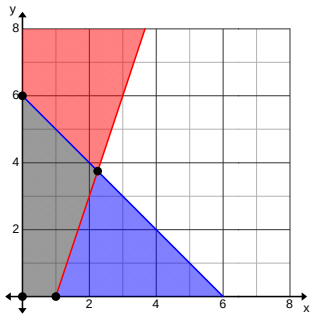
Name_____ Date_____ Period_____

LINEAR PROGRAMMING WORKSHEET

Example: Find the maximal and minimal value of the objective function $z = 2x + y$ subject to the following constraints: $x + y \le 6,\ 3x - y \le 3,\ x \ge 0,\ y \ge 0$



Step One: Graph all four inequalities. Shade the appropriate regions.

Step Two: Find all of the corner points of the commonly shaded region between all three inequalities. These corners form the vertices of the polygon determined by the common shading. We call this region the feasible region. Note: Use methods for solving a system of linear equations (graphing, substitution, elimination, calculator). The corner points are: (0, 0), (0, 6), (1, 0) and (2.25, 3.75)

Step Three: Plug each corner point (vertex) into our objective function, z = 2x + y. This is the equation/relationship that we want to maximize or minimize, depending on the application. For example, we might want to maximize profit or minimize cost.

$z = 2(0) + 0 = 0$

$z = 2(0) + 6 = 6$

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

$z = 2(2.25) + 3.75 = 8.25$

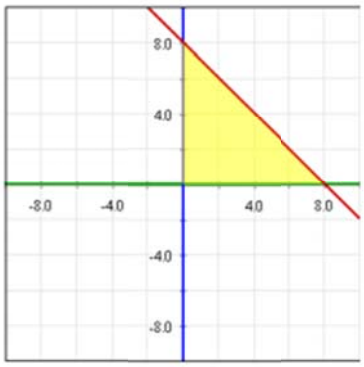
The maximum value is 8.25 which occurs at (2.25, 3.75) and the minimum value is 0 which occurs at (0, 0).

1. Given the following objective function and the vertices of the feasible region, determine the maximum and minimum values and state where they occur.

Objective Function: $P = 3x + y$ Vertices: $(3,0),(4,5),(-1,6),(-7,-5)$

2. Given the following feasible region and the objective function, find the maximum and minimum values.

a) $P = x - y + 0.60$



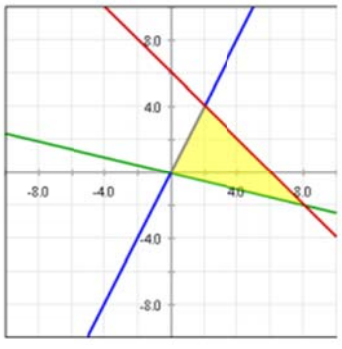
Max_____

at_____

Min_____

at_____

b) $1.6x - 3.7y - 0.5$



Max_____

at_____

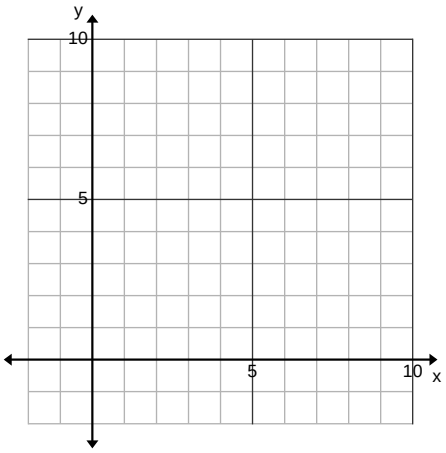
Min_____

at_____

3. Given the objective function: $P = 4x + 7y$

a. On the graph below, graph the given constraints and shade the feasible region.

$$x + y \le 8$$
$$y - x \le 2$$
$$x \ge 0$$
$$y \ge 0$$



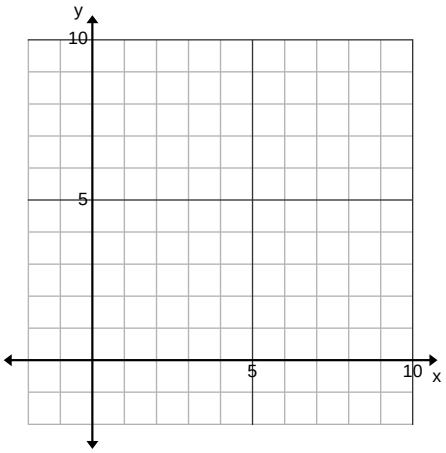
b. What are the vertices (corner points) of the feasible region?

c. Using the points, determine the maximum and minimum values for *P.* At what points do they occur?

4. Given the objective function: $P = 25x + 45y$

a. On the graph below, graph the given constraints and shade the feasible region.

$$x + 2y \le 6$$
$$2x + 2y \le 8$$
$$x \ge 0$$
$$y \ge 0$$



b. What are the vertices (corner points) of the feasible region?

c. Using the points, determine the maximum and minimum values for *P.* At what points do they occur?

5. Danielle and Tim decide to open a music shop in which they will sell guitars and keyboards. They want to find out the maximum amount of money they may have to borrow to purchase new instruments. Each guitar will cost them $150 and each keyboard $350.

a. Define the two variables:

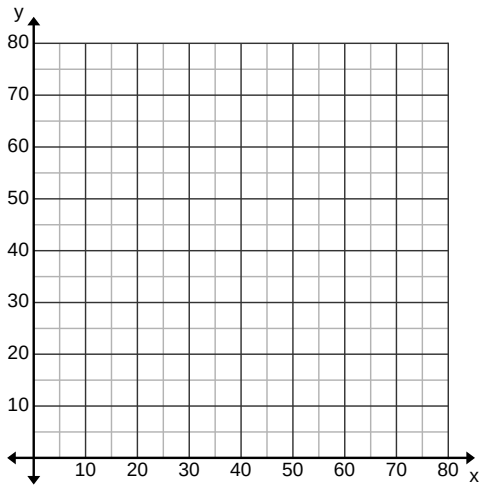
b. Write the objective function on the amount of money they have to borrow to pay for the instruments.

c. Danielle and Tim have certain restrictions on the number of instruments they can purchase.

- They can only purchase a maximum of 75 instruments.
- Because guitars are more popular than keyboards, the number of guitars they will purchase will be at least twice the number of keyboards.
- To get started, they feel they need at least 10 guitars and at least 7 keyboards.

Using this information, write the four constraints below.

d. Graph the feasible region. Use the graph below, or if available, use technology.



e. Determine the vertices of the feasible region. (There are 3)

f. Determine the amount they need to borrow from each vertex.

g. What is the maximum amount they need to borrow?