6.1 Graphing Linear Inequalities in Two Variables (Concept #1)

Determining solutions of inequalities

Example#1: For which inequalities is (3, 1) a possible solution?

a) $13 - 3x > 4y$

$13 - 3(3) > 4(1)$

$13 - 9 > 4$

$4 > 4$ x Not true

$\therefore$ (3,1) is not a solution

b) $2y - 5 \leq x$

$2(1) - 5 \leq 3$

$2 - 5 \leq 3$

$-3 \leq 3$ ✓ True

$\therefore$ (3,1) is a solution

c) $y \geq 9$

$1 \geq 9$ x False

$\therefore$ (3,1) is not a solution

Graphing Linear Inequalities in two variable

Steps to Graphing Inequalities

1. Initially, graph the boundary line. (ex. y= mx+b)

Methods of Graphing:

- table of values
- find x-intercept and y-intercept
- $y = mx + b$ (m = slope, b = y-intercept)

2. If the inequality is < or > use a ***dotted line*** (the points on the line are NOT included in the solution)
   If the inequality is ≤ or ≥ use a ***solid line*** (the points on the line ARE included in the solution)

When given a domain and range, the solution set is considered :

Continuous – (Real Numbers) (ex. x ∈ R, y ∈ R)
Discrete – separate or distinct set of number (Integers, Whole Numbers)(eX. x ∈ W, y ∈ W or x ∈ I, y ∈ I)
If no domain and range are given, assume the set of Real Numbers.

3. Choose a check point (if possible, choose the origin) and substitute into the original equation.
   Shade on the appropriate side of the line. Do NOT pick a point that lies on the line.

Example#2: Graph $-2x + 5y \geq 10$ $+2x$ $+2x$

Boundary Line $\frac{5y}{5} \geq \frac{2x}{5} + \frac{10}{5}$

solid line $y \geq \frac{2}{5}x + 2$

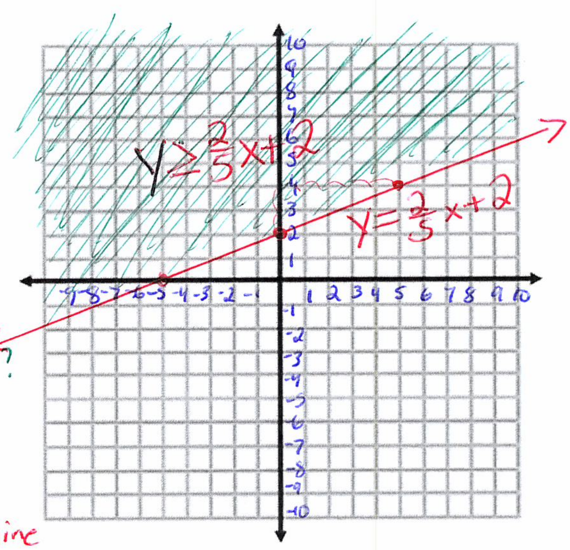
Equation of the boundary line $\rightarrow y = \frac{2}{5}x + 2$

Test Point ↳ (0,0) is the solution region?

$-2(0) + 5(0) \geq 10$

$0 \geq 10$ False

$\therefore$ Shade the region above the boundary line where (0,0) is not included



Question: Is (5,4) a part of the solution set? Is (3,-4) ?

Yes NO

How would the above graph look if the domain and range changed to integers?

Example #3: Graph

a) {(x, y)| $x - 3 > 0$; x ∈ R, y ∈ R}

dashed boundary line

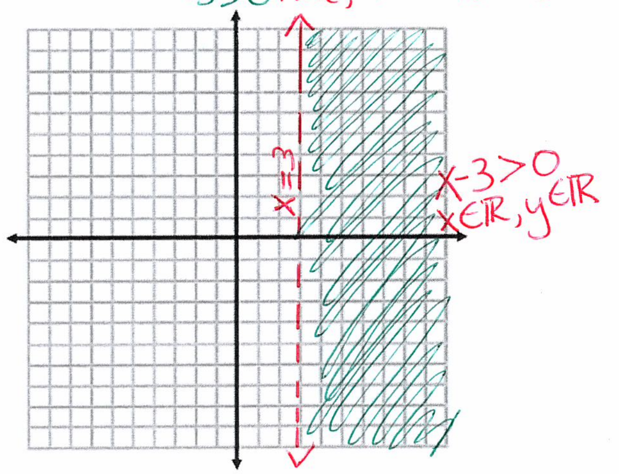
$x - 3 = 0$ (+3 to both sides)

$x = 3$ $x > 3$

Test point (0,0)

$0 - 3 > 0$

$-3 > 0$ False, ∴ shade other side



b) (x, y) l $x - 2y - 3 < 7 - 2x$, x ∈ I, y ∈ I}

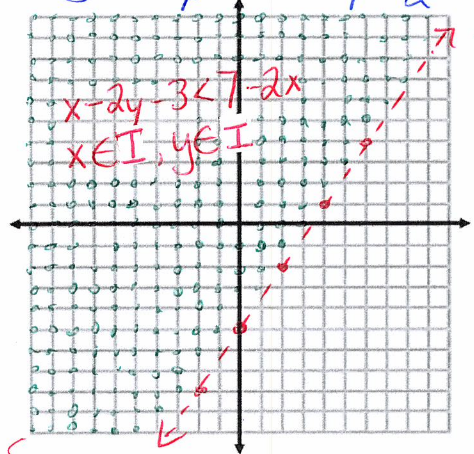
dashed line

$x - 2y - 3 < 7 - 2x$ (−x, +3 to both sides)

