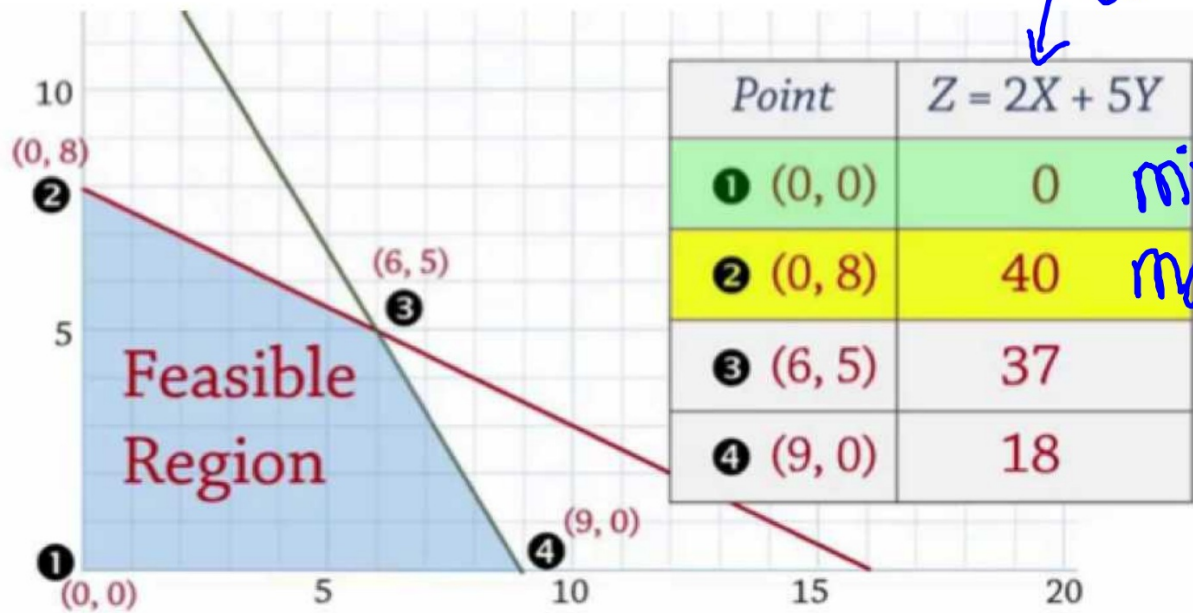


Optimization



HW:

1, 3, 5, 7, 8

ex: Find the maximum and minimum values of the feasible region with the given constraint.

a) $3 \leq y \leq 6$

$y \leq 3x + 12$ (-3, 3)

$y \leq -2x + 6$ (-2, 6)

$Z f(x, y) = 4x - 2y$

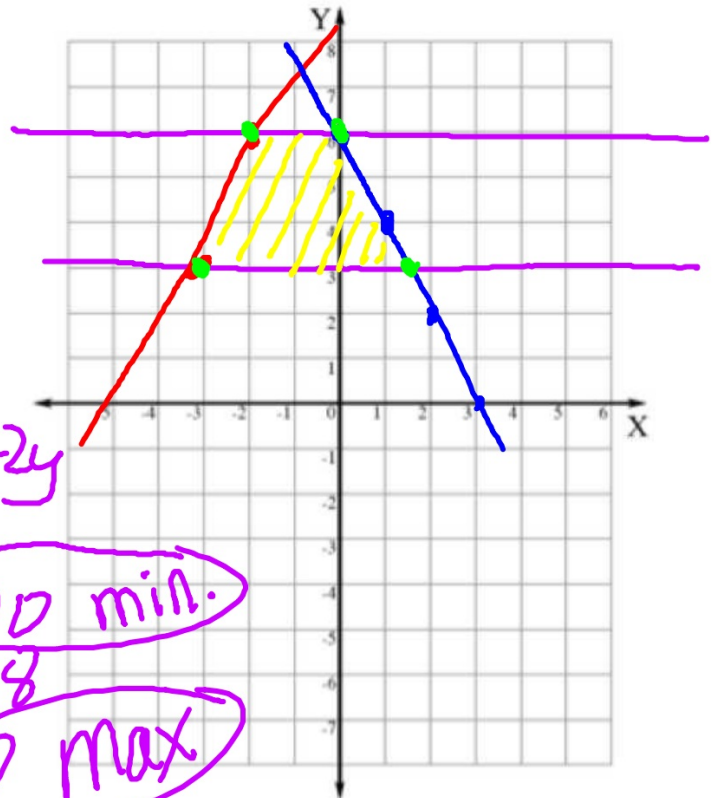
$(x, y) \quad | \quad f(x, y) = 4x - 2y$

$(0, 6) \quad -12$

$(-2, 6) \quad -8 - 12 = -20 \text{ min.}$

$(-3, 3) \quad -12 - 6 = -18$

$(\frac{3}{2}, 3) \quad 6 - 6 = 0 \text{ max.}$



ex: Find the maximum and minimum values of the feasible region with the given constraint.

