**3.4 – Linear Programming**

**Constraints**: limits or restrictions placed on the variables in a function

**Linear Programming**: a method for finding a minimum or maximum value of some quantity, given a set of constraints

**Feasible Region:** the area that contains all the points that satisfy the constraints (a system of inequalities)

**Objective Function:** the function that is being modeled to try and maximize or minimize

**Vertex Principle of Linear Programming**

If there is a max or a min value of the linear objective function, it occurs at one or more vertices of the feasible region.

Examples from page 158-159 (below).

**Problem 1: Testing Vertices**

What point in the feasible region maximizes P for the objective function

Constraints:

Step 1: Graph the Inequalities (section 2.8)

Step 2: Form the feasible region (section 2.8 and 3.3)

Step 3: Find the coordinates of the vertices

Step 4: Evaluate P at each vertex (vertex principle of linear programming)

1.)

2.)

3.)

(0, 0) (0, 2.5) (3, 1) (2, 0)

4.)

P = 2(0) + 0 = 0

P = 2(0) + 2.5 = 2.5

P = 2(3) + 1 = 7 🡨**Maximum Value when x=3 and y =1.**

P = 2(2) + 0 = 4

**Problem 2: Using Linear Programming to Maximize Profit**

You are screen-printing T-shirts and sweatshirts to sell at a Festival and are working with the following constraints:

-You have at most 20 hours to make shirts

- You want to spend no more than $600 on supplies

- You want to have at least 50 items

-T-shirts take 10 minutes to make, supplies cost $4 and the profit is $6

-Sweatshirts take 30 minutes to make, supplies cost $20 dollars and the profit is $30

How many T-shirts and how many sweatshirts should you make to maximize your profit? How much is the maximum profit?

Step 1: Organize the Data

Step 2: Write the constraints and the objective function

Step 3: Graph the constraints

Step 4: Find the vertices

Step 5: Evaluate at each vertex to identify the maximum.

1.) **T-shirt, t Sweatshirt, s Total**

**Minutes** 10t + 30s 1200 (20 hrs)

**# of shirts** t + s 50

**Cost** 4t + 20s 600

**Profit** 6t 20s 6t+20s

Note:

2.) P = 6t + 20s

3.)

4.) (50, 0) (25, 25) (75, 15) (120, 0)

5.) P = 6(50) +20(0) = 300

P = 6(25) +20(25) = 650

P = 6(75) +20(15) = 750 🡨 **Maximum when you sell 75**

P = 6(120) +20(0) = 720 **t-shirts** **and 15 sweatshirts.**

**HMWK: pg 160 #1-2, 5, 8, 10-12, 15-17**