

3.4: Linear Programming

Linear Programming - A technique that identifies max/min of some quantity

Constraint – Limits on variable

Objective Function – A model of the quantity that you want to maximize

Vertices – Points of intersection of constraints

Example 2: Manufacturing

A small company makes two similar products, which all follow the same two-step process, consisting of cutting and gluing. Time requirements in minutes for each product at each operation are given below.

operation	product	
	<i>x</i>	<i>y</i>
cutting	1.5	0.8
gluing	0.6	2.2

$$\begin{aligned} \leftarrow 30 \times 60 &= 1800 \\ \leftarrow 55 \text{ hrs} &= 3300 \end{aligned}$$

The firm has 30 hours available in the next period for cutting and 55 hours for gluing. Product *x* contributes \$4.40 per unit to profit and *y* contributes \$4.50 per unit. Find the product mix that maximizes profit.

1. Define Variables

$$x = \begin{matrix} \# \\ \text{product 1} \end{matrix} \quad y = \begin{matrix} \# \\ \text{product 2} \end{matrix}$$

2. Write Constraints

$$\begin{aligned} 1.5x + 0.8y &\leq 1800 \\ 0.6x + 2.2y &\leq 3300 \end{aligned}$$

$$\begin{aligned} x &\geq 0 \\ y &\geq 0 \end{aligned}$$

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A small company makes two similar products, which all follow the same two-step process, consisting of cutting and gluing. Time requirements *in minutes* for each product at each operation are given below.

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1. Write Objective Function

$$P = 4.40x + 4.50y$$

2. Graph Constraints

- a. Use a graphing calculator (see handout)

(468, 1372)

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1. Test Vertices

Example 3: Running a Bakery

A baking tray of corn muffins takes 4c milk and 3c flour. A tray of bran muffins takes 2c milk and 3c flour. A baker has 16c milk and 15c flour. He makes \$3 profit per tray of corn and \$2 profit per tray of bran muffins. How many trays of each type of muffin should he bake to get maximum profit?

1. Define Variables

$$X = \# \text{ corn}$$

$$Y = \# \text{ bran}$$

2. Write Constraints

$$4x + 2y \leq 16 \quad 3x + 3y \leq 15$$

	corn	bran
milk	4	2
flour	3	3

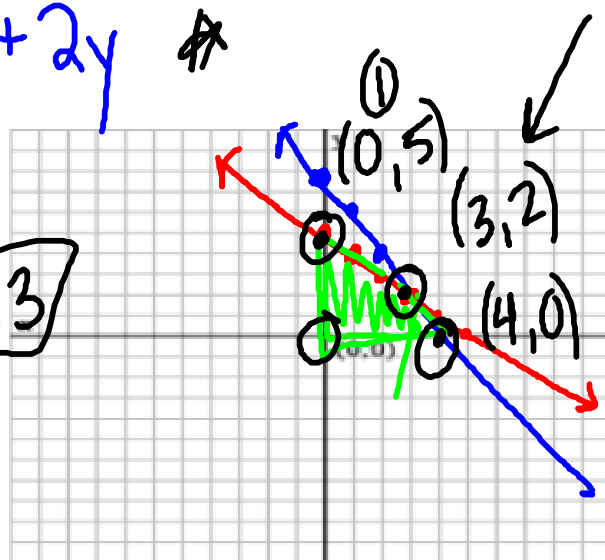
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1. Write Objective Function $P = 3x + 2y$ ★

1. Graph (both by hand and on calculator)

$$\begin{aligned}
 P &= 3(0) + 2(5) = 10 \\
 3(3) + 2(2) &= 9 + 4 = 13 \\
 3(4) + 2(0) &= 12
 \end{aligned}$$



Worksheet