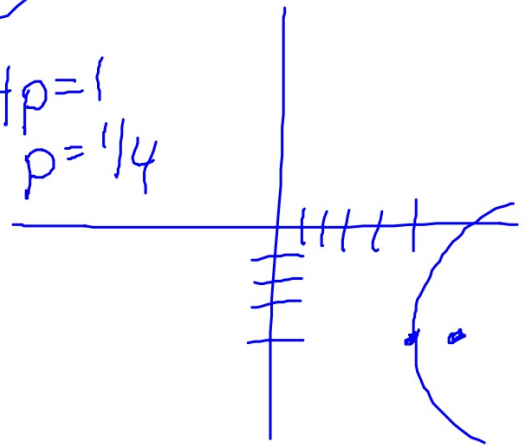


$$10.) (x-5) - (y+4)^2 = 0$$

$$(y+4)^2 = (x-5) \quad \begin{array}{l} 4p=1 \\ p=1/4 \end{array}$$

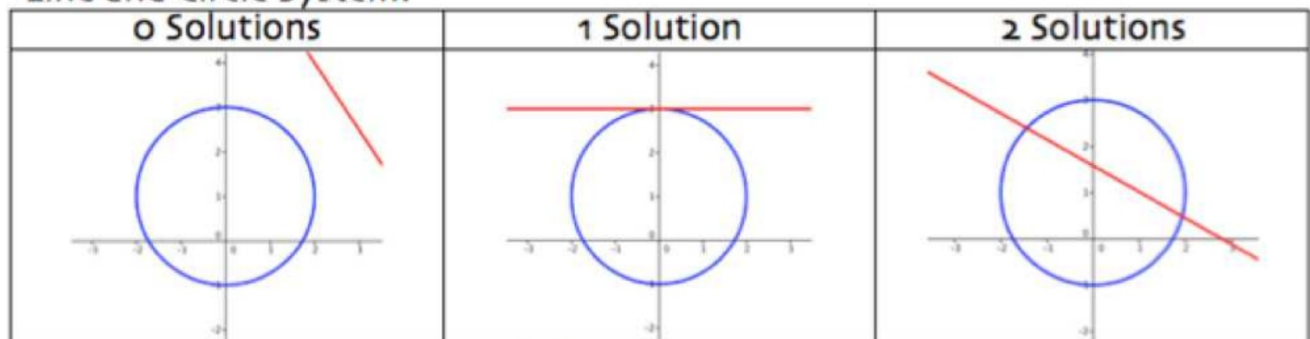
$$V(5, -4)$$

$$F(5\frac{1}{4}, -4)$$

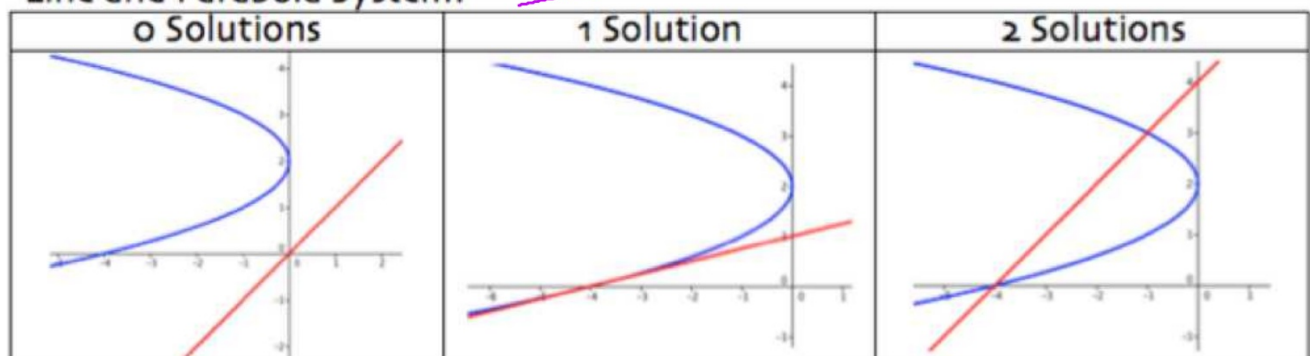


8.7 Nonlinear Systems

Line and Circle System:

