

Honors Algebra 2/Trig
4.11 Linear Programming

Name: Key

1. Baking a tray of banana muffins takes 4 cups of milk and 3 cups of flour. Baking a tray of blueberry muffins takes 2 cups of milk and 3 cups of flour. A baker has 16 cups of milk and 15 cups of wheat flour. He makes \$3 profit per tray of banana muffins and \$2 profit per tray of blueberry muffins. How many trays of each type of muffin should the baker make to maximize profit?

a. Define the variables

$x = \# \text{ trays banana muffins}$

$y = \# \text{ trays blueberry muffins}$

b. Constraints

$$4x + 2y \leq 16$$

$$3x + 3y \leq 15$$

c. Objective Function

$$3x + 2y = P$$

d. Graph

$$3(4x + 2y = 16)$$

$$-2(3x + 3y = 15)$$

$$12x + 6y = 48$$

$$\underline{-6x - 6y = -30}$$

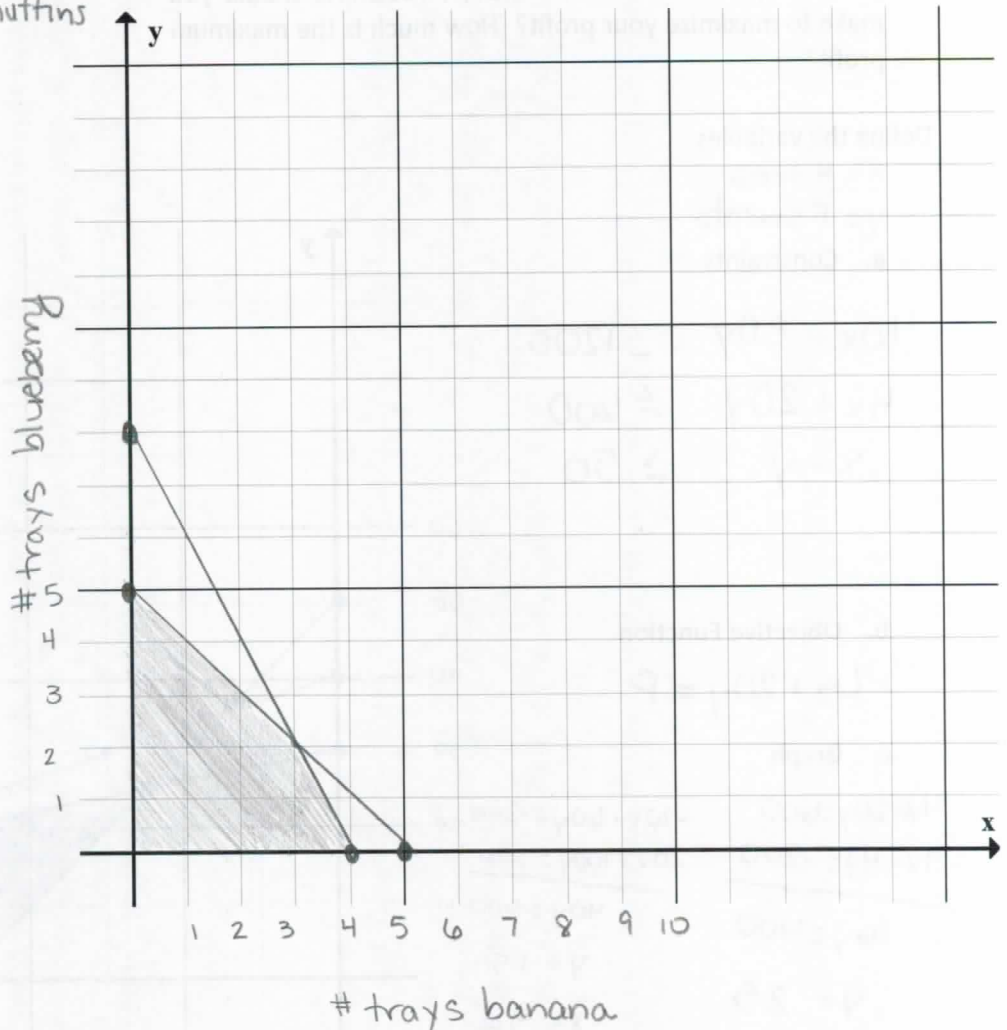
$$6x = 18$$

$$x = 3$$

$$y = 2$$

$$12 + 2y = 16$$

$$2y = 4$$



e. Maximize

$$(4, 0) \quad 12$$

$$(0, 5) \quad 10$$

$$(3, 2) \quad \$13$$

3 trays of Banana muffins and
2 trays of Blueberry muffins

2. You are screen-printing T-shirts and sweatshirts to sell at the Polk County Blues Festival and are working with the following constraints:

- You have at most 20 hours to make shirts.
- You want to spend no more than \$600 on supplies.
- You want to have at least 50 items to sell.