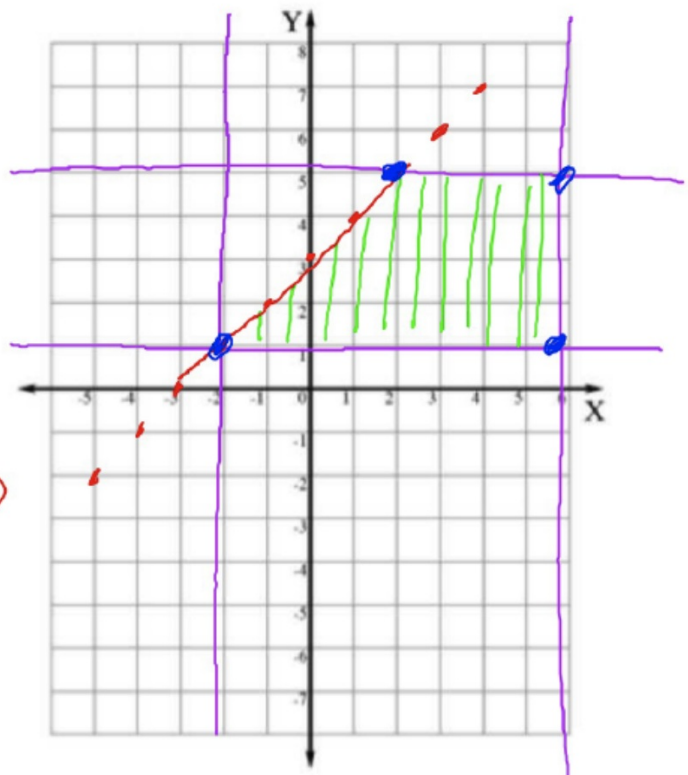
b) $-2 \leq x \leq 6$

$1 \leq y \leq 5$

$y \leq x + 3$

$f(x, y) = 2y - 2x$

(x, y)	$f(x, y)$
$(6, 1)$	-10 min
$(6, 5)$	-2
$(-2, 1)$	6
$(2, 5)$	6 max



ex: 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?

Constraint
 $f(x,y) = 8x + 12y$

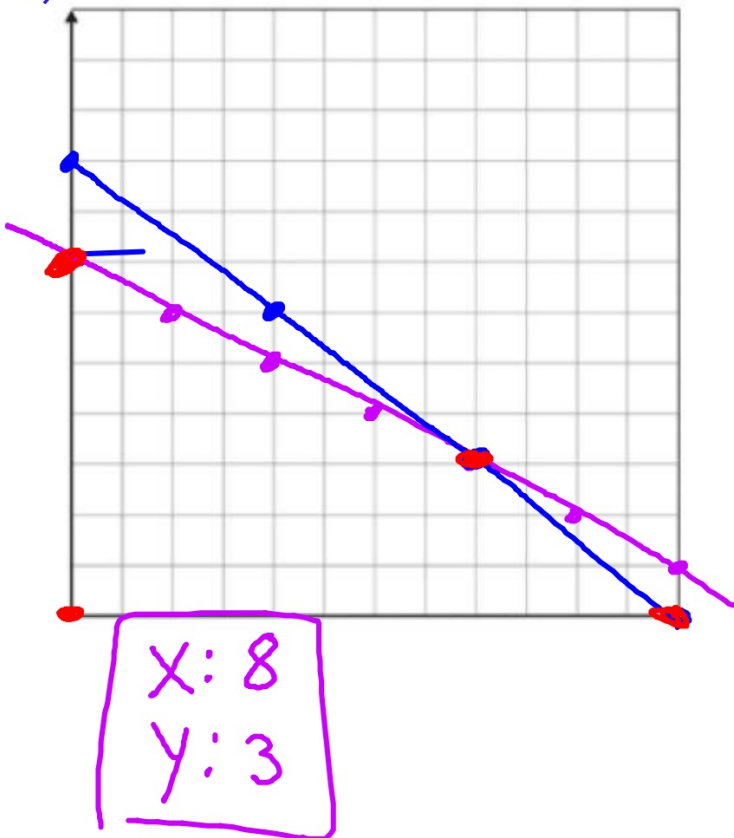
$$x \geq 0$$

$$y \geq 0$$

$$\text{\$} : 10x + 20y \leq 140$$

$$\text{floor space} : 6x + 8y \leq 72$$

c)



$$x \geq 0 \quad y \geq 0$$

$$10x + 20y \leq 140$$

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

$$6x + 8y \leq 72$$

$$y \leq -\frac{3}{4}x + 9$$

(x, y)	$8x + 12y$
$(0, 0)$	0
$(0, 7)$	84
$(8, 3)$	100 *
$(12, 0)$	96

d)