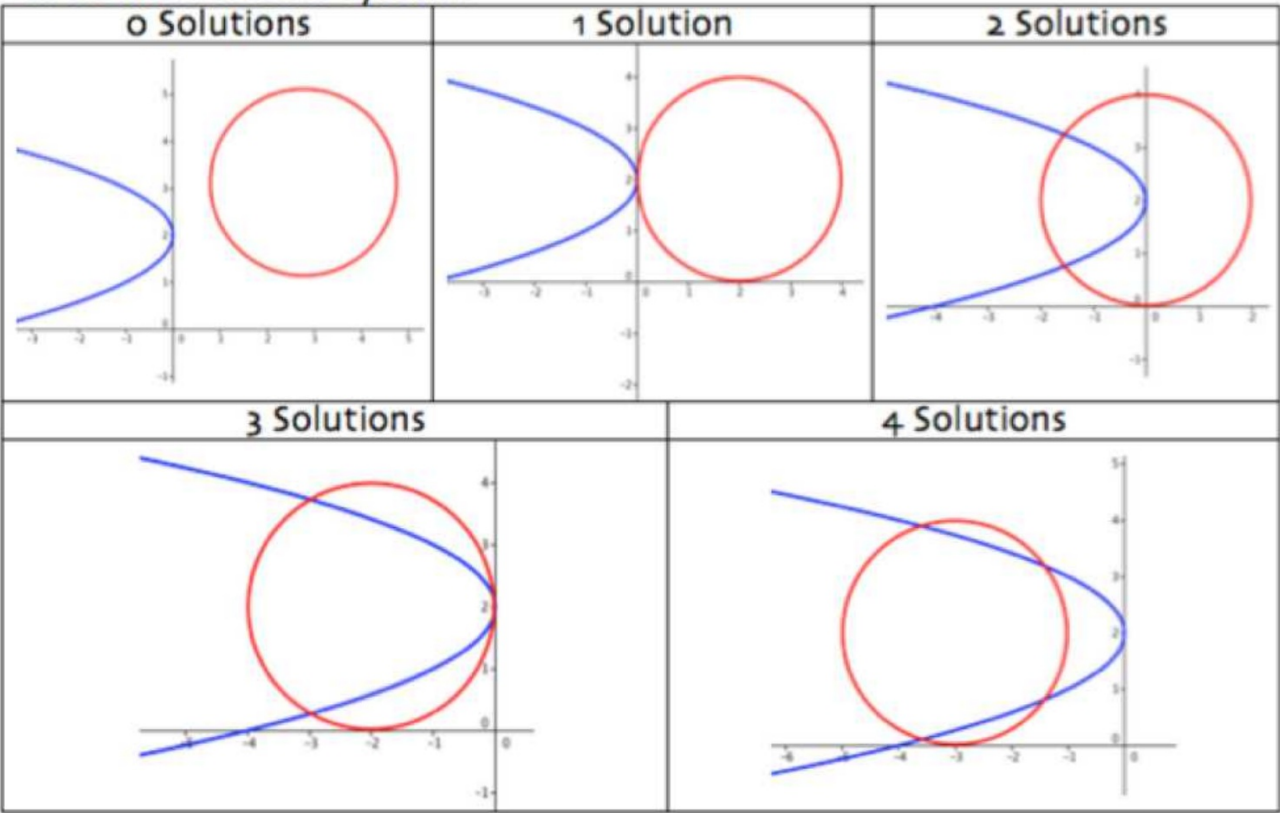


Line and Parabola System:



*See printout.

Circle and Parabola System:




ex: Is the point a solution to the system?

Yes.

a) (1, 2)

$$4y^2 + 34x + y - 52 = 0$$

$$2x + y - 4 = 0$$


$$4(2)^2 + 34(1) + (2) - 52 = 0$$
$$0 = 0 \checkmark$$

$$2(1) + 2 - 4 = 0$$
$$0 = 0 \checkmark$$

ex: Is the point a solution to the system?

b) (2, 7)

