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

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

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

$$\Rightarrow rank \begin{pmatrix} \mathbf{A} - \mathbf{B} & \mathbf{C} - \mathbf{B} \end{pmatrix} = 1 \tag{0.2}$$

$$\Rightarrow \begin{pmatrix} \mathbf{A} - \mathbf{B} & \mathbf{C} - \mathbf{B} \end{pmatrix}^T = \begin{pmatrix} -240 & -2 \\ x - 1220 & 1 \end{pmatrix} \tag{0.3}$$

$$\overset{C_1 \leftrightarrow C_2}{\longleftrightarrow} \begin{pmatrix} -2 & -240 \\ 1 & x - 1220 \end{pmatrix} \tag{0.4}$$

$$\xleftrightarrow{R_2 \to R_2 + \frac{1}{2}R_1} \begin{pmatrix} -2 & -240 \\ 0 & x - 1340 \end{pmatrix} \tag{0.5}$$

so for rank = 1, x = 1340.
1340 litres is the required answer.
Graph: