Clothes, houses, and jewelry

Name____Date______________Period______

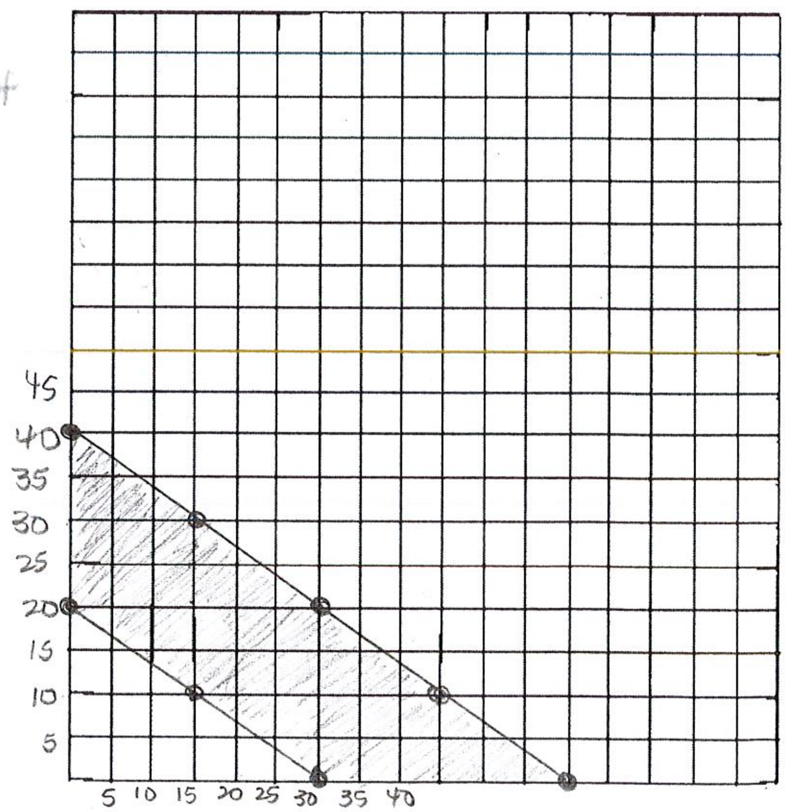
1. A clothing store manager wants to restock the men's department with two new types of shirts. Type **x** shirt costs $20 and type **y** shirt costs $30. The store manager needs to stock at least $600 worth of shirts to be competitive with other stores, but the store's purchasing budget cannot exceed $1200 worth of shirts.
   a. Write two inequalities demonstrating the minimum and maximum shirts to be stocked. $20x + 30y \geq 600$ $20x + 30y \leq 1200$
   b. Rewrite in y = mx + b form.

   $30y \geq -20x + 600$ $30y \leq -20x + 1200$

   $y \geq -\frac{2}{3}x + 20$ $y \leq -\frac{2}{3}x + 40$

   c. Graph and shade the region that satisfies both inequalities. Obviously, x > 0 and y > 0 are two more inequalities (constraints) in this problem.

   * you cannot have a negative amt of shirts!



   d. If you were the owner of the store, choose the most feasible number of each type of shirt you would purchase for your store. Explain your choice.

20 of type X
25 of type y

2. A painting contractor estimates it will take 5 hours to paint a one-story house (x) and 10 hours to paint a two-story house (y). The contractor submits a bid to paint at least 15 houses in less than 180 hours.

   a. Write a system of inequalities to model the time to paint the houses and the number of houses to be painted. $5x+10y<180$ $x+y\geq 15$

