Name: KEY Date: _____

GRAPHS OF LINEAR INEQUALITIES

So, we have graphed linear functions and in the last lesson learned that the points that lie on a graph are simply the (x, y) pairs that make the equation true. Graphing an inequality in the xy-plane is exactly the same

GRAPHING INEQUALITIES

To graph an inequality simply means to plot (or shade) **all** (x, y) **pairs that make the inequality true**

***Exercise* #1:** Consider the inequality $y > x+3$.

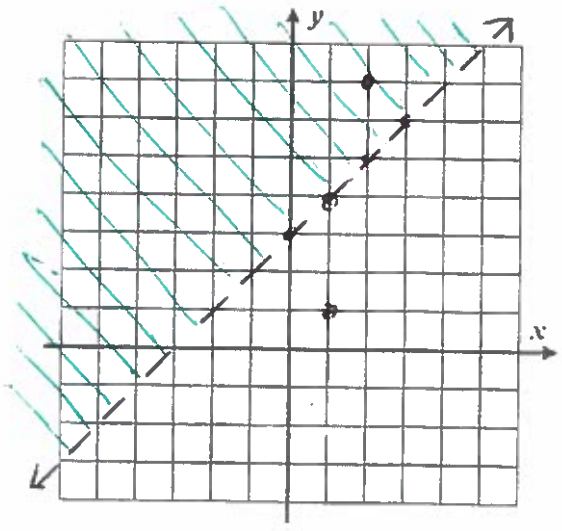
(a) Determine whether each of the following points lies in the solution set (and thus on the graph of) the inequality given.

$(2,7)$ yes
$7 > 2+3$
$\checkmark$
$7 > 5$ ✓

$(0,1)$ no
$1 > 0+3$
$1 > 3$ x

$(1,4)$ no
$4 > 1+3$
$4 > 4$ x

(b) Graph the line $y = x+3$ on the grid below in **dashed form.** Why are points that lie on this line **not** part of the **solution set** of the inequality? it's not equal to, only greater than



(c) Plot the three points from part (a) and use them to help you shade the proper region of the **plane** that represents the solution set of the inequality.

(d) Choose a fourth point that lies in the region you shaded and show that it is in the solution set of the inequality.

$(-1, 4)$
$4 > -1+3$
$4 > 2$
$\checkmark$

(e) The point $(10, 12)$ cannot be drawn on the graph grid above, so it is difficult to tell if it falls in the shaded region. Is $(10, 12)$ part of the solution set of this inequality? Show how you arrive at your answer.

$12 > 10+3$
$12 > 13$
no, untrue statement

There are some challenges to graphing linear inequalities, especially if the output, y, has not been solved for. Let's look at the **worst case scenario**.

Exercise #2: Consider the inequality $3x - 2y \geq 2$

(a) Rearrange the left-hand side of this inequality using the commutative property of addition.

$-2y + 3x \geq 2$

(b) Solve this inequality for y by applying the **properties of inequality** that we used in Unit #2.

$-2y + 3x \geq 2$

$-3x \quad -3x$

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

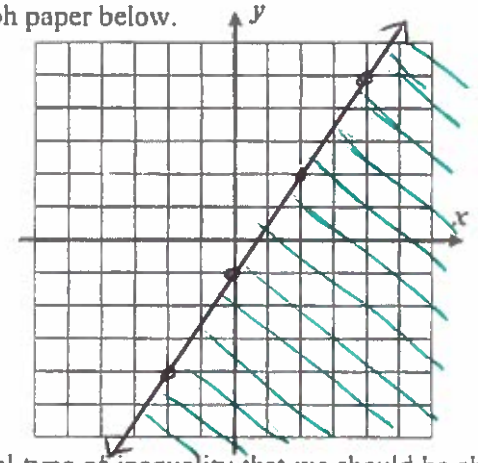
$y \leq \frac{3}{2}x - 1$

$(0,0)$:

$3(0) - 2(0) \geq 2$

$0 \geq 2$ ×

(c) Shade the solution set of this inequality on the graph paper below.