No

$$x^2 + y^2 \leq 9$$

$$x^2 > -4(y-1)$$

$$2^2 + 7^2 \leq 9$$

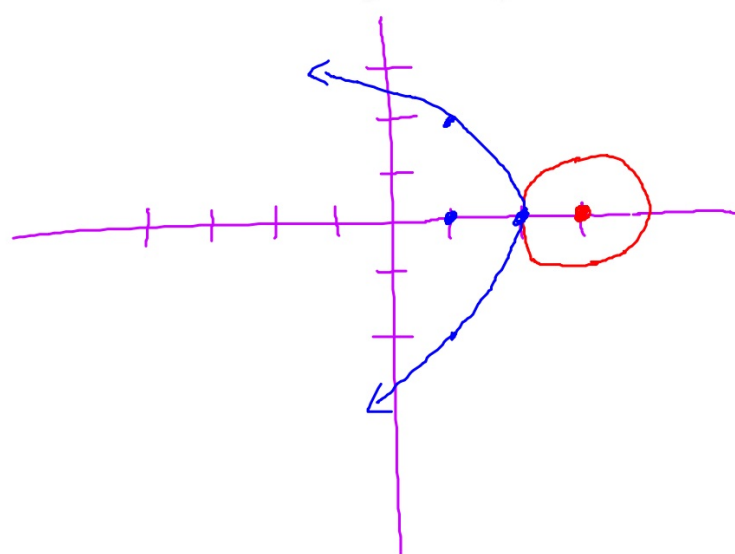
$$\times 4 + 49 \leq 9$$

Systems of Equations

ex: Solve graphically.

$$(x-3)^2 + y^2 = 1$$

$$y^2 = -4(x-2)$$



$(2, 0)$

Systems of Equations

ex: Solve algebraically.

a) $x^2 + y^2 = 13$

$$y = x - 1$$

$$x^2 + (x-1)^2 = 13$$

$$x^2 + x^2 - 2x + 1 - 13 = 0$$

$$2x^2 - 2x - 12 = 0$$

$$x^2 - x - 6 = 0$$

$$(x-3)(x+2) = 0$$

$$x = 3, -2$$

$$(3, 2)$$

$$(-2, -3)$$

Systems of Equations

ex: Solve algebraically.

$$\text{b) } -2y^2 + x + 2 = 0 \quad y^2 - 1 = 0$$

$$2(x^2 + y^2 - 1) = 0 \quad y = \pm 1$$

$$-2y^2 + x + 2 = 0$$

$$2y^2 + 2x^2 - 2 = 0$$

$$2x^2 + x = 0$$

$$x(2x+1) = 0$$

$$x = 0, -\frac{1}{2}$$

$$(0, \pm 1)$$

$$\left(-\frac{1}{2}, \pm \frac{\sqrt{3}}{2}\right)$$

$$-2y^2 - \frac{1}{2} + 2 = 0$$

$$-2y^2 = -\frac{3}{2}$$

$$y^2 = \frac{3}{4}$$

$$y = \pm \frac{\sqrt{3}}{2}$$

$$x^2 + y^2 + 1 = 0$$

$$\cancel{x^2} \quad y^2 + 1 = 0$$

Systems of Equations

ex: Solve algebraically.

$$c) x^2 - y^2 - 16x + 39 = 0$$

$$- (x^2 - y^2 - 9 = 0)$$

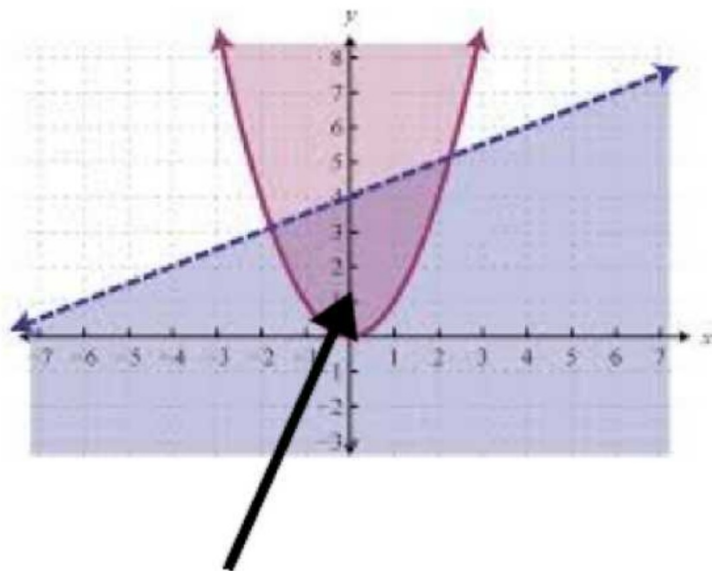
$$(3, 0)$$

$$\begin{array}{r} x^2 - y^2 - 16x + 39 = 0 \\ -x^2 + y^2 + 9 \end{array}$$

$$-16x + 48 = 0$$

$$x = 3$$

Systems of Inequalities



Solution: Where the shading overlaps

Systems of Inequalities

ex: Solve graphically.

