

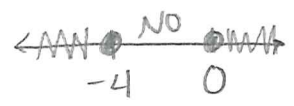


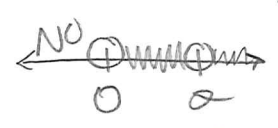
Solve and graph the following inequalities.

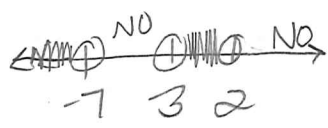
1.  $3 - 2x > 5$   
 $\begin{array}{r} 3 - 2x > 5 \\ -3 \quad -3 \\ \hline -2x > 2 \\ \frac{-2x}{-2} > \frac{2}{-2} \\ x < -1 \end{array}$   
 Linear → isolate x on left  
 flip ÷ by neg  


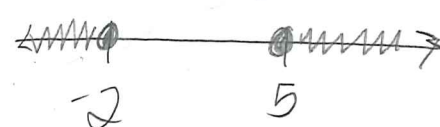
2.  $3\left(\frac{x-5}{3}\right) \geq (2x+1)3$  \*mult. by common den.  
 $\begin{array}{r} x-5 \geq 6x+3 \\ -6x \quad -6x \\ \hline -5x-5 \geq 3 \\ +5 \quad +5 \\ \hline -5x \geq 8 \\ \frac{-5x}{-5} \geq \frac{8}{-5} \end{array}$   
 flip  
 $x \leq -\frac{8}{5}$   


3.  $x(x+4) \geq 0$   
 $\begin{array}{l} \swarrow \quad \searrow \\ x=0 \quad x=-4 \end{array}$   
  
 $x \leq -4$  OR  $x \geq 0$

Factors → not Linear  
 \* Test intervals  
 $f(-5) = (-)(-) = \text{pos} > 0$  yes  
 $f(-3) = (-)(+) = \text{neg} > 0$  NO  
 $f(1) = (+)(+) = \text{pos} > 0$  yes

4.  $x^3 - 4x^2 + 4x > 0$  Cubic → plot roots & test intervals  
 $x(x^2 - 4x + 4)$   
 $x(x-2)(x-2) \rightarrow (x)(x-2)^2 > 0?$   
 $x=0 \quad x=2$   
  
 $x > 0$   
 $x \neq 2$   
 $f(-1) = (-)(+) = \text{neg} > 0$  NO  
 $f(1) = (+)(+) = \text{pos} > 0$  yes  
 $f(3) = (+)(+) = \text{pos} > 0$  yes

5.  $\frac{(x+7)(2-x)}{(x+3)} > 0$   
 $\begin{array}{l} \swarrow \quad \searrow \\ x=-7 \quad x=2 \\ \text{open} \quad \text{open} \end{array}$   
 $x=-3$  open  
  
 $x < -7$  OR  $-3 < x < 2$

6.  $|2x - 3| \geq 7$   
 $2x - 3 \geq 7$  OR  $2x - 3 \leq -7$   
 $\begin{array}{r} 2x - 3 \geq 7 \\ +3 \quad +3 \\ \hline 2x \geq 10 \\ x \geq 5 \end{array}$  OR  $\begin{array}{r} 2x - 3 \leq -7 \\ +3 \quad +3 \\ \hline 2x \leq -4 \\ x \leq -2 \end{array}$   
 $x \geq 5$  OR  $x \leq -2$   


$f(-8) = \frac{(-)(+)}{(-)} = \text{pos} > 0$  yes  
 $f(-4) = \frac{(+)(+)}{(-)} = \text{neg} > 0$  NO  
 $f(0) = \frac{(+)(+)}{+} = \text{pos} > 0$  yes  
 $f(3) = \frac{(+)(-)}{(+)} = \text{neg} > 0$  NO

Solve and graph the following inequalities.

