

Name _____

Algebra 2
Lesson 3-4
Linear Programming

When the United States entered World War II, it quickly became apparent to the U.S. leaders in order to win the war, massive amounts of resources would be required, and building/upgrading of many factories would be a priority. Food, planes, medicine, tanks, and other weaponry had to be transported to many places worldwide. The problem was how could the United States transport massive amounts of supplies and weapons to key points worldwide in a short time?

Dr. George Dantzig of Stanford University had the answer, but his methodology worked only for a few equations with and then it was limited to a few variables. Though his contributions to the war effort were significant, his **Simplex** method was not fully explored until the 1950's when computer technology could operate hundreds of variables and equations. **Simplex** is now known as **Linear Programming**.

In general, a system of inequalities is "linear programmed" when the inequalities are graphed, a common shaded (and **feasible**) region is found, and the region's "corners" or vertices are located and tested for a maximum or minimum result. Each inequality in the system is called a **constraint**. A function that is minimized or maximized is called an **objective function**.

- maximization – a **maximum** value of a function inside a shaded region.
- minimization – a **minimum** value of a function inside a shaded region.
- **TESTING:** identify the vertices of the common area and plug into the equation and solve. Compare the values of the equation at the different vertices and determine the minimum or maximum value.

Example:

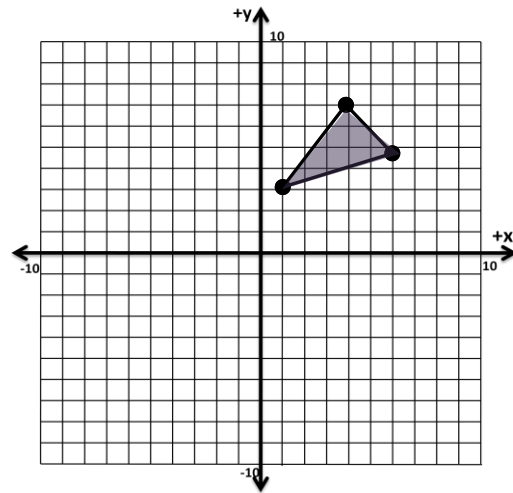
Maximize $N = 3x + 2y$ in the shaded region. Replace (x,y) with vertices. Which one yields the maximum value?

$(1,3) \longrightarrow 3(1) + 2(3) = \underline{9}$

$(6,5) \longrightarrow 3(6) + 2(5) = \underline{28}$

$(4,7) \longrightarrow 3(4) + 2(7) = \underline{26}$

The function $N = 3x + 2y$ reaches a maximum value at $(6,5)$.



Example: Graph the system and minimize for

$$P = x + 2y$$

$$x \geq 0, \quad y \geq \frac{1}{2}x - 6, \quad y \leq -x + 3$$

1. Graph the three inequalities
2. Locate and identify the vertices
3. Test the points
4. Minimum point is the minimum.

Test: $(0,6), (0,3), (6,-3)$

$$* P = 0 + 2(-6) = -12$$

$$P = 0 + 2(3) = 6$$

$$P = 6 + 2(-3) = 0$$

*Minimum occurs at $(0,-6)$.