a) $x^2 + y^2 \leq 9$ $(0,0)$

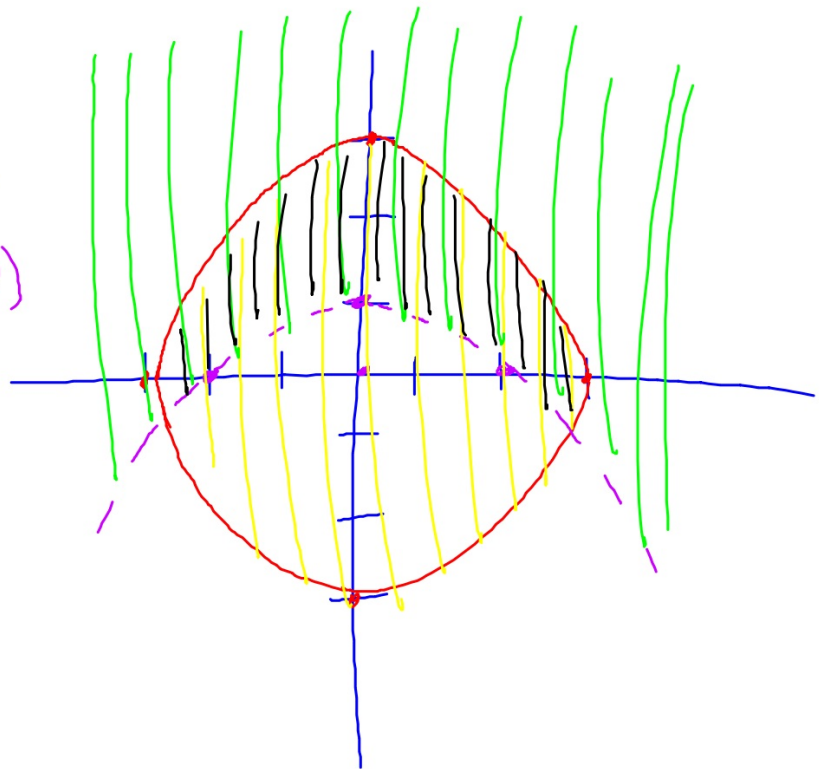
$x^2 > -4(y-1)$ $(0,0)$

$V: (0,1)$

$0 > -4(-1)$

$0 > 4$

False



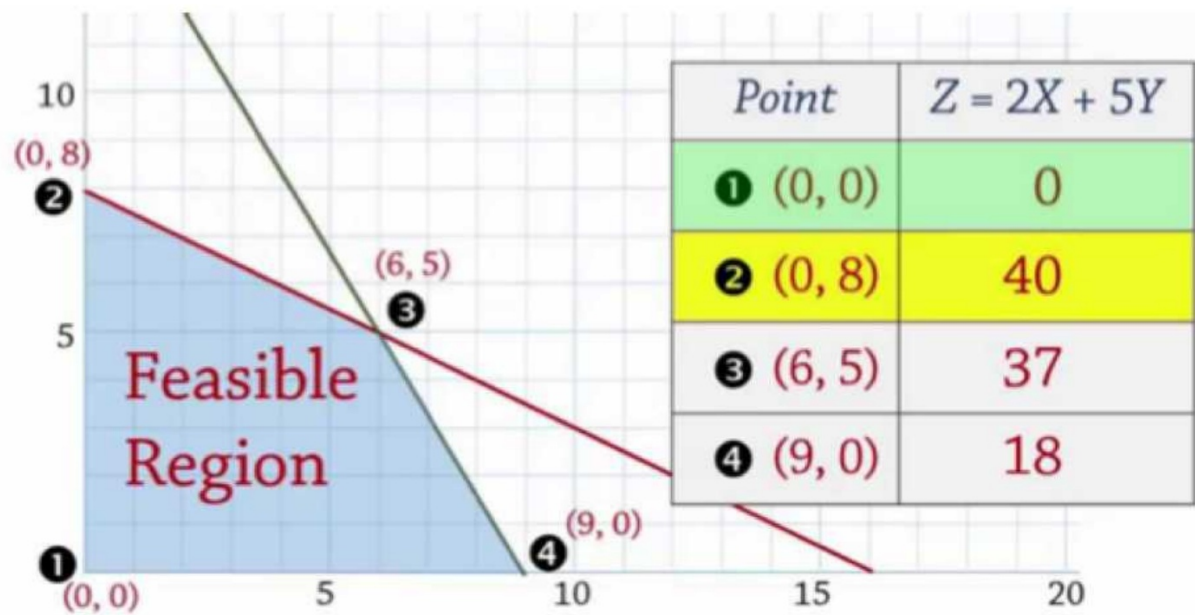
Systems of Inequalities

ex: Solve graphically.

