OPTIMIZATION

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QUESTION: 7.7

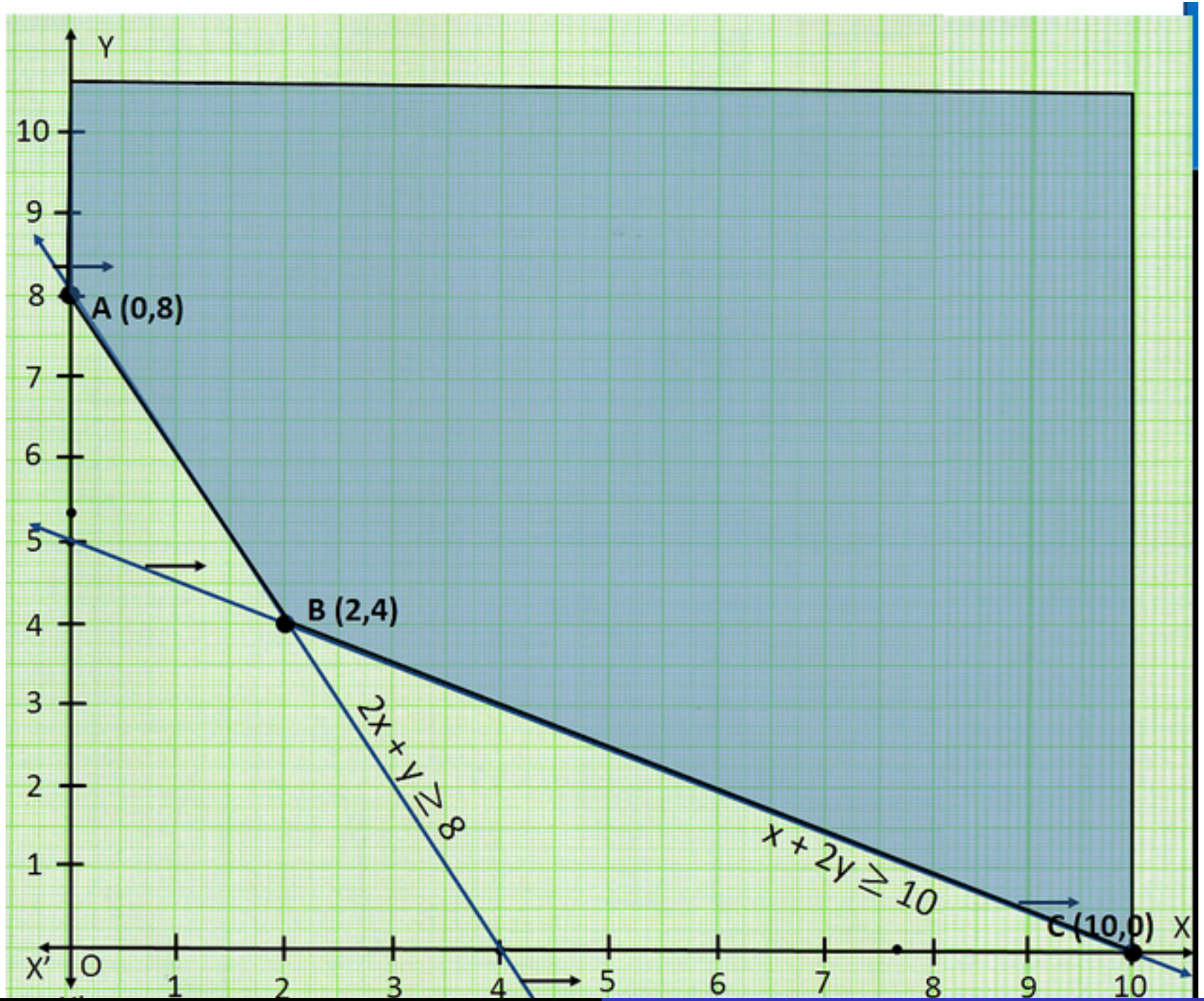
(Diet problem): A dietician wishes to mix two types of foods in such a way that vitamin contents of the mixture contain atleast 8 units of vitamin A and 10 units of vitamin C. Food 'I' contains 2 units/kg of vitamin A and 1 unit/kg of vitamin C. Food 'II' contains 1 unit/kg of vitamin A and 2 units/kg of vitamin C. It costs Rs 50 per kg to purchase Food 'I' and Rs 70 per kg to purchase Food 'II'. Formulate this problem as a linear programming problem to minimise the cost of such a mixture ?

SOLUTION

Let the mixture contains x kg of food I and y kg of food II.

Resources	Food		Requirement
	I	II	
Vitamin A	2	1	Atleast 8 Units
Vitamin C	1	2	Atleast 10 Units
Cost	50	70	

GOAL: We need to minimize the cost of mixture.
Cost of FOOD I per kg = Rs 50
Cost of FOOD II per kg = Rs 70
Minimize $Z = 50x + 70y$
Subject to constraints:
$2x + y >= 8$
$x + 2y >= 10$
$x, y >= 0$


Y
X
X'
O
A (0,8)
B (2,4)
C (10,0)
2x + y ≥ 8
x + 2y ≥ 10
1
2
3
4
5
6
7
8
9
10

Corner Point	$Z = 50x + 70y$
(0,8)	560
(2,4)	380
(10,0)	500

The smallest value of Z is 380 at the point (2,4). But the feasible region is unbounded therefore we draw the graph of the inequality: $50x + 70y < 380$
to check whether the resulting open half has any point common with the feasible region but on checking it doesn't have any points in common.

Thus the minimum value of Z is 380 attained at (2,4). Hence optimal mixing strategy for the dietician would be to mix 2 Kg of Food I and 4 Kg of Food II.