   $x >$ 0 $y >$ 0

   * can't have a neg. # of houses *

   b. Graph and shade the system

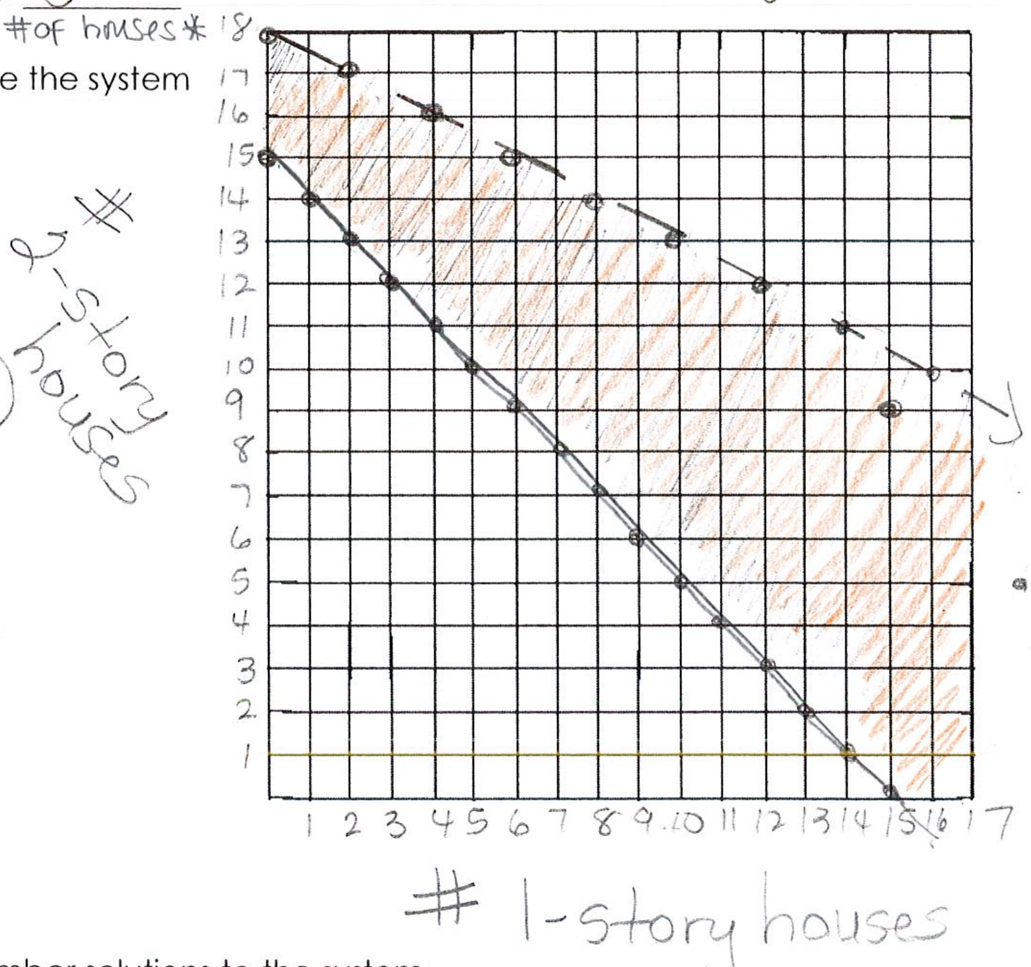
$5x+10y<180$

$\frac{10y}{10} < \frac{-5x}{10} + \frac{180}{10}$

$y < -\frac{1}{2}x+18$

$x+y\geq 15$

$y\geq -x+15$



   c. Give 3 whole number solutions to the system.

15 1-story houses
9 2-story houses

2 1-story houses
16 2-story houses

18 1-story houses
5 2-story houses

3. It costs \$.80 to make a bracelet and \$2 to make a necklace. To make a profit, the total cost for bracelets (x) and necklaces (y) must be less than \$30. The jeweler can make no more than 20 pieces of jewelry each day.

   a. Write a system of **4** inequalities to model the number of bracelets and necklaces to be made each day. $.80x+2y<30$ $x+y\le 20$ $x>0$ $y>0$

   b. Graph and shade the system to show the solution.