$\frac{-2y}{-2} < \frac{10 - 3x}{-2}$ ✱ Flip the inequality when you multiply or divide by a negative

$y > \frac{3}{2}x - 5$

boundary line equation ⇒ $y = \frac{3}{2}x - 5$



Test Point (0,0)

$0 > \frac{3}{2}(0) - 5$

$0 > -5$

True

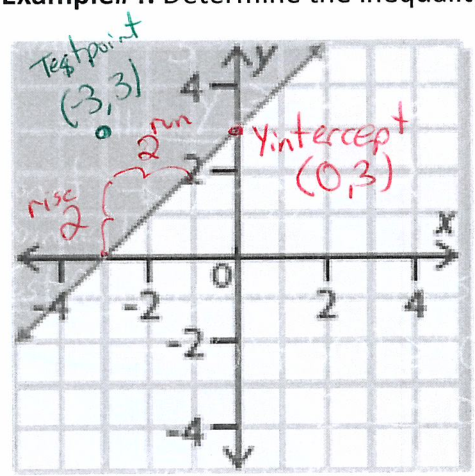
The domain and range only include the integers

In graph b is ($\frac{1}{2}$, 0) in the solution set?

No, because x is a rational #

Remember: When you divide or multiply both sides of an inequality by a negative number, you must Flip the inequality sign!!!

Example#4: Determine the inequality of this graph



$y = x + 3$ boundary line equation

$y \geq x + 3$

check
Pick a point in the shaded region and test it in the inequality.

(-3,3)

$y \geq x + 3$

$3 \geq -3 + 3$

$3 \geq 0$ True.

∴ $y \geq x + 3$ is the inequality.

EXAMPLE #5: Kolton and Carolyn want to donate some money to a local food pantry. To raise funds, they are selling PI necklaces and earrings that they have made themselves. Necklaces cost \$8 and earrings cost \$5. What is the range of possible sales they could make in order to donate at least \$100?

a) Assign your variables: Let x = # of necklaces
Let y = # of earrings

b) Establish your inequality: $8x + 5y \geq 100$

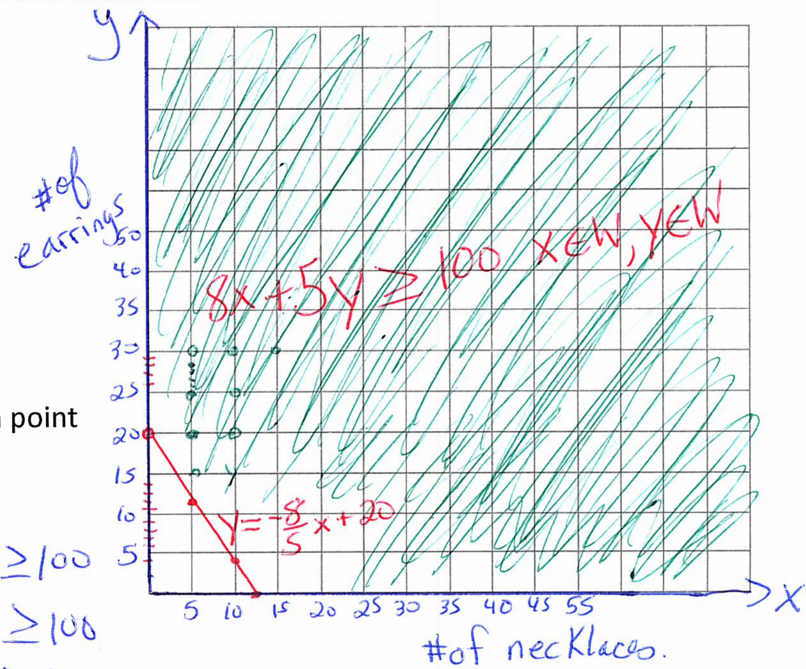
c) Decide what type of restrictions will be on the domain and range and decide if your graph would include all Real Numbers, Integers or Whole Numbers.

$x \in W \quad y \in W$

d) Sketch a graph of this situation.

$\frac{5y}{5} \geq \frac{-8x}{5} + \frac{100}{5}$

$y \geq -\frac{8}{5}x + 20$



e) Find two points that satisfy this situation.

(15,15) (20,25)

f) Verify both your points and explain what each point means within the context of this situation.

(15,15)

$8(15) + 5(15) \geq 100$

$120 + 75 \geq 100$

$195 \geq 100$

True

(20,25)

$8(20) + 5(25) \geq 100$

$160 + 125 \geq 100$

$285 \geq 100$

True

ASSIGNMENT: TEXTBOOK p303 #3, 4, 5, 6, AT LEAST TWO OF 7-12 & 14

PLUS THE FOLLOWING

1. For $y < 3x + 5$ which of the following points fall within the solution set?

$(-1,-3), (-1,2), (-4,3), (-2,-3), (3,1), (1,5), (0,5), (-1,3)$

2 Determine the inequality for the following graphs