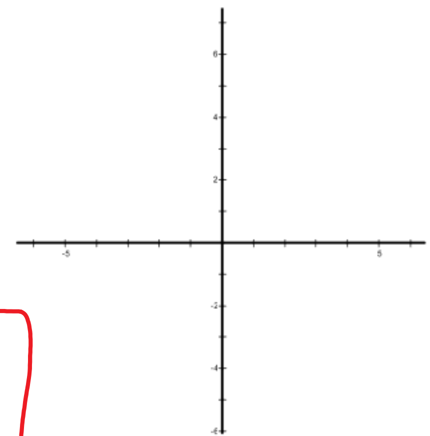
FOM 11 **6.1 Graphing Linear Inequalities In Two Variables**

Look at the graph of $y = x$.



The line divides the plane into two half-planes:

- $y < x$ is the region below the line.
- $y > x$ is the region above the line.
- $y = x$ is the boundary line.

A **solid boundary line** is used to represent $\leq$ or $\geq$.

A **dotted boundary line** is used to represent $<$ or $>$.

To graph an inequality:

1. Graph the boundary line. → convert inequality into $y = mx + b$
2. Pick a point not on the line and substitute it into the inequality. → Test point
3. If the inequality is satisfied, shade the region containing the point. If not, shade the other region.

Example 1: Graph $4x - 5y < 20$.

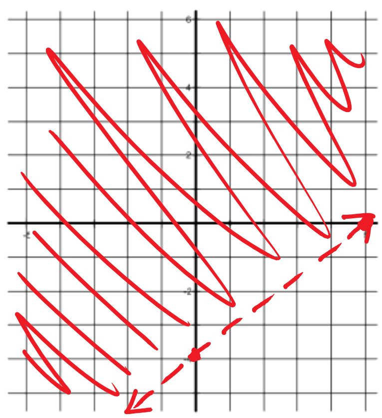
dotted line

1. $4x - 5y = 20$

$-4x \qquad -4x$

$\frac{-5y}{-5} = \frac{-4x}{-5} + \frac{20}{-5}$

$y = \frac{4}{5}x - 4$



2. Test point $(0, 0)$

$4(0) - 5(0) < 20\ ?$

$0 - 0$

$0 < 20$ ✓

3. since $(0, 0)$ satisfies the inequality, we shade the region including $(0, 0)$.

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

Solid

① $2x-5y=10$
$-2x \qquad -2x$

$-5y=-2x+10$

$\frac{-5y}{-5}=\frac{-2x}{-5}+\frac{10}{-5}$

$y=\frac{2}{5}x-2$

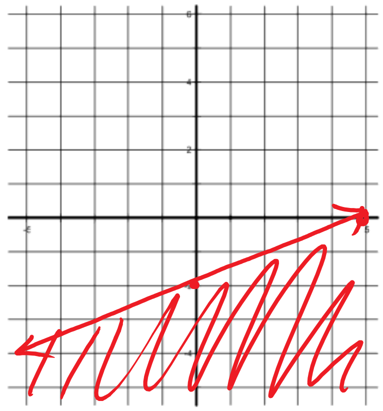
② Test pt. $(0,0)$

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

$0-0\geq 10$ ✗

$0\geq 10$

③ shade opposite region



R = real number

Example 3: Graph the solution set for each linear inequality on a Cartesian plane:

a. $\{(x,y)|x-3>0, x\in R, y\in R\}$

① $x-3=0$

$x=3$

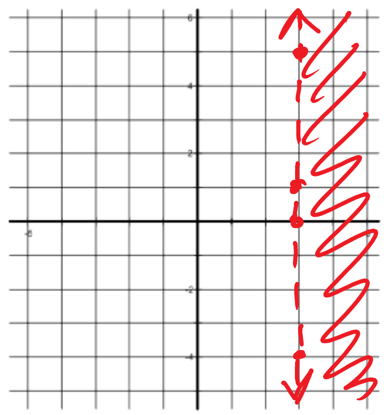
dotted

② Test pt $(0,0)$

$0-3>0$?

$-3>0$ ✗

③ shade the opposite



b. $(x,y)|-3y+9\geq -3+y$, $\cancel{x\in I, y\in I}$

① $-3y+9=-3+y$
$-y \qquad -y$

Solid.