$.80x+2y<30$

$2y<-.8x+15$

$y<-.4x+15$

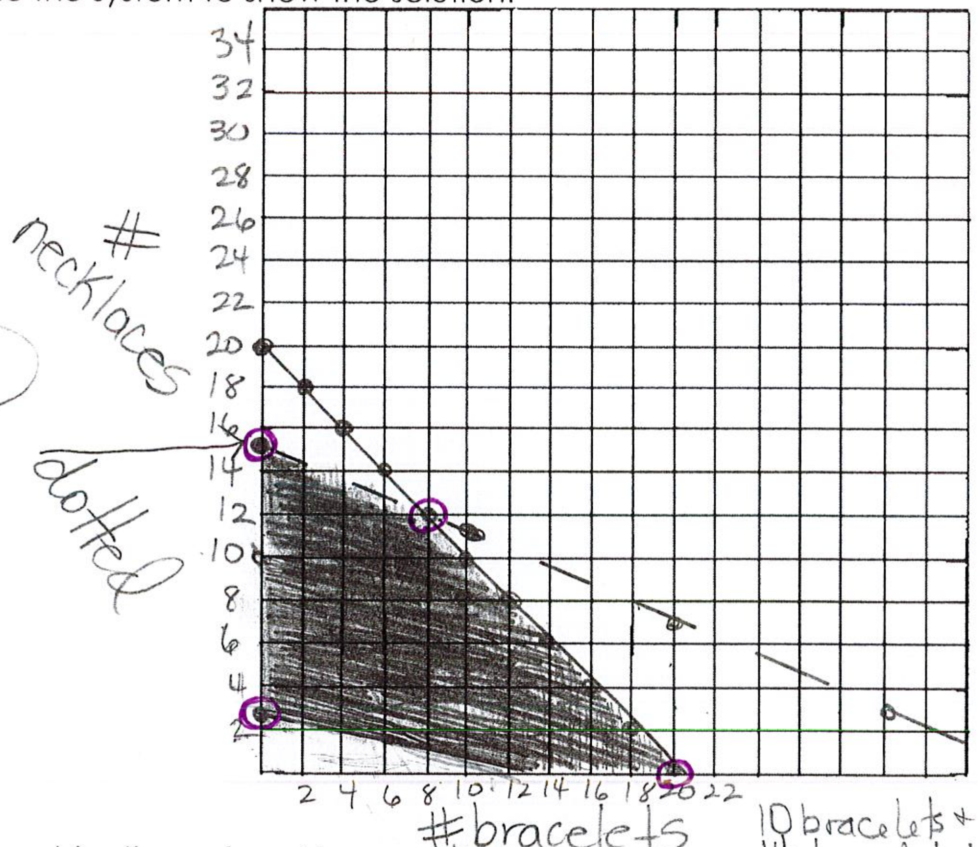
$y<-\frac{4}{10}x+15$

or $y<-\frac{2}{5}x+15$

$x+y\le 20$

$\cancel{-x}\quad -x$

$y\le -x+20$



   c. Give 2 possible combinations of necklaces and bracelets. 10 bracelets + 8 neck; 14 bracelets + 4 neck

* d. The jeweler sells bracelets for \$5 and necklaces for \$15. Write an inequality for profit as \$30 or more. $4.20x+13y\ge 30$ $\frac{13y}{13}\ge\frac{-4.20x}{13}+\frac{30}{13}$

   e. Graph this inequality and shade on your existing graph. $y\ge -.3x+2.3$

   f. Test the "corner points" that form the shape on your graph by substituting the points into your profit function above. Determine how many bracelets and necklaces should be made to maximize profits.

try (0, 14)
$4.20(0)+13(14)$
\$182

try (8, 12)
$4.20(8)+13(12)$
\$189.60

try (20, 0)
$4.20(20)+13(0)$
\$84

Honors Algebra 1 Unit 2B WS#6

Linear Programming WS#6 Name________________

Case #1: A calculator company produces a scientific calculator and a graphing calculator. Long-term projections indicate an expected demand of at least 100 scientific and 80 graphing calculators each day. Because of limitations on production capacity, no more than 200 scientific and 170 graphing calculators can be made daily. To satisfy a shipping contract, a total of at least 200 calculators must be shipped each day.