(d) Pick a point in the shaded region and show that it is a solution to the **original** inequality.

$(2,0)$: $3(2) - 2(0) \geq 2$

$6 - 0 \geq 2$

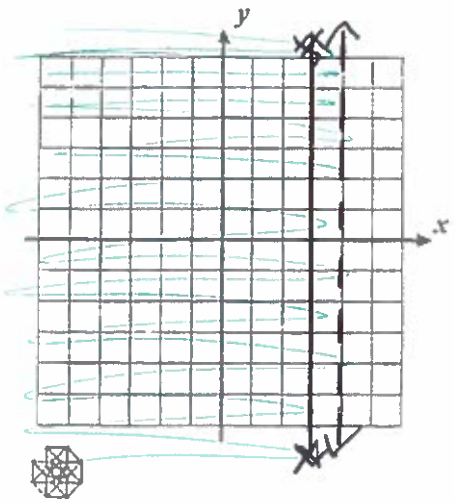
$6 \geq 2$ ✓

The final type of inequality that we should be able to graph quickly and effectively is one that involves either a **horizontal line** or a **vertical line**.

Exercise #3: Shade the solution set for each of the following inequalities in the xy-planes provided. First, state in your own words the (x, y) pairs that the inequality is describing.

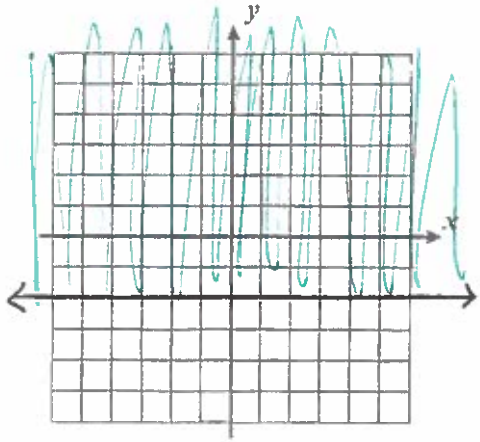
(a) $x < 4$

Your own words: X-values that are less than 4



(b) $y \geq -2$

Your own words: Y-values that are greater than or equal to -2



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GRAPHS OF LINEAR INEQUALITIES

FLUENCY

1. Determine which of following points lie in the solution set of the inequality $y \geq 2x-4$ and which do not. Justify each choice.

(a) $(5,4)$ no
$4 \geq 2(5)-4$
$4 \geq 10-4$
$4 \geq 6$
X

(b) $(0,-1)$ yes
$-1 \geq 2(0)-4$
$-1 \geq 0-4$
$-1 \geq -4$
✓

(c) $(10,16)$ yes
$16 \geq 2(10)-4$
$16 \geq 20-4$
$16 \geq 16$
✓

(d) $(2,-1)$ no
$-1 \geq 2(2)-4$
$-1 \geq 4-4$
$-1 \geq 0$
X

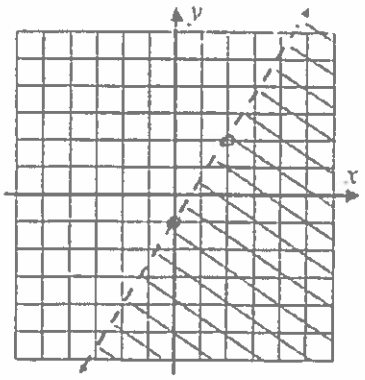
2. Which of the following points lies in the solution set of the inequality $y \geq 3x+10$?

