Answer on Question #84092 – Math – Other

Question

A company owns two flour mills viz. A and B, which have different production capacities for high, medium and low quality flour. The company has entered a contract to supply flour to a firm every month with at least 8, 12 and 24 quintals of high, medium and low quality respectively. It costs the company Rs.2000 and Rs.1500 per day to run mill A and B respectively. On a day, Mill A produces 6, 2 and 4 quantals of high, medium and low quality flour, Mill B produces 2, 4 and 12 quintals of high, medium and low quality flour respectively. How many days per month should each mill be operated in order to meet the contract order most economically.

Solution

Let x_1 be the number of days per month the mill A operates and x_2 be the number of days per month the mill B operates. The objective is to minimize the total cost of operation and to satisfy the contract order. The linear programming problem is given by

Minimize $2000x_1 + 1500x_2$

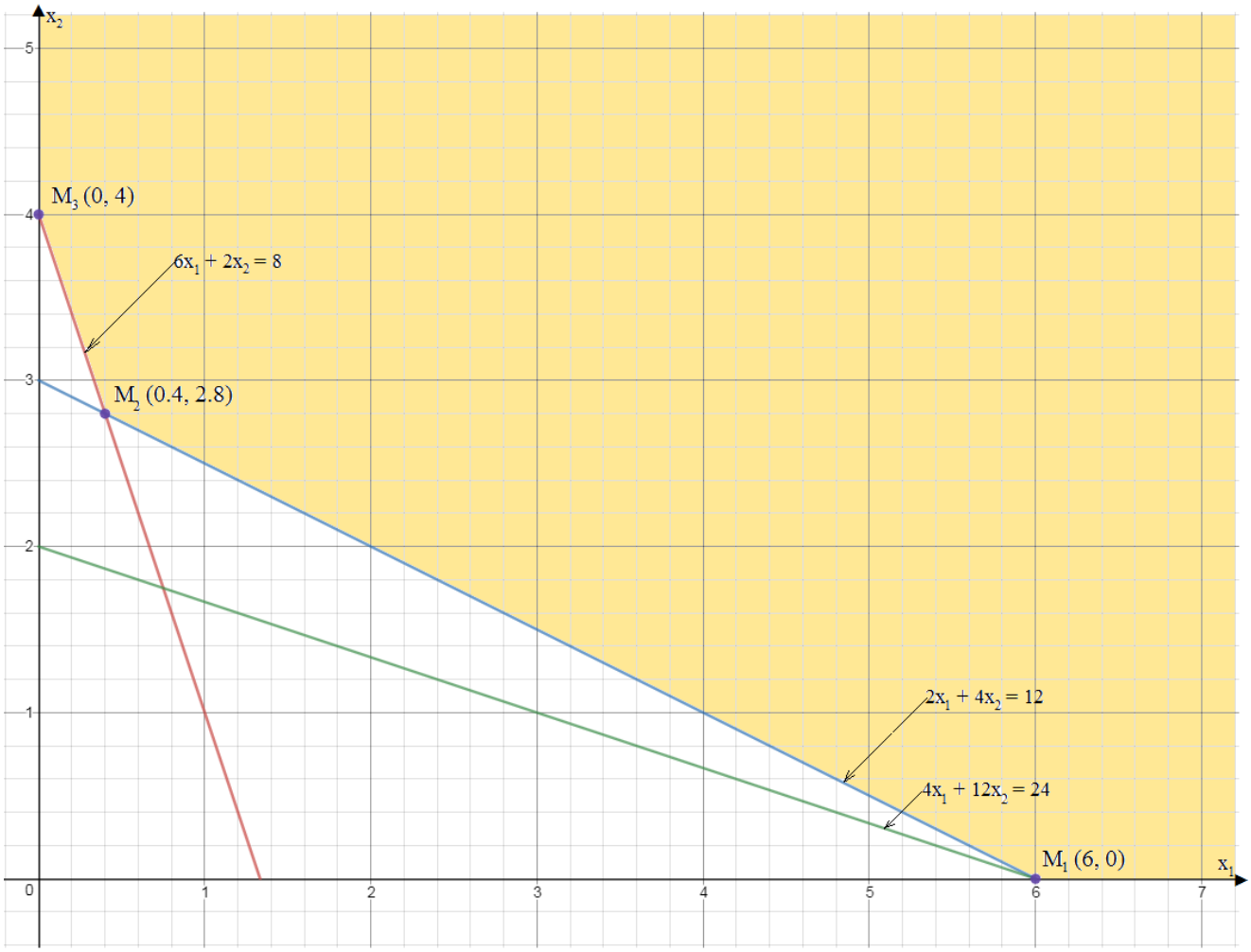
Subject to: $6x_1 + 2x_2 \geq 8$

$2x_1 + 4x_2 \geq 12$

$4x_1 + 12x_2 \geq 24$

$x_1 \geq 0, x_2 \geq 0$

We now graph the constraint inequalities as follows:



$6x_1 + 2x_2 = 8: (0,4), \left(\frac{4}{3}, 0\right)$
$2x_1 + 4x_2 = 12: (0,3), (6,0)$
$4x_1 + 12x_2 = 24: (0,2), (6,0)$

$$\begin{cases} 6x_1 + 2x_2 = 8 \\ 2x_1 + 4x_2 = 12 \end{cases} => \begin{cases} x_2 = 4 - 3x_1 \\ x_1 + 2(4 - 3x_1) = 6 \end{cases} => \begin{cases} x_1 = 0.4 \\ x_2 = 2.8 \end{cases}$$

$M_1(6,0), M_2(0.4, 2.8), M_3(0,4).$
The area shaded is called the region of feasible solutions.
$M_1(6,0): 2000(6) + 1500(0) = Rs.12000$
$M_2(0.4, 2.8): 2000(0.4) + 1500(2.8) = Rs.5000$
$M_3(0,4): 2000(0) + 1500(4) = Rs.6000$
We note that the minimum cost is $Rs.5000$ per month obtainable at point M_2, where the company operates mills A and B for 0.4 days and 2.8 days respectively in a month.
Answer: the company operates mills A and B for 0.4 days and 2.8 days respectively.