How many T-shirts and how many sweatshirts should you make to maximize your profit? How much is the maximum profit?

Define the variables

$$x = \# \text{ tees}$$

$$y = \# \text{ sweats}$$

a. Constraints

$$10x + 30y \leq 1200$$

$$4x + 20y \leq 600$$

$$x + y \geq 50$$

b. Objective Function

$$6x + 20y = P$$

c. Graph

$$\begin{array}{r} 4x + 20y = 600 \\ -4x - 4y = -200 \\ \hline 16y = 400 \end{array}$$

$$y = 25$$

$$x = 25$$

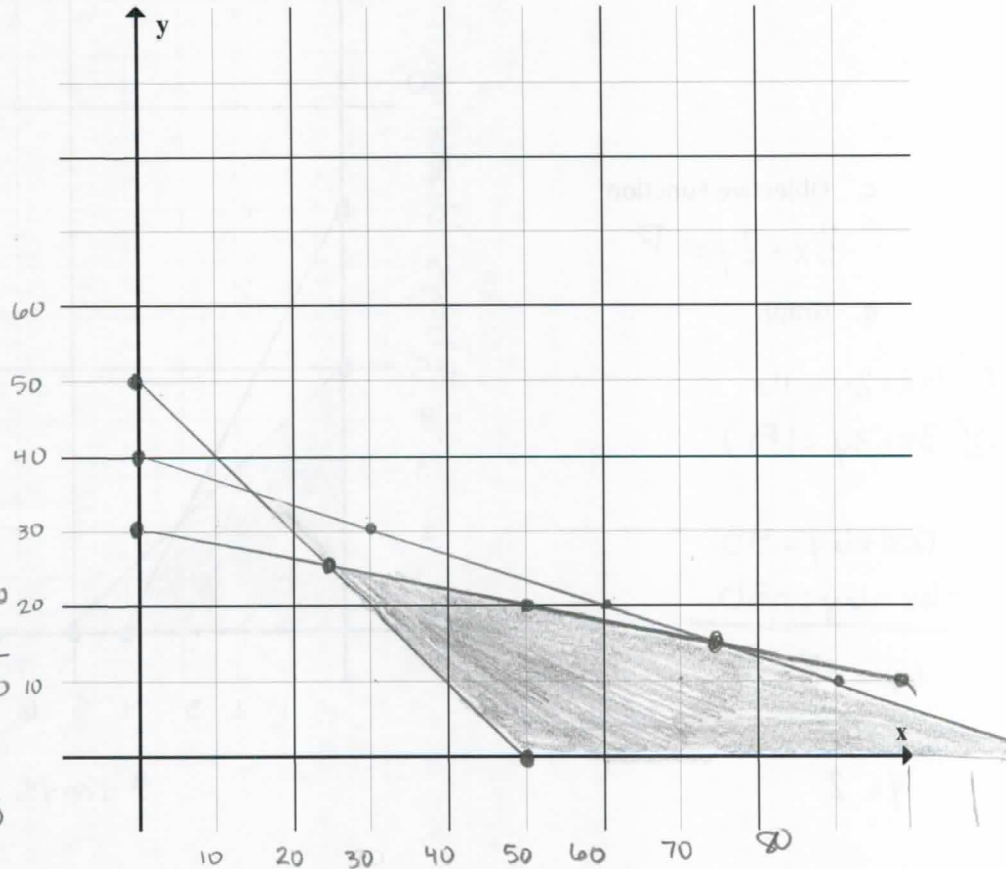
$$-20x - 60y = -2400$$

$$20x + 100y = 3000$$

$$40y = 600 \quad | \quad \div 40$$

$$y = 15$$

$$x = 75$$



d. Maximize

$$(25, 25) \quad \$650$$

$$(50, 0) \quad \$300$$

$$(120, 0) \quad \$720$$

$$(75, 15) \quad \$750$$

Make 75 tees and 15 sweatshirts.
Max profit is \$750.

3. A city wants to plant maple and spruce trees to absorb carbon dioxide. It has \$2100 to spend on planting spruce trees and maple trees. The city has 45,000 ft² available for planting. How many of each tree should the city plant to maximize carbon dioxide absorption?

