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Maximizing the Profit of a Business

Math 1010 Intermediate Algebra Group Project

In this project your group will solve the following problem:

A manufacturer produces the following two items: computer desks and bookcases. Each item requires processing in each of two departments. Department A has 55 hours available and department B has 39 hours available each week for production. To manufacture a computer desk requires 4 hours in department A and 3 hours in department B while a bookcase requires 3 hours in department A and 2 hours in department B. Profits on the items are $72 and $23 respectively. If all the units can be sold, how many of each should be made to maximize profits?

Let X be the number of computer desks that are sold and Y be number of bookcases sold.

Dept A 4x, 3y, profit = $72 for computer desk

Dept B 3x, 2y, profit = $23 for bookcase

1. Write down a linear inequality for the hours used in Department A

$4x + 3y \leq 55$

2. Write down a linear inequality for the hours used in Department B

$3x + 2y \leq 39$

There are two other linear inequalities that must be met. These relate to the fact that the manufacturer cannot produce negative numbers of items. These inequalities are as follows:

$$X \geq 0$$
$$Y \geq 0$$

3. Next, write down the profit function for the sale of X desks and Y bookcases:

$P = \$72x + 23y$

You now have four linear inequalities and a profit function. These together describe the manufacturing situation. These together make up what is known mathematically as a **linear programming** problem. Write all of the inequalities and the profit function together below. This is typically written one on top of another, with the profit function last.

$4x + 3y \leq 55$ comp desk
$3x + 2y \leq 39$ bookcase
$x \geq 0$
$y \geq 0$
$P = 72x + 23y$

4. To solve this problem, you will need to graph the **intersection** of all four inequalities on one common XY plane. Do this on the grid below. Have the bottom left be the origin, with the horizontal axis representing X and the vertical axis representing Y.

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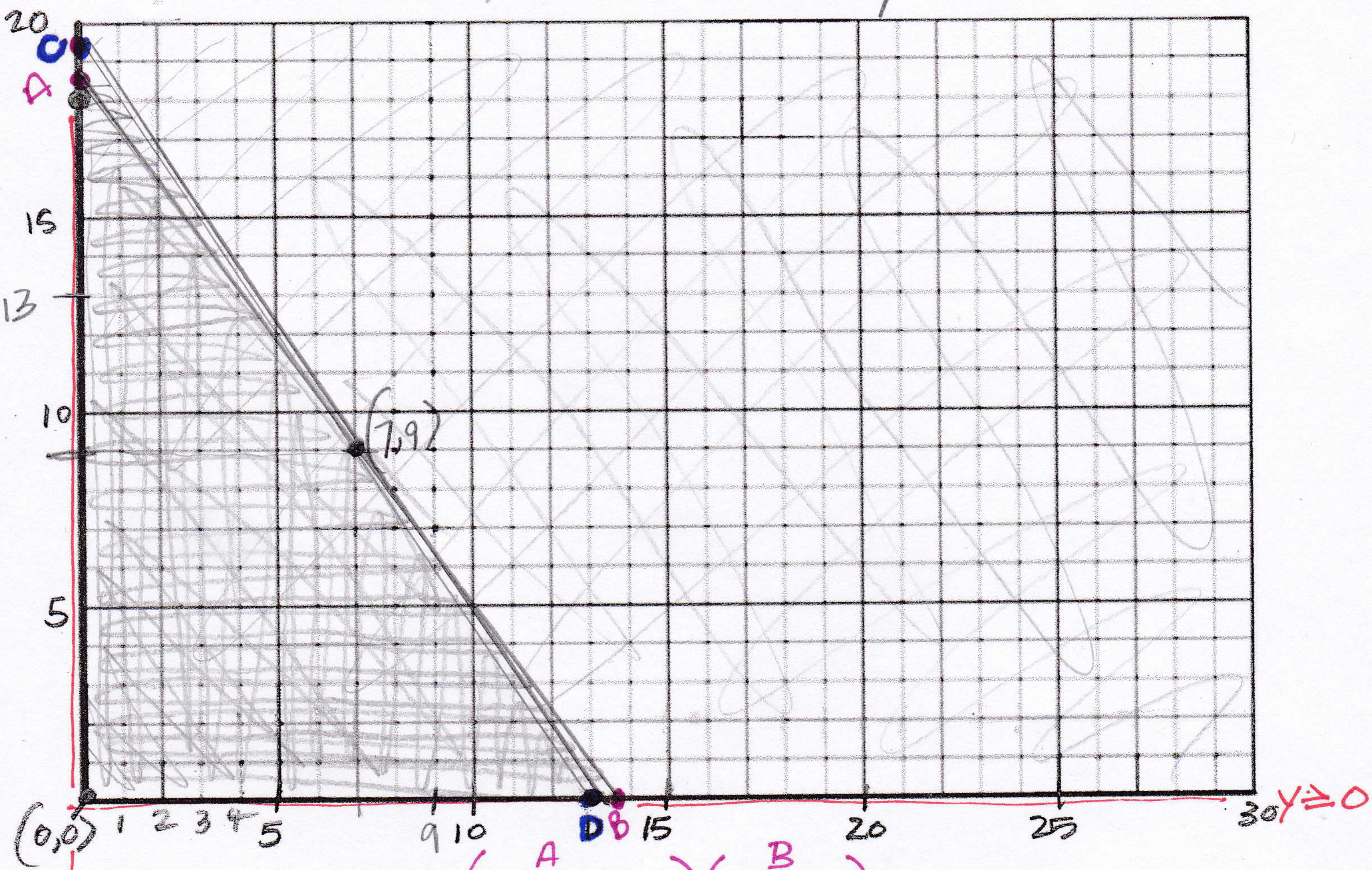