7.  $|x+2| < -5$

$x+2 < -5$  AND  $x+2 > 5$   
 $-2$   $-2$

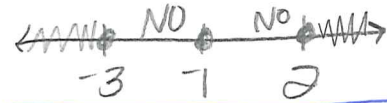
$x < -7$  and  $x > 3$   
 look for intersection



NO intersection → NO solution

8.  $(x-2)(x+1)^2(x+3) \geq 0$

$x=2$   $x=-1$   $x=-3$



$x \leq -3$  OR  $x \geq 2$

$f(-4) = (-)(+)(-) = \text{POS} \geq 0$  YES

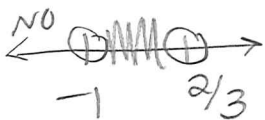
$f(-2) = (-)(+)(+) = \text{NEG} \geq 0$  NO

$f(0) = (-)(+)(+) = \text{NEG} \geq 0$  NO

$f(3) = (+)(+)(+) = \text{POS} \geq 0$  YES

9.  $(3x-2)(x+1) < 0$

$x=2/3$   $x=-1$



$-1 < x < 2/3$

$f(-2) = (-)(-) = \text{POS} < 0$  NO

$f(0) = (-)(+) = \text{NEG} < 0$  YES

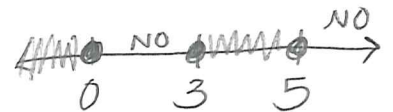
$f(3) = (+)(+) = \text{POS} < 0$  NO

10.  $x^3 - 8x^2 + 15x \leq 0$

$x(x^2 - 8x + 15)$  solid circle

$(x)(x-5)(x-3) \leq 0$  ?

$x=0$   $x=5$   $x=3$



$f(-1) = (-)(-)(-) = \text{NEG} \leq 0$  YES

$f(1) = (+)(-)(-) = \text{POS} \leq 0$  NO

$f(4) = (+)(-)(+) = \text{NEG} \leq 0$  YES

$f(7) = (+)(+)(+) = \text{POS} \leq 0$  NO

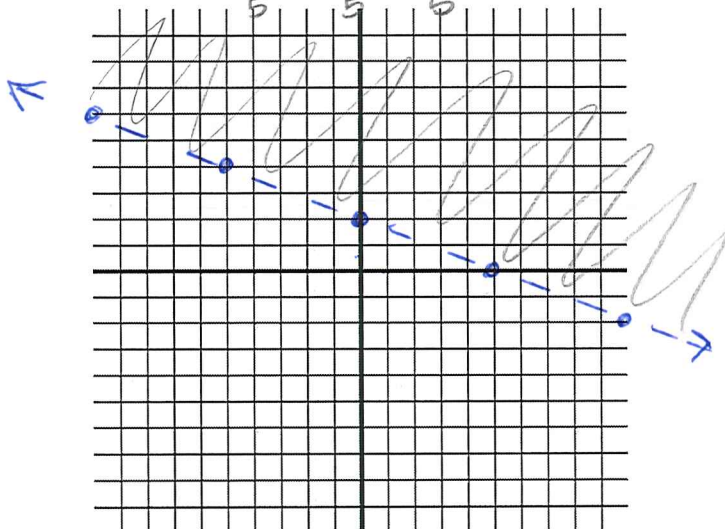
$x \leq 0$   
 OR  
 $-3 \leq x \leq 5$

Sketch the graph of each inequality.

11.  $2x + 5y > 10$

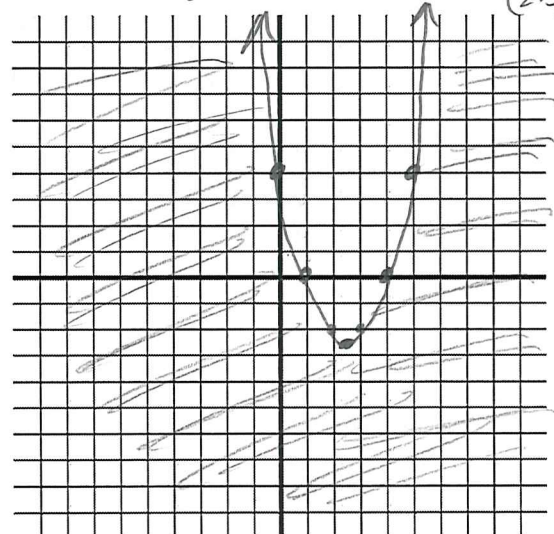
$y > \frac{2}{5}x + 2$   
 above  
 dash