Spruce and Maple Tree Data

	Spruce	Maple
Planting Cost	\$30	\$40
Area Required	600 ft ²	900 ft ²
Carbon Dioxide Absorption	650 lb/yr	300 lb/yr

SOURCE: Auburn University and Anderson Associates

a. Define the variables

$$x = \# \text{ Spruce}$$

$$y = \# \text{ maple}$$

b. Constraints

$$30x + 40y \leq 2100$$

$$600x + 900y \leq 45,000$$

c. Objective Function

$$P = 650x + 300y$$

d. Graph

$$\begin{array}{r} -20(30x + 40y = 2100) \\ 600x + 900y = 45000 \\ -600x - 800y = -42000 \\ \hline 100y = 3000 \end{array}$$

$$100y = 3000$$

$$y = 30$$

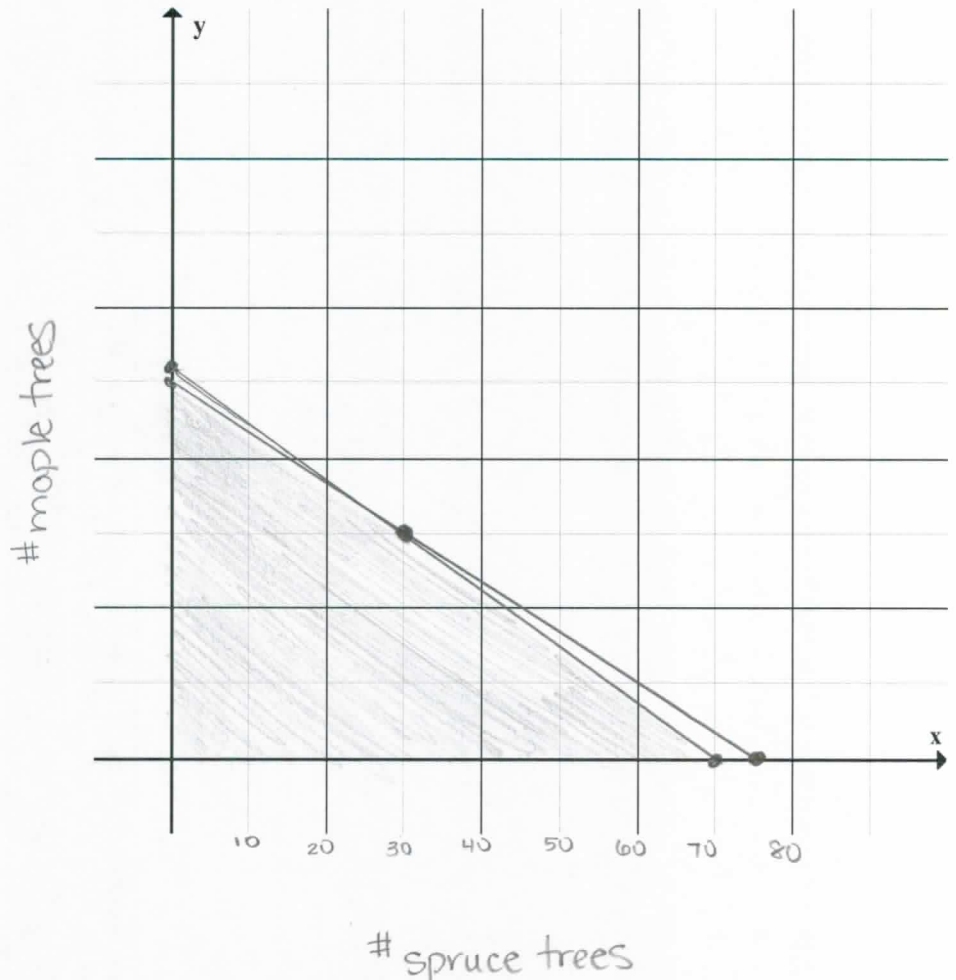
$$x = 30$$

e. Maximize

$$(70, 0) \quad 45,500 \text{ lbs}$$

$$(30, 30) \quad 28,500 \text{ lbs}$$

$$(0, 50) \quad 15,000 \text{ lbs}$$



You should plant 70 Spruce trees to maximize CO₂ absorption.

4. You are about to take a test that contains computation problems worth 6 points each and word problems worth 10 points each. You can do a computation problem in 2 minutes and a word problem in 4 minutes. You have 40 minutes to take the test and may answer no more than 12 problems. Assuming you answer all the problems attempted correctly, how many of each type of problem must you answer to maximize your score? What is the maximum score?

a. Define the variables

$$x = \# \text{ comp. problems}$$

$$y = \# \text{ word problems}$$

b. Constraints

$$x + y \leq 12$$

$$2x + 4y \leq 40$$

c. Objective Function

$$P = 6x + 10y$$

d. Graph

$$-2(x + y = 12)$$

$$2x + 4y = 40$$

$$\underline{-2x - 2y = -24}$$

$$2y = 16$$

$$y = 8$$

$$x = 4$$



Comp. problems

e. Maximize

$$(0, 10) \quad 100 \text{ pts}$$

$$(12, 0) \quad 72 \text{ pts}$$

$$(4, 8) \quad 104 \text{ pts}$$

You should answer 4 computation problems and 8 word problems to maximize your score.