$$\text{b) } (y + 3)^2 < 8(x + 2)$$

$$x > 2$$

Optimization



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

a) $3 \leq y \leq 6$

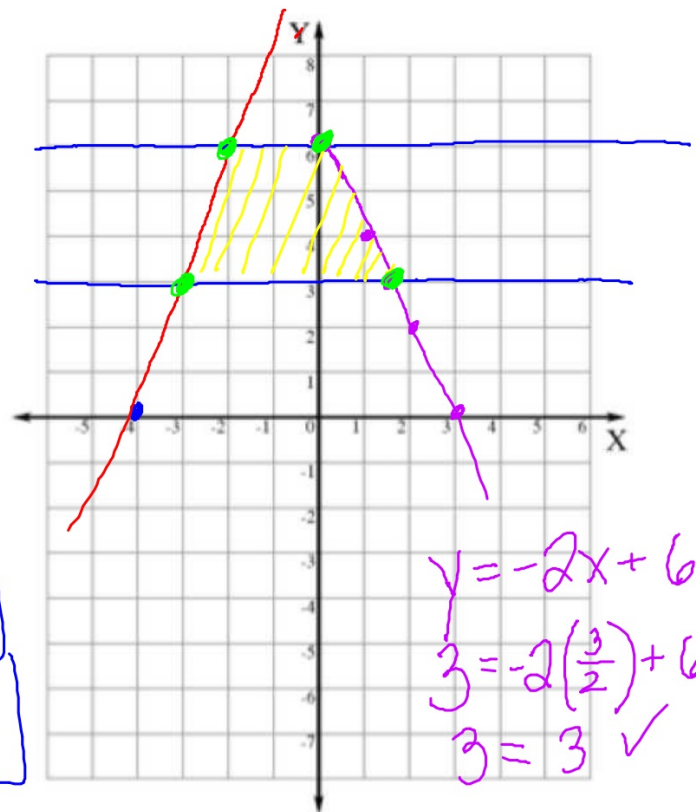
$$y \leq 3x + 12$$

$$y \leq -2x + 6$$

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

(x, y)	$f(x, y)$
$(0, 6)$	-12
$(-3, 3)$	-18
$(-2, 6)$	-20
$(\frac{3}{2}, 3)$	0

Max
0
min
-20



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

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

$$1 \leq y \leq 5$$

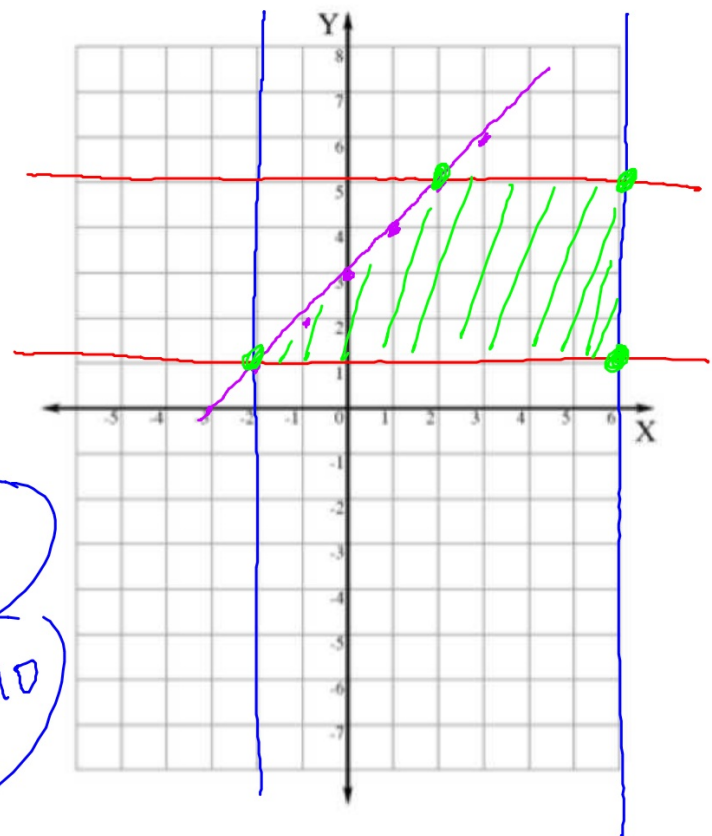
$$y \leq x + 3$$

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

(x, y)	$f(x, y)$
$(-2, 1)$	6
$(0, 5)$	6
$(6, 1)$	-10
$(6, 5)$	-2

Max 6

Min -10



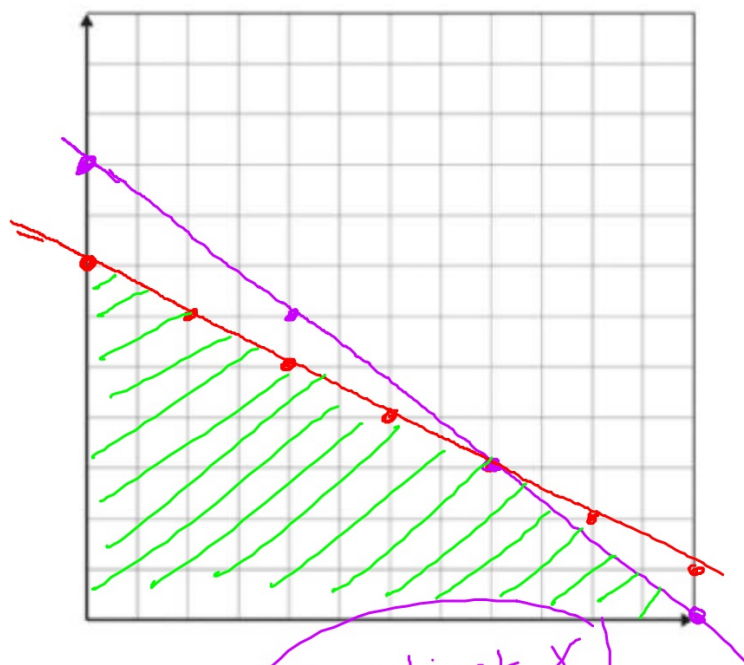
ex: You need to buy some filing cabinets. You know that Cabinet X costs \$10 per unit, requires six square feet of floor space, and holds eight cubic feet of files. Cabinet Y costs \$20 per unit, requires eight square feet of floor space, and holds twelve cubic feet of files. You have been given \$140 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?

$$\text{Constraint: } f(x, y) = 8x + 12y$$

$$x \geq 0, y \geq 0$$

$$10x + 20y \leq 140 \Rightarrow x + 2y \leq 14$$

$$6x + 8y \leq 72 \Rightarrow 3x + 4y \leq 36$$



8 cabinet x
3 cabinet y

$$x + 2y \leq 14$$

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

$$3x + 4y \leq 36$$

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

(x, y)	$f(x, y)$
$(0, 7)$	\$84
$(0, 0)$	\$0
$(8, 3)$	\$100
$(12, 0)$	\$96

ex: SET UP ONLY: In order to ensure optimal health (and thus accurate test results), a lab technician needs to feed the rabbits a daily diet containing a minimum of 24 grams (g) of fat, 36 g of carbohydrates, and 4 g of protein, but the rabbits should be fed no more than five ounces of food a day. Rather than order rabbit food that is custom-blended, it is cheaper to order Food X and Food Y, and blend them for an optimal mix. Food X contains 8 g of fat, 12 g of carbohydrates, and 2 g of protein per ounce, and costs \$0.20 per ounce. Food Y contains 12 g of fat, 12 g of carbohydrates, and 1 g of protein per ounce, at a cost of \$0.30 per ounce. What is the optimal blend?

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?

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

$$40 \leq x \leq 60$$

$$35 \leq y \leq 50$$

$$x + y \leq 100$$

Constraint

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