

4.12.6

AI25BTECH11001 - ABHISEK MOHAPATRA

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Question: The owner of a milk store finds that he can sell 980 litres of milk each week at 14/litre and 1220 litres of milk each week at 16/litre. Assuming a linear relationship between selling price and demand, how many litres could he sell weekly at 17/ litre?

Solution: Let the litres at 17/ litre be x . Representing the data, Let

$$\mathbf{A} = \begin{pmatrix} 980 \\ 14 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 1220 \\ 16 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} x \\ 17 \end{pmatrix} \quad (0.1)$$

so as per the question these point lies on a line,

$$\Rightarrow \text{rank}(\mathbf{A} - \mathbf{B} \quad \mathbf{C} - \mathbf{B})^{\top} = 1 \quad (0.2)$$

$$\Rightarrow (\mathbf{A} - \mathbf{B} \quad \mathbf{C} - \mathbf{B})^{\top} = \begin{pmatrix} -240 & -2 \\ x - 1220 & 1 \end{pmatrix} \quad (0.3)$$

$$\xleftrightarrow{C_1 \leftrightarrow C_2} \begin{pmatrix} -2 & -240 \\ 1 & x - 1220 \end{pmatrix} \quad (0.4)$$

$$\xleftrightarrow{R_2 \rightarrow R_2 + \frac{1}{2}R_1} \begin{pmatrix} -2 & -240 \\ 0 & x - 1340 \end{pmatrix} \quad (0.5)$$

so for rank = 1, $x = 1340$.

1340 litres is the required answer.

Graph:

