

1. Manufacturing Problem

The maximum quantity of sulfur dioxide that can be released per hour, according to an environmental agency, is 15 units. How many gallons of high sulfur and low sulfur must be used per hour to reduce fuel cost if at least 16 kilowatts must be produced per hour?

Solution:

x = amount of low sulfur fuel in gallon
 y = amount of high sulfur fuel in gallon
 z = minimum fuel cost

$$z = 160x + 150y$$
$$\underline{4x + 4y = 16}$$
$$4(0) + \frac{44}{4} = \frac{16}{4}$$

$$y = 4$$

 $(0,4)$

let $x, y = 0$

$$0 \geq 16$$

False

Let $y = 0$

$$4x + 4(0) = 16$$

$$\frac{9x}{4} = \frac{16}{4}$$

$$x = 4 \quad (4, 0)$$

$$3x + 5y = 15$$

let $x=0$

$$3(0) + 5y = 15$$

$$\frac{F_y}{d} = \frac{15}{5}$$

$$y = 3^5 (0,3)$$

let $x, y = 0$

$$0 \leq 15$$

TRUE

let $y=0$

$$\frac{B \times}{B} = \frac{15}{3}$$

$$x = 5 \quad (5, 0)$$

$$(3)(4x + 4y) = (16)(3) \rightarrow 12x + 12y = 48$$

$$(-4)(3x + 5y) = (15)(-4) \quad + -12x - 20y = -60$$

$$\frac{-8}{-8} = \frac{-12}{-8}$$

$$y = \frac{3}{2} = 1.5$$

Intersection $(\frac{5}{2}, \frac{3}{2})$

$$4x + 4y = 16$$

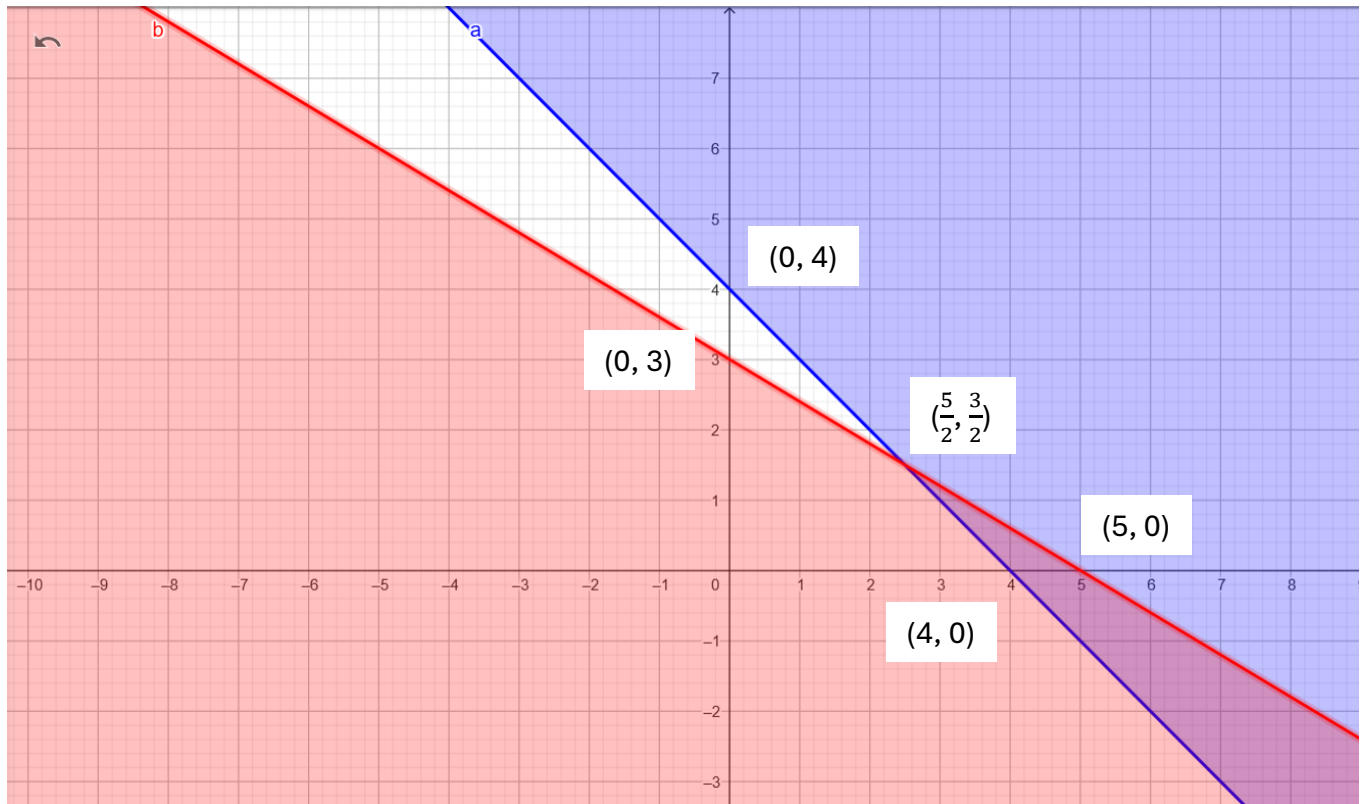
$$4x + 4\left(\frac{3}{2}\right) = 16$$

$$4x + \frac{12}{2} = 16$$

$$4x = 16 - 6$$

$$\frac{4x}{4} = \frac{10}{4}$$

$$x = \frac{5}{2} = 2.5$$



Corner Points

$$(4, 0) \quad z = 160(4) + 150(3) = 640$$

$$\left(\frac{5}{2}, \frac{3}{2}\right) \quad z = 160\left(\frac{5}{2}\right) + 150\left(\frac{3}{2}\right) = 400 + 225 = 625 \text{ (minimum cost)}$$

$$(5, 0) \quad z = 160(5) + 150(0) = 800$$

Final Answer:

5/2 (or 2.5) gallons of low sulfur fuel and 3/2 (or 1.5) gallons of high sulfur fuel should be burned to minimize the cost to P650.

2. Diet Problem

A person wants to design a daily diet plan using two food items, Meal A and Meal B. Each meal has a cost in pesos and provides carbohydrates, protein, and fat. The person has minimum daily requirements for each nutrient and aims to minimize the cost of this diet.

Meal A:

Cost per serving: 50 pesos

Carbohydrates: 400 grams per serving

Protein: 10 grams per serving

Fat: 20 grams per serving

Meal B:

Cost per serving: 30 pesos

Carbohydrates: 300 kcal per serving

Protein: 15 grams per serving

Fat: 10 grams per serving

Nutritional Requirements:

The person needs at least:

Carbohydrates: 1200 grams

Protein: 30 grams

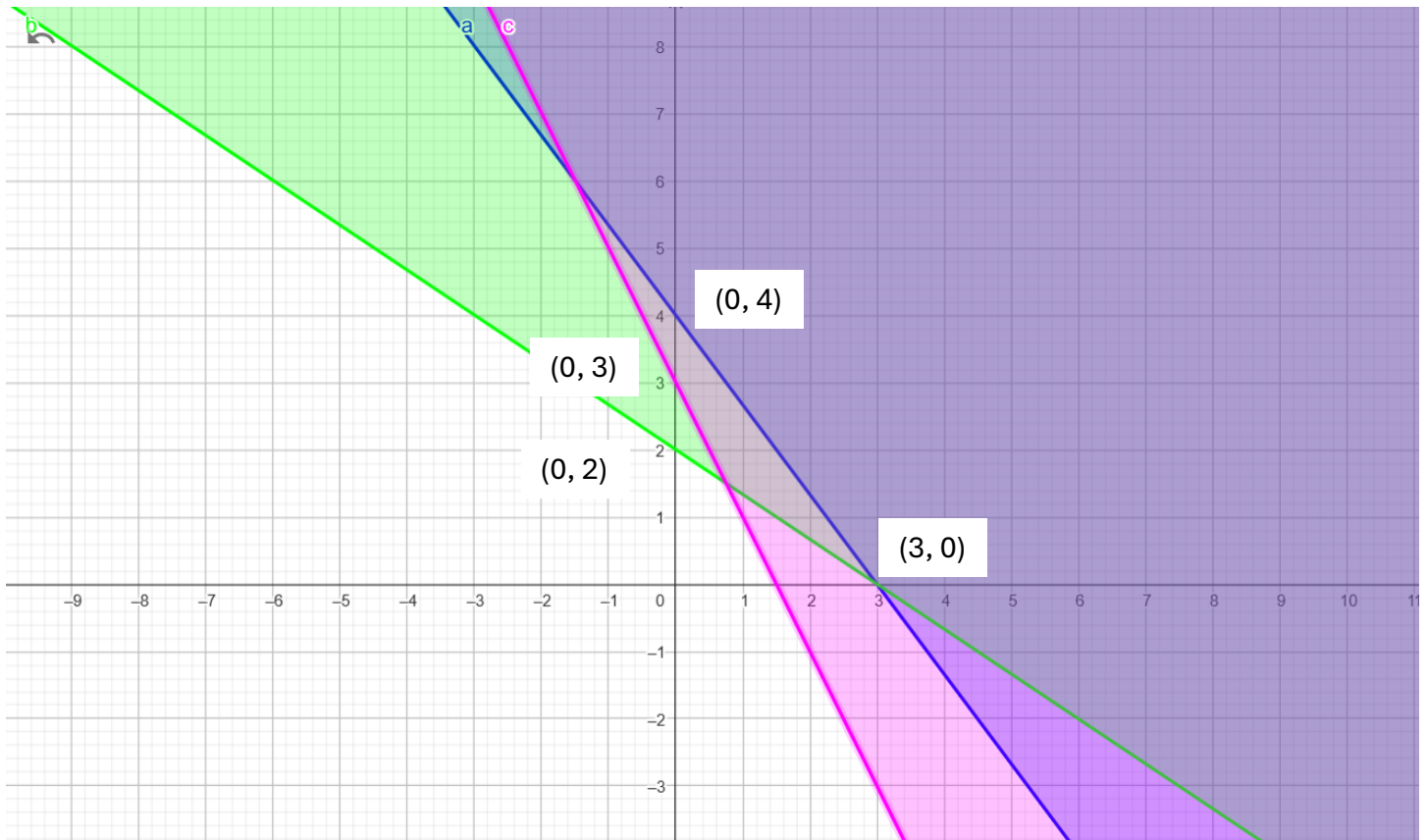
Fat: 30 grams

Solution:

Let x = number of servings of meal A

y = number of servings of meal B

$$z = \text{minimum cost}$$



Note: If an intersection is not in the optimal region, there's no need to compute/determine the coordinates)

Corner Points:

$$(0, 4) \quad z = 50(0) + 30(4) = 120 \text{ (minimum cost)}$$

$$(3, 0) \quad z = 50(3) + 30(0) = 150$$

Final Answer:

The person should have 4 servings of meal B to minimize the cost to P120.

Transportation Problem

Transportation problem is a special kind of **Linear Programming Problem (LPP)** in which *goods are transported from a set of sources* to a set of destinations subject to the supply and demand of the sources and destination respectively such that the total cost of transportation is **minimized**. It is also sometimes called the Hitchcock problem.

1. Northwest Corner Cell Method

	D1	D2	D3	D4	Supply
S1	12	18	9	11	105
S2	19	7	30	15	145
S3	8	10	14	16	50
Demand	80	60	70	90	300

S1, S2, and S3 are the three sources of certain products, while D1, D2, D3, and D4 are the four different destinations of delivery. The numbers with black font colors are the prices of each delivery with the specific source and destination. For example, 12 in row 2 column 2 is the price when S1 delivers in D1. To solve this problem, we need to allocate number of units for a specific destination from a certain source. Since this is Northwest Corner Cell method, you will start with the allocation in the northwest corner cell which is 12 in this example. When you allocate, you choose between the demand and supply of the cell, and you allocate whichever is lower. In 12, the demand is 80 and the supply is 125. Since 80 is lower, you allocate 80 in destination 1, from source 1.

	D1	D2	D3	D4	Supply
S1	12 (80)	18	9	11	105 - 80
S2	19	7	30	15	145
S3	8	10	14	16	50
Demand	80 - 80 = 0	60	70	90	300

In the table above, once 80 is allocated, you cannot allocate to the other cells aligned to 80. On the other hand, 105 in the demand will be reduced by 80 since that number is already allocated to 12. Once you continue the process, you must find the next northwest corner cell until such time that all cells are allocated or removed once the demand or supply becomes zero.

	D1	D2	D3	D4	Supply
S1	12 (80)	18 (25)	9	11	25 – 25 = 0
S2	19	7	30	15	145
S3	8	10	14	16	50
Demand	0	60 – 25 = 35	70	90	300

The next northwest corner cell is 18, so you allocate in 18.

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