(1) $(1,10)$ $10 \geq 3+10$ $10 \geq 13$
(2) $(4,20)$ $20 \geq 12+10$ $20 \geq 22$
(3) $(-1,3)$ $3 \geq -3+10$ $3 \geq 7$
(4) $(2,16)$ $16 \geq 6+10$ $16 \geq 16$

3. Which of the following points does *not* lie in the solution set to the inequality $y \geq -\frac{1}{3}x+5$?

(1) $(6,3)$ $3 \geq -2+3$ $3 \geq 3$ ✓
(2) $(-6,5)$ $5 \geq +2+5$ $5 \geq 7$
(3) $(-3,8)$ $8 \geq 1+5$ $8 \geq 6$
(4) $(12,3)$ $3 \geq -4+5$ $3 \geq 1$

4. Which of the following linear inequalities is shown graphed below?



$b = -1$
$m = \frac{3}{2}$

(1) $y < \frac{3}{2}x-1$
(2) $y > \frac{2}{3}x-1$
(3) $y \leq \frac{2}{3}x-1$
(4) $y \geq \frac{3}{2}x-1$

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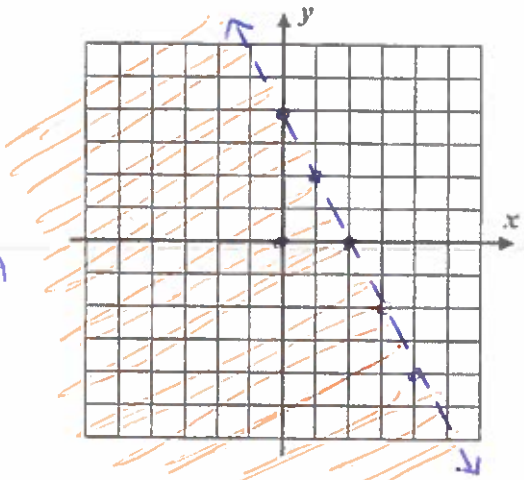
5. Graph the solution set to the inequality shown below. State one point that lies in the solution set and one point that does not.

$y < -2x + 4$ $b = 4$ dashed line

$m = -\frac{2}{1}$



One Point In Solution: $(0,0): 0 < -2(0) + 4$, $0 < 4$ ✓

One Point Not In Solution: $(2,3): 3 < -2(2) + 4$, $3 < -4 + 4$, $3 < 0$ ×

6. Rearrange the inequality below so that it is easier to graph and then sketch its solution set on the grid given. Be careful when dividing by a negative and remember to switch the inequality sign.

$x - 2y \leq 6$

$-x \quad -x$

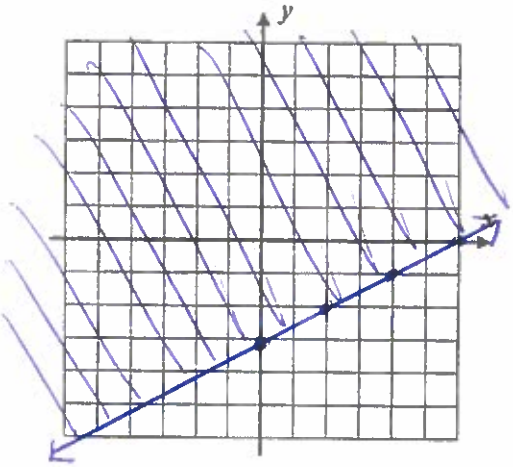
$\frac{-2y}{-2} \leq \frac{-x + 6}{-2}$

$y \geq \frac{1}{2}x - 3$

$b = -3$

$m = \frac{1}{2}$

Solid line

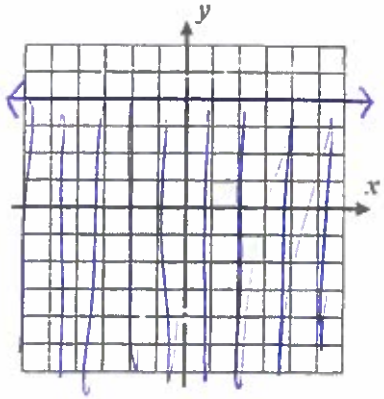


One Point In Solution: $(0,0): 0 - 2(0) \leq 6$, $0 \leq 6$ ✓

One Point Not In Solution: $(0,-4): 0 - 2(-4) \leq 6$, $8 \leq 6$ ×

7. Graph the solution set to each of the following inequalities.

(a) $y \leq 4$



(b) $x > 1$