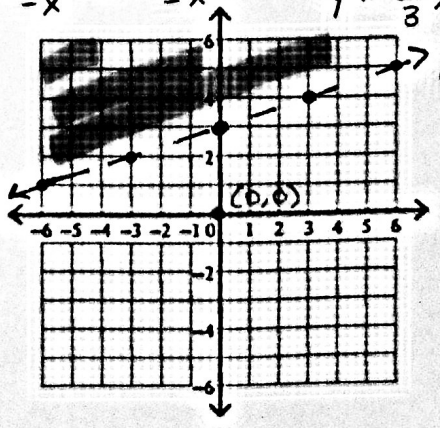
Not a solution

12) $x - 3y < -9$

$-x \quad -x$

$\frac{-3y}{-3} < \frac{-x}{-3} - \frac{9}{-3}$

$y > \frac{1}{3}x + 3$



$(0) > \frac{1}{3}(0) + 3$

$0 > 3$

Not true!

Not a solution