If each scientific calculator sold results in a \$2 loss, but each graphing calculator produces a \$5 profit, how many of each type should be made daily to maximize net profits?

X: number of scientific calculators produced

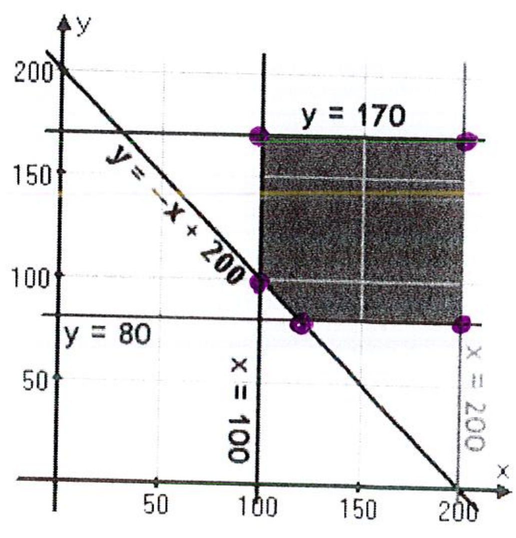
Y: number of graphing calculators produced

1. What do the following constraints mean?
   a. $X \geq 100$ Expected demand for scientific calc
   b. $Y \geq 80$ Expected demand for graphing calc
   c. $X \leq 200$ you can produce no more than 200 scientific
   d. $Y \leq 170$ you can produce no more than 170 graphing
   e. $x + y \geq 200$ total for shipping contract

2. The above constraints are graphed. One of the vertices is (120, 80).

   Name the rest of the vertices in the bounded region.

   (100, 170) (100, 100)
   (200, 80) (200, 170)



3. Each scientific calculator sold results in a \$2 loss, but each graphing calculator produces a \$5 profit. The equation $P = -2x + 5y$ represents this situation. Explain each part of the equation: * NET *
   a. P represents PROFIT (total)
   b. $-2x$ represents LOSS of profit (SC)
   c. $5y$ represents Gain of profit (G)

4. Using the profit equation and vertices, find how many of each type of calculator should be made daily to maximize net profits.

(120, 80)	(100, 170)	(100, 100)	(200, 170)	(200, 80)
\$160	\$650	\$300	\$450	\$0

a. scientific calculators 100 b. graphing calculators 170 c. max profit \$650

Case #2: The area of a parking lot is 600 square meters. A car requires 6 square meters and a bus requires 30 square meters of space The lot can handle a maximum of 60 vehicles.

1. Explain the following inequalities given x = # of cars and y = # of buses.

   a. $x \geq 0$ # of cars is greater than or equal to zero

   b. $y \geq 0$ # of buses is greater than or equal to zero

   No Negative amts

   c. $6x + 30y \leq 600$ total square meters the vehicles travel

   d. $x + y \leq 60$ total number of vehicles

2. Graph and name the four vertices of the region. Be sure to label your axes.

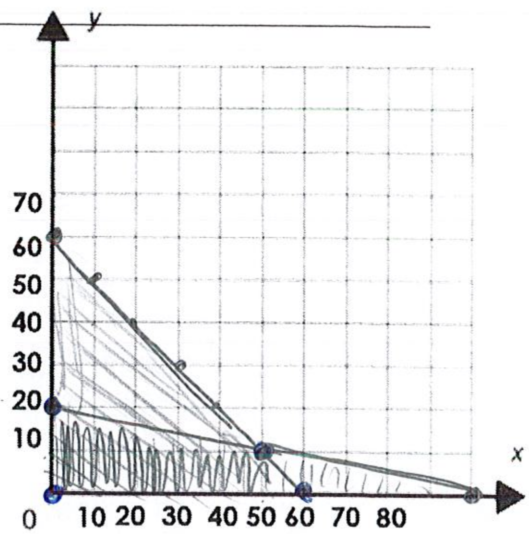
$30y \leq -6x + 600$

$y \leq -\frac{1}{5}x + 20$

$x + y \leq 60$

$y \leq -x + 60$

(0,0) (0,20) (50,10) (60,0)



3. If a car costs \$4 and a bus costs \$7 to park in the lot, the function for the total profit is:

   F(x,y) = 4x + 8y

   Determine the profit for each vertex above.