$5y > -2x + 10$   
 $5$   $5$   $5$



12.  $y \leq x^2 - 5x + 4$

Vertex  $(2.5, -2.5)$   
 $\frac{-b}{2a} = \frac{5}{2} = 2.5$   
 $(2.5)^2 - 5(2.5) + 4 = -2.5$



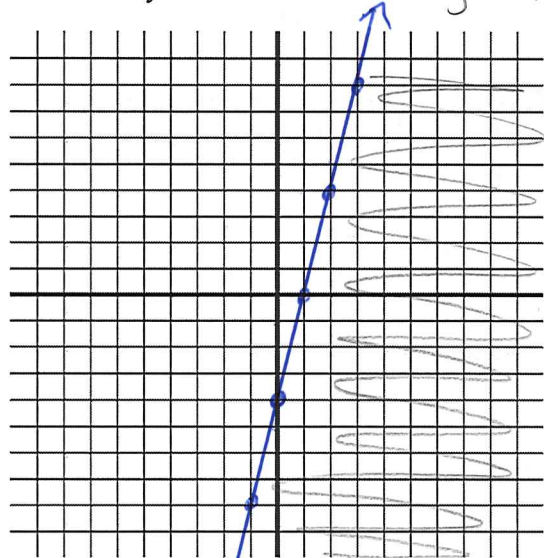
x	y
2	-2
3	-2
0	4
1	0

Sketch the graph of each inequality.

13.  $4x - y \geq 4$

$4x - 4 \geq y$

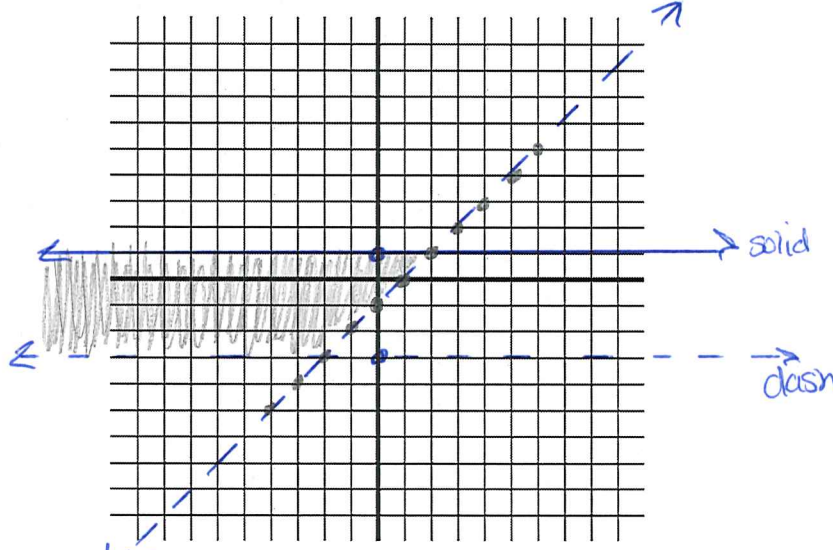
$y \leq 4x - 4$



14.  $-3 < y \leq 1$

and

$x - 1 < y \rightarrow y > x - 1$

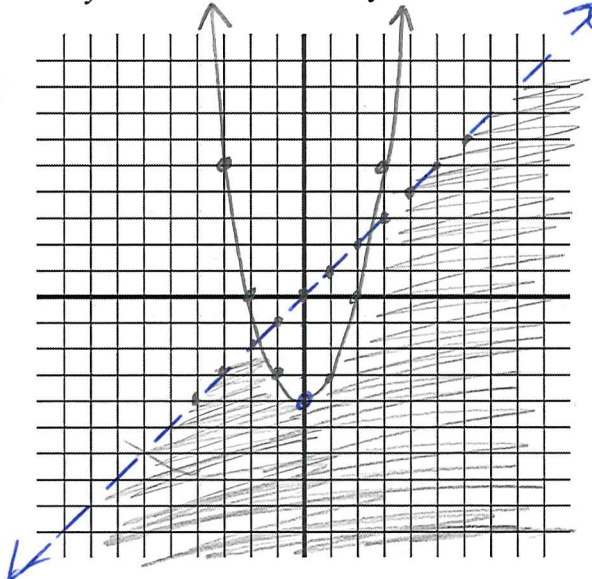


15.  $y \leq x^2 - 4$

and  $y < x + 0$

Vertex (0, -4)

