

sean

Q2

Linear Programming in Everyday Life.

NOTE: WORKED WITH VAUGHN

There are many everyday problems that math can help us to figure out. Sometimes there is a particular situation where there are several variables and you want to get maximum profit for minimum cost. We can use linear programming to find out things from everyday life. Here are two different problems with steps and limiting factors that could be part of someones everyday life. The first example is of a flower shop. This flower shop has three different kinds of flowers and two different kinds of arrangements. We can find out things like how to get the most money and how many flowers to order. The second example comes from workers in the tiling business. We have a company that deals with craftsmen and apprentices, they use different kinds of tiles specialty, plain, and trim. Linear programming can involve practical math for everyday people and businesses, and this paper will show examples of these in use.

We are now at a flower shop there are different kinds of arrangements both special and regular and three different types of flowers that go into each arrangement. The florist already has flowers and needs to figure out how to get maximum profit for minimum cost. You are given data showing:

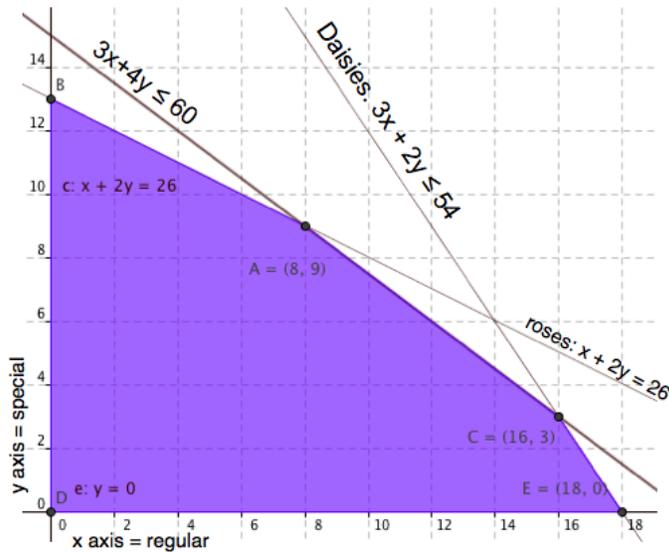
	Mums	Daisies	Roses
Special	4	2	4
Regular	3	3	2
Total	60	54	52

We can now experiment with the types of arrangements, in order to get the most money. Let x be the number of regular arrangements and let y be the number of special arrangements. If we plug this numbers into the different arrangements we can get different amounts and kinds of flower arrangements. The three types of flowers are mums, daisies, and roses. The equations for the different flowers are as follows: Mums: $3x + 4y = 60$, Daisies: $3x + 2y = 54$, Roses: $2x + 4y = 52$.

Now we can let x be the profit of regular arrangements and let y be the profit of special arrangements. So $2x + 3y =$ the profit.

We can now start to deal with money involved for different arrangements. These are the constraints. Mums: $3x + 4y \leq 60$, Daisies: $3x + 2y \leq 54$, Roses: $2x + 4y \leq 52$, $x \geq 0$, $y \geq 0$.

Here is a graph of the information about mums, daisies, and roses.



These are the amounts of arrangements that could work, both regular and special. The x value represents regular and y value represents special.

- A=(8,9)
- C=(16,3)
- D=(0,13)
- E=(18,0)
- F=(0,0)

But in this case we want the maximum profit for the florist so we put all the variables into this equation $2(8) + 3(9) = 48$ to find that (A) get us the max profit. A = (8,9) so the florist should make 8 regular and 9 special arrangements.

It should be noted however that for max profit, there will still be flowers left over. There will still be flowers left over. These flowers are daisies and there will be 6 left over. This is seen with reference to the above graph.

We are now at a tiling business that works with craftsmen and apprentices and tiles with three different types of tiles. The goal is to tile at minimum labor cost. Craftsmen can install bigger amounts of tile, and these craftsmen have apprentices working under them that install different amounts of tile. The tiles are specialty, plain, and trim and each is different. You are given data

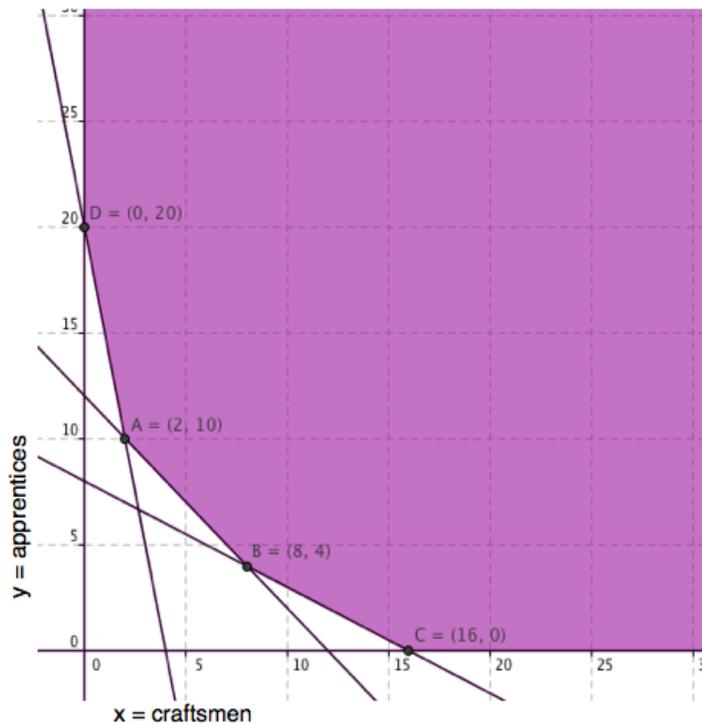
showing:

