Name: _Key_

Date: _____ Hour: ___

**Example 1:** Solve an Applied Minimization Problem

A manufacturer of animal food makes two grain mixtures, $G_1$ and $G_2$. Each kilogram of $G_1$ contains 300 grams of vitamins, 400 grams of protein, and 100 grams of carbohydrate. Each kilogram of $G_2$ contains 100 grams of vitamins, 300 grams of protein, and 200 grams of carbohydrate. Minimum nutritional guidelines require that a feed mixture made from these grains contain at least 900 grams of vitamins, 2200 grams of protein, and 800 grams of carbohydrate. $G_1$ costs \$2.00 per kilogram to produce, and $G_2$ costs \$1.25 per kilogram to produce. Find the number of kilograms of each grain mixture that should be produced to minimize cost.

**Step 1:** Define the variables.

$X = $ # of Kg of $G_1$ mixture
$Y = $ # of Kg of $G_2$ mixture

**Objective Function:**
$C = 2.00x + 1.25y$

**Step 2:** Write a system of inequalities.

$$300x + 100y \geq 900 \quad \rightarrow \quad 3x + y \geq 9 \quad \rightarrow \quad y \geq -3x + 9$$
$$400x + 300y \geq 2200 \quad \rightarrow \quad 4x + 3y \geq 22 \quad \rightarrow \quad y \geq -\tfrac{4}{3}x + \tfrac{22}{3}$$
$$100x + 200y \geq 800 \quad \rightarrow \quad x + 2y \geq 8 \quad \rightarrow \quad y \geq -\tfrac{1}{2}x + 4$$
$$x \geq 0 \,;\; y \geq 0$$



$-3(3x + y = 9)$
$4x + 3y = 22$
$-9x - 3y = -27$
$-5x = -5$
$x = 1$

$3(1) + y = 9$
$y = 6$
$(1, 6)$

$4x + 3y = 22$
$-4(x + 2y = 8)$

$4x + 3y = 22$
$-4x - 8y = -32$
$-5y = -10$
$y = 2$

$x + 2(2) = 8$
$x = 4$
$(4, 2)$

$(0, 9) \quad C = 2(0) + 1.25(9)$
$C = 11.25$

$(1, 6) \quad C = 2(1) + 1.25(6)$
$C = 9.5$

$(4, 2) \quad C = 2(4) + 1.25(2)$
$C = 10.50$

$(8, 0) \quad C = 2(8) + 1.25(0)$
$C = 16$

**✱** The manufacturer needs to produce 1 Kg of $G_1$ and 6 Kg of $G_2$ to minimize the cost at \$9.50/Kg.