$-4y+9=-3$
$-9 \qquad -9$

$\frac{-4y}{-4}=\frac{-12}{-4}$

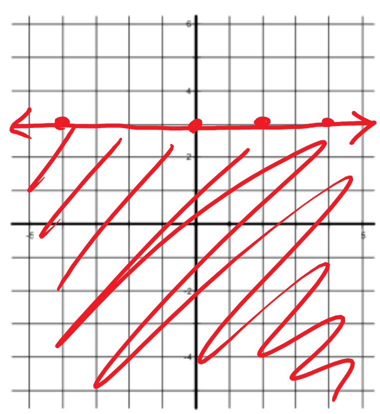
$y=3$

② Test pt $(0,0)$

$-3(0)+9\geq -3+(0)$

$0+9\geq -3$

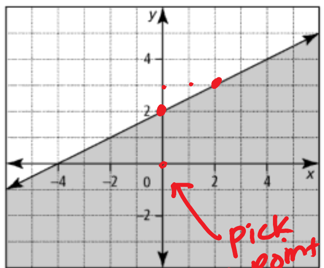
$9\geq -3$



Example 4: Write an inequality to represent the graph:

① Boundary Line $y = mx + b$ ($m \uparrow \frac{1}{2}$, $b \uparrow 2$)

a.



pick a point from the soln.

$y = \frac{1}{2}x + 2$

② $y \ \square \ \frac{1}{2}x + 2$

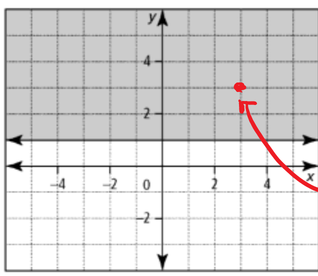
$0 \ \square \ \frac{1}{2}(0) + 2$

$0 \ \square \ 0 + 2$

$0 \ \boxed{\leq} \ 2$

$\boxed{y \leq \frac{1}{2}x + 2}$

b.



① B.L.

$y = 1$

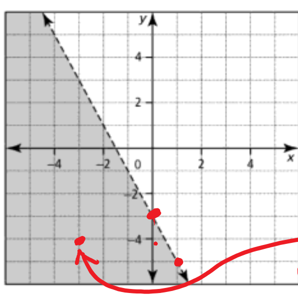
② $y \ \square \ 1$

$3 \ \square \ 1$

$3 \geq 1$

$\boxed{y \geq 1}$

c.



① B.L. $y = mx + b$ ($m \uparrow -\frac{2}{1}$, $b \uparrow -3$)

$y = -2x - 3$

② $y \ \square \ -2x - 3$

$(-3, -4)$ $-4 \ \square \ -2(-3) - 3$

$-4 \ \square \ 6 - 3$

$-4 \ \square \ 3$

$<$

$\boxed{y < -2x - 3}$

HW: p. 303 # 2, 5 acdf

Example 5: Ben is buying snacks for his friends. He has \$10.00. The choices are apples for \$0.80 and muffins for \$1.25.

a) Write an inequality in two variables to model this situation. Define your variables.

Let x = # of apples

y = # of muffins

$0.8x + 1.25y \le 10$

b) State the restrictions on the variables.

$x \in W$

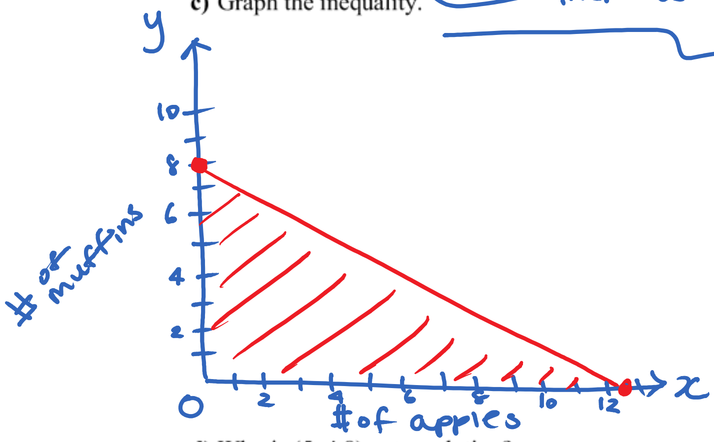
$y \in W$ ← includes

(W means whole numbers.)

x has to be whole #.

y has to be whole #.

c) Graph the inequality.



$0.8x + 1.25y \le 10$

x-int ($y = 0$)

$0.8x + 1.25(0) = 10$

$0.8x = 10$

$x = 12.5$

y-int ($x = 0$)

$0.8(0) + 1.25y = 10$

$1.25y = 10$

$y = 8$

d) Why is (5, 4.8) not a solution?

Not a sol$^{\underline{n}}$ b/c you cannot buy 4.8 muffins

Assignment: ~~pg. 303 #2, 5, 6ace, 7, 8, 10-12~~ $\boxed{\text{p. 303 \# 6ef, 7, 10}}$