	Specialty	Plain	Trim
Craftsmen	500sq ft	100sq ft	100 ft
Apprentices	100sq ft	200sq ft	100 ft
Firm Total	2000sq ft	1600sq ft	1200 ft

Let x be the number of craftsmen, and let y be the number of apprentices. So we have equations for the different types of tiles which are, Specialty: $500x + 100y = 2000$, Plain: $100x + 200y = 1600$, Trim: $100x + 100y = 1200$.

For the tiling business labor costs would equal this equation: $200x + 120y = \textit{profit}$. If you put in different numbers of craftsmen and apprentices you will get the total profit.

The different groups of workers put down tiles. There are different constraints for how much tiles cost, when craftsmen and apprentices put them down. So the constraints are: Specialty: $500x + 100y \geq 2000$, Plain: $100x + 200y \geq 1600$, Trim: $100x + 100y \geq 1200$, $x \geq 0$, $y \geq 0$. Here is a graph on the tile information:



There are different arrangements of workers that could get the job done. They may not all get it done for the least amount of money but each of these satisfy the constraints.

$$A=(2,10)$$

$$B=(8,4)$$

$$C=(16,0)$$

$$D=(0,20)$$

However if you want to get the minimum labor cost, you should sub all the data into the equation $200(x) + 120(y) = \text{profit}$. The data set that involves the east labor cost if (A).

$200(2) + 120(10) = 1600$, so the lowest price would be \$1600, and 2 craftsman and 10 apprentices would be used.

As with anything in life, more detail could be added, such as a constraint could be added by increasing the apprentices wages to \$150. So the equation would be: $200x + 150y = \text{profit}$. Then you sub in all the numbers from A, B, C, and D. (above).

$$200(2) + 150(10) = 1900$$

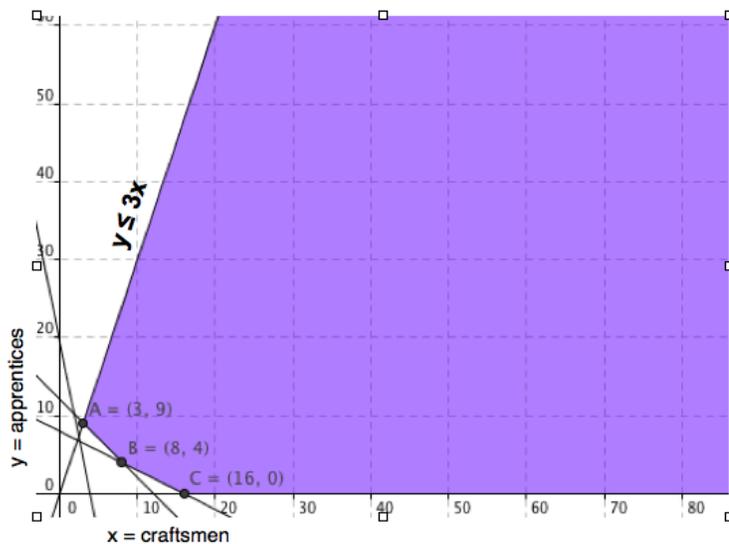
$$200(8) + 150(4) = 2200$$

$$200(16) + 150(0) = 3200$$

$$200(0) + 150(20) = 3000$$

From this we find that the minimum amount of labor cost needed would be brought from 2 craftsman and 10 apprentices. (A). Another question to ask might be if there was region in which there would be no craftsmen? The answer is of course, Yes, there is a feasible region from all apprentices and no craftsmen. The region is (0, 20). (as seen in the graph) Something you could do to limit the constraints on this data would be to put in a constraint saying $x \geq 1$, this would make it so that (0, 20) is not possible.

Another constraint would be if you needed 1 craftsmen to supervise 3 of less apprentices. The vertex $y \leq 3x$ satisfies the constraint. If you add the new constraint to the graph it would look like this:



Now if you wanted to find the minimum labor cost for the original work, you would factor in these number groupings. $A = (3, 9)$, $B = (8, 4)$, $C = (16, 0)$. Into the equation, $200x + 120y = \text{cost}$. Then you would sub in the numbers for A, B, and C to the equation.

$$200(3) + 120(9) = 1680$$

$$200(8) + 120(4) = 2080$$

$$200(16) + 120(0) = 3200$$

To get the minimum labor cost there should be 3 craftsmen and 9 apprentices assigned to the job. (A). The cost would be \$1680.

Carrying out this project helped me to understand the concepts behind linear programming, and I definitely think that the problems helped to simulate an everyday use of algebra. There were two examples given, one was for a flower shop, trying to get the lowest cost at the maximum price. One was from a tiling business that wanted to lay tile for the lowest cost at the maximum price. Although someone could probably just guess, or try to figure out things about costs with flowers or tiles, linear programming seems to help us do math that we might need in job situations or any part of calculations in life.