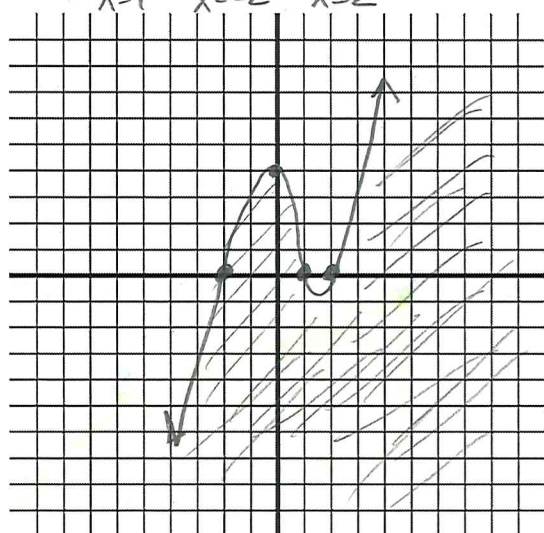
x	y
1	-3
2	0
3	5



16.  $y \leq (x-1)(x+2)(x-2)$

$x=1$   $x=-2$   $x=2$

$+x^3$

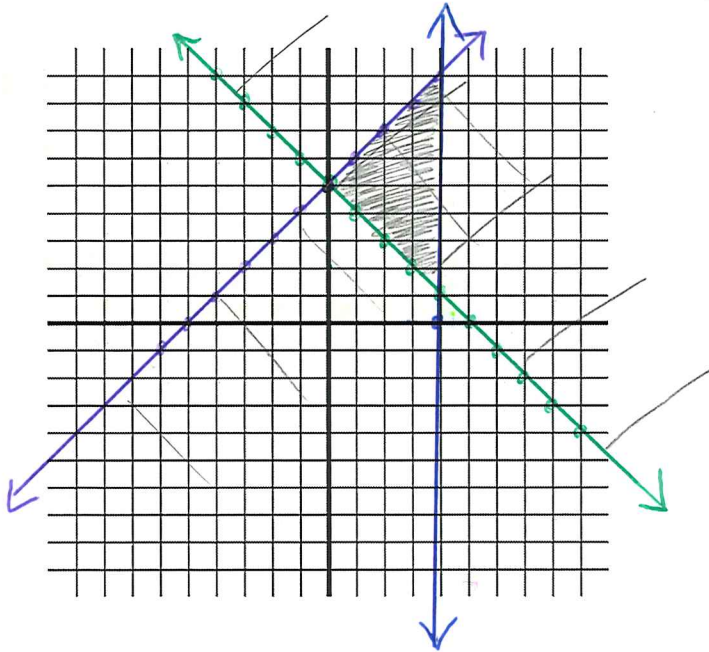


17. Graph the system.

\*  $x + y \geq 5$   $y \geq -x + 5$

\*  $x - y \geq -5$   $-y \geq -x - 5$   
 $y \leq x + 5$

\*  $x \leq 4$   
 vertical



Solve each problem by defining the variables, writing an objective function, and the constraints. Look at sections 3.4 (day 2) notes for the step by step process if needed.

18. Shoua is an amateur artist who specializes in geometric designs. She is trying to get ready for an art fair next month. She paints both watercolors and pastels. Each type of picture takes about the same amount of time to paint. She has \$180 to spend on supplies and time to paint at most 16 pictures before the fair. Materials for each pastel cost \$5 and materials for each watercolor cost \$15. Shoua makes a profit of \$40 on each pastel and \$100 on each watercolor.

Given the above facts, determine the number of painting of each type that Shoua should paint in order to maximize her profits at the art fair. What is the maximum profit Shoua could expect?