A snack bar cooks and sells hamburgers and hot dogs during softball games. To stay in business, it must sell at least 10 hamburgers but cannot cook more than 40. It must also sell at least 30 hot dogs, but cannot cook more than 70. The snack bar cannot cook no more than 90 items total. The profit of a hamburger is ~~50 cents~~ 3.00 and the hot dog is ~~30 cents~~ 2.00. How many of each item should it sell to maximize profit?

$$f(x, y) = 3x + 2y$$

$$x \geq 0 \quad y \geq 0$$

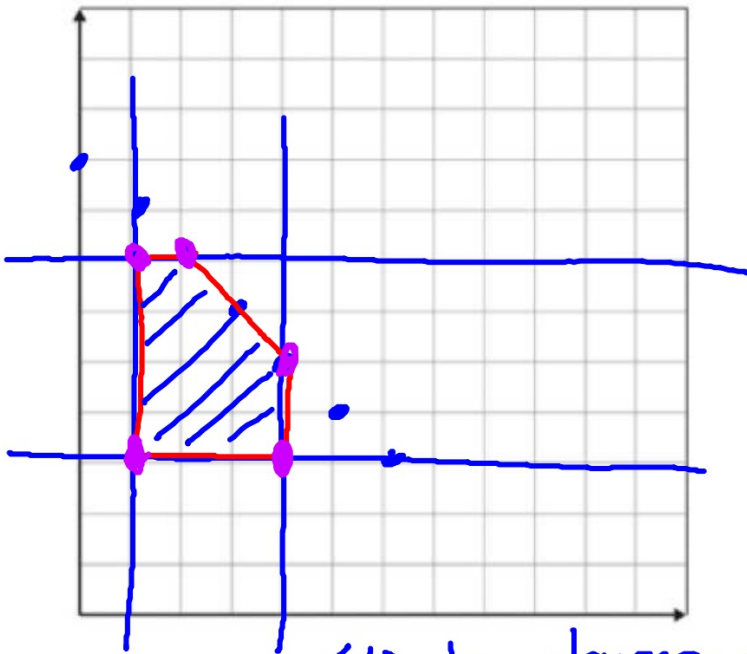
$$10 \leq x \leq 40$$

$$30 \leq y \leq 70$$

$$x + y \leq 90$$

x: hamburgers
y: hot dogs

d)



40 hamburgers
50 hot dogs

(x, y)	$3x + 2y$
$(10, 30)$	90
$(10, 70)$	170
$(40, 30)$	180
$(40, 50)$	220*
$(20, 70)$	200

e) ex: SET UP ONLY: A lunch stand makes \$0.75 in profit on each chef's salad and \$1.20 in profit on each Caesar salad. On a typical weekday, it sells between 40 and 60 chef's salads and between 35 and 50 Caesar salads. The total number sold has never exceeded 100 salads. How many of each type of salad should be prepared to maximize profit?

$$f(x, y) = .75x + 1.2y$$

$$x \geq 0$$

$$y \geq 0$$

$$40 \leq x \leq 60$$

$$35 \leq y \leq 50$$

$$x + y \leq 100$$

The Northern Wisconsin Paper Mill can convert wood pulp to either notebook paper or newsprint. The mill can produce at most 200 units a day. At least 10 units of notebook paper and 80 units of newspaper are required daily by regular customers. If the profit on a unit of notebook paper is \$500 and the profit on a unit of newsprint is \$350, how many units of each type should the manager have the mill produce each day to maximize profits?

ex: Sandy has nickels, dimes and quarters that amount to \$3.75 in change. She has three more quarters than dimes but twice as many nickels as quarters. How many dimes, nickels and quarters does Sandy have?

$$5n + 10d + 25q = 375 \leftarrow$$

$$q = d + 3$$

$$n = 2q$$

$$5(2q) + 10(q - 3) + 25q = 375$$

$$q = 9$$

$$n = 18$$

$$d = 6$$