A B

$4x + 3y \le 55$ (0, ~~1~~18.33)(13.75, 0)

try(0,0) $4(0) + 3(0) \le 55$ $0 \le 55$ yes

x ≥ 0 line

C D

$3x + 2y \le 39$ (0, 19.5)(13, 0)

try(0,0) $3(0) + 2(0) \le 39$ $0 \le 39$ yes

$x = 0$ $x \ge 0$ try (0,1)

$y = 0$ $y \ge 0$ (0,0)(13,0)(0,18)(7,9)

$P = 72x + 27y$

$P = 72(0) + 27(0)$ $P = 0$

$P = 72(13) + 27(0)$ P = \$936

$P = 72(0) + 27(18)$ P = \$486

$P = 72(7) + 27(9)$ → P = \$747

504 + 243

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5. The above shape should have 4 corners. Find the coordinates of the ordered pairs that make up these corners. For the intersection of the two slanted lines you will have to solve the 2 by 2 system made up of their equations.

(0,0)
(13,0)
(0,18)
(7,9)

6. The next thing to do is to plug each of the points you found in part 5 into the profit function to determine which ordered pair gives the maximum profit. Do this and write a sentence describing how many of each type of furniture you should build and sell and what is the maximum profit you will make.

$P = 72(0) + 27(0) \quad P = 0$

$P = 72(13) + 27(0) \quad P = 936$

$P = 72(0) + 27(18) \quad P = 486$

$P = 72(7) + 27(9)$

$504 + 243 \quad P = 747$

For maximum profit, it would be best to make 13 desks and no bookshelves. Profit would be $936.00.

7. Reflective Writing.
Did this project change the way you think about how math can be applied to the real world? Write one paragraph stating what ideas changed and why. If this project did not change the way

This project definitely reaffirmed out belief that math can and does apply to almost anything. It has also reaffirmed our belief that math can be very challenging! What is interesting is how many steps it takes to accurately determine the solution of a problem, and how the slightest mistake in the process can drastically affect results. It can be very difficult! Sometimes it's best to walk away and give your mind a break, and come back to try again. There are so many formulas to remember, and deciding which one(s) to use in any given situation can be tricky. The key is definitely learning how to interpret math formulas into real words and vice versa.

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