

### 3.4 Linear Programming

Objective: Find the max & min values of a function over a region.  
Solve real-world problems using linear programming.

Ex1)  $x \geq 1$   
 $y \geq 0$   
 $2x + y \leq 6$

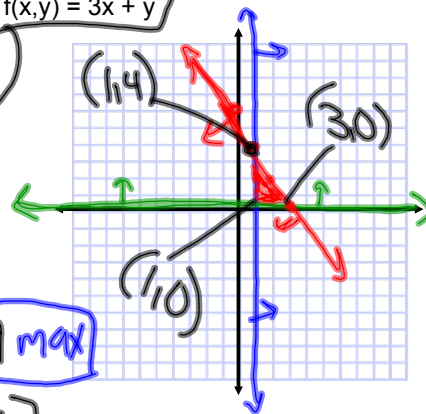
The inequalities are called constraints

$-2x$   $-3x$

Find the max & min values of the function  $f(x,y) = 3x + y$

These always occur at one of the vertices of the feasible region

$y \leq -\frac{2}{1}x + 6$



$f(x,y) = 3x + y$   
 $f(3,0) = 3 \cdot 3 + 0 = 9$  max  
 $f(1,4) = 3(1) + 4 = 7$   
 $f(1,0) = 3(1) + 0 = 3$  min

#### Ex2) Veterinary Medicine

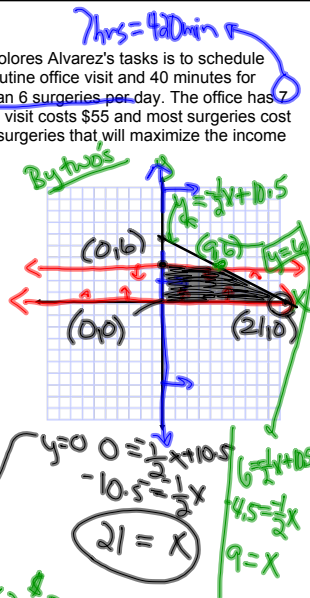
As a receptionist for a veterinarian, one of Dolores Alvarez's tasks is to schedule appointments. She allots 20 minutes for a routine office visit and 40 minutes for surgery. The veterinarian cannot do more than 6 surgeries per day. The office has 7 hours available for appointments. If an office visit costs \$55 and most surgeries cost \$125, find a combination of office visits and surgeries that will maximize the income the veterinarian practice receives per day.

$x = \#$  of office visits  
 $y = \#$  of surgeries

$x \geq 0$   
 $y \geq 0, y \leq 6$   
 $20x + 40y \leq 420$

$f(x,y) = 55x + 125y$

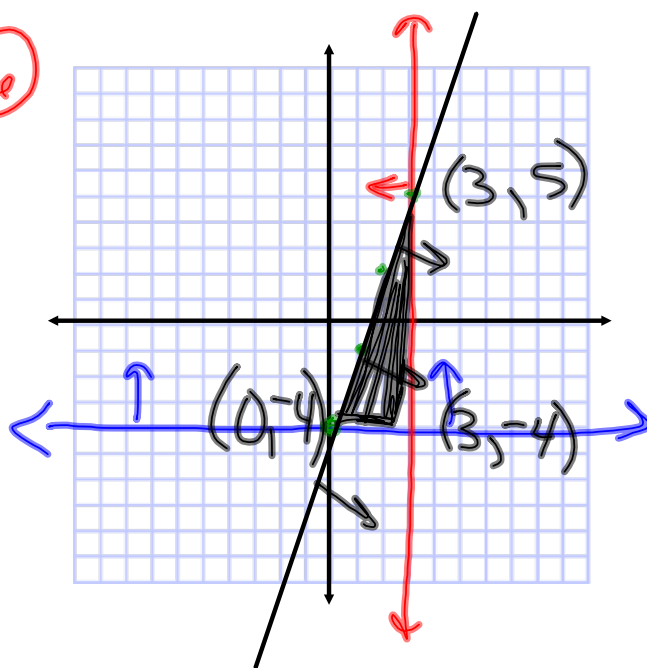
$\frac{40}{40}y \leq \frac{20x + 420}{40}$   
 $y \leq \frac{1}{2}x + 10.5$



$f(0,0) = 55(0) + 125(0) = 0$   
 $f(2,10) = 55(2) + 125(10) = 1310$   
 $f(0,6) = 55(0) + 125(6) = 750$   
 $f(9,6) = 55(9) + 125(6) = 1145$  max income

9 office visits & 6 surgeries

16



$$y \geq -4$$

$$x \leq 3$$

$$y \leq \frac{3}{1}x - 4$$

$$f(x, y) = x - y \quad \text{min}$$

$$f(3, 5) = 3 - 5 = -2$$

$$f(0, -4) = 0 - (-4) = 4$$

$$f(3, -4) = 3 - (-4) = 7$$

max