Define the variables:

$x = \# \text{ of pastels}$      $y = \# \text{ of watercolors}$

Constraints:

$x + y \leq 16 \rightarrow y \leq -x + 16 *$

$5x + 15y \leq 180 \rightarrow y \leq \frac{-5x + 180}{15}$

$y \leq -\frac{1}{3}x + 12 *$

1st Quad  $\begin{cases} x \geq 0 \\ y \geq 0 \end{cases}$

Objective Function: *This is profit so don't subtract cost of supplies in the end.*

$P = 40x + 100y$

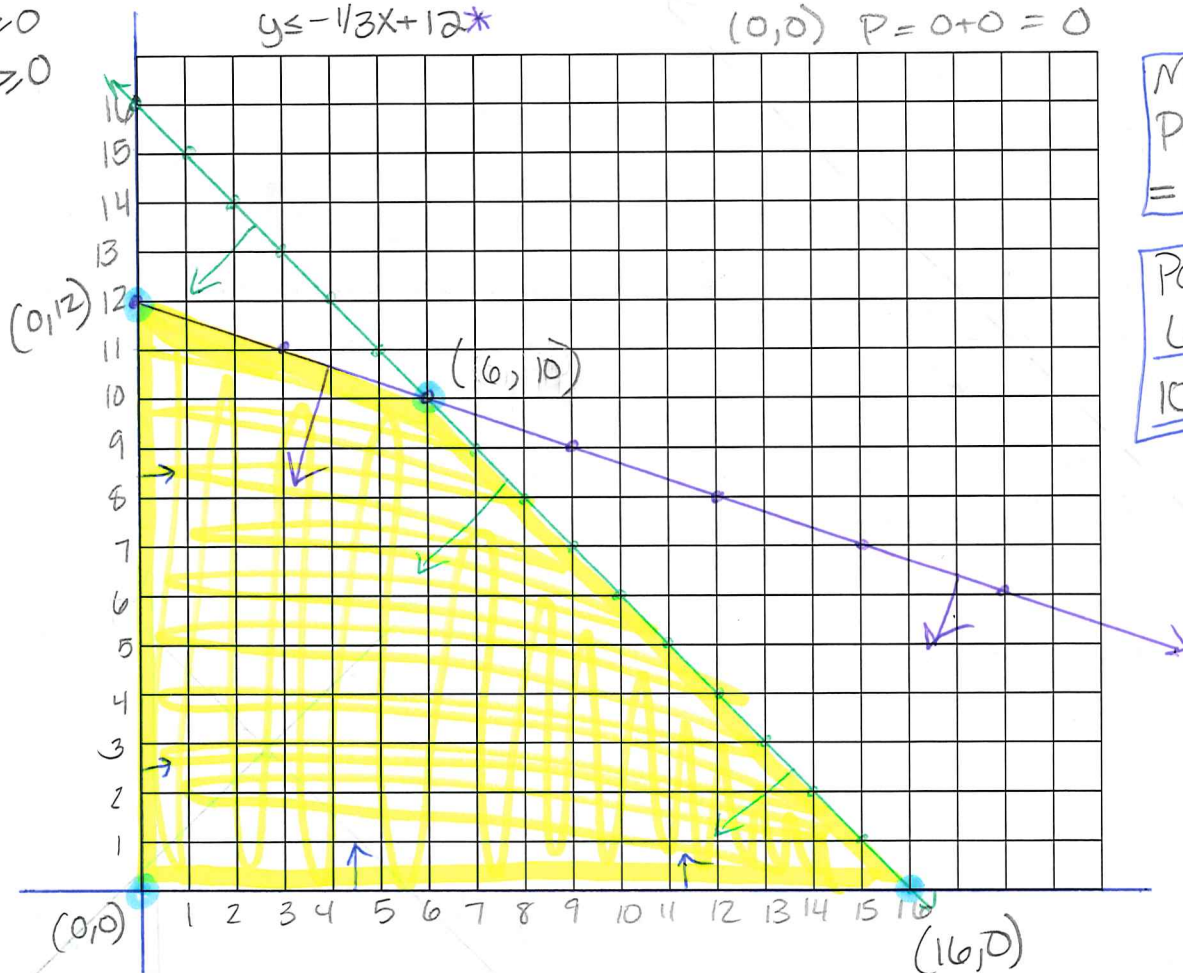
Vertices:

$(0, 12) \quad P = 100(12) = 1200$

$(6, 10) \quad P = 40(6) + 100(10) = 1240 *$

$(16, 0) \quad P = 40(16) = 640$

$(0, 0) \quad P = 0 + 0 = 0$



Max Profit = \$1240

Paint 6 pastels 10 watercolors