① (0,0) \$0

② (0,20) \$160

③ (50,10) 4(50)+8(10) \$280

④ (60,0) \$240

4. What is the maximum profit the parking lot can make? \$280

   How many cars and buses will there be for that amount of profit? 50 cars 10 buses

Case #3: You need to buy some filing cabinets. You know that Cabinet X costs \$10 per unit, requires six square feet of floor space, and holds eight cubic feet of files. Cabinet Y costs \$20 per unit, requires eight square feet of floor space, and holds twelve cubic feet of files. You have been given \$140 for this purchase, though you don't have to spend that much. The office has room for no more than 72 square feet of cabinets. How many of which model should you buy, in order to maximize storage volume?

1. Create your constraints:
   - Cabinet x: $x \geq 0$
   - Cabinet y: $y \geq 0$
   - Cost: $10x + 20y \leq 140$
   - Space: $6x + 8y \leq 72$
   - Volume: $V = 8x + 12y$

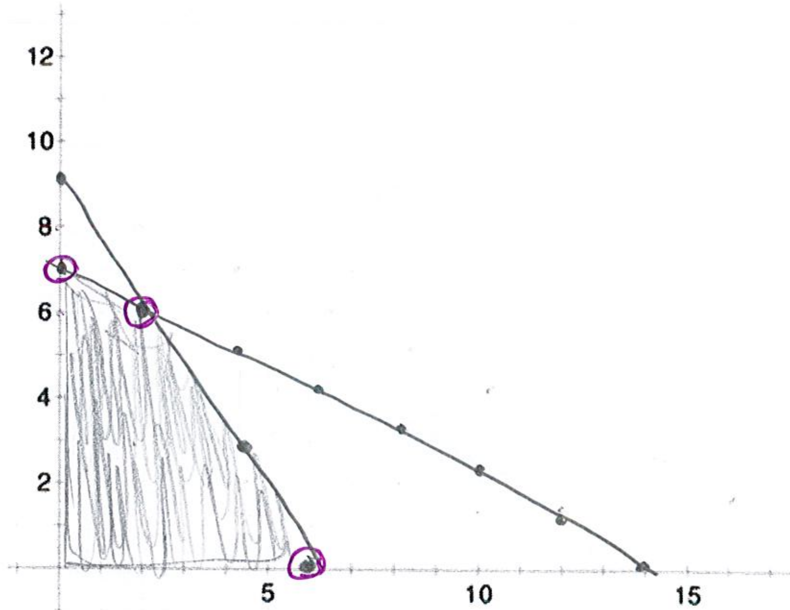
2. Graph.

$20y \leq -10x + 140$

$\boxed{y \leq -\frac{1}{2}x + 7}$

$8y \leq -6x + 72$

$\boxed{y \leq -\frac{3}{2}x + 9}$



3. How many of each cabinet should you purchase to maximize storage space?

0 of cabinet x and 9 of cabinet y will give you a maximum storage volume of 108 cubic feet.

(0, 9) (2, 6) (6, 0)

$8(0) + 12(9)$ $8(2) + 12(6)$ $8(6) + 12(0)$

$108\ ft^3$ $88\ ft^3$ $48\ ft^3$

Hopefully, you see how linear programming is useful in life and in business… and can be a very lucrative career. Think programming the information into a computer, which will evaluate your vertices for you. Or programming the computer itself ☺