

# 1.6.9

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## Question:

if three points  $\begin{pmatrix} h \\ 0 \end{pmatrix}, \begin{pmatrix} a \\ b \end{pmatrix}, \begin{pmatrix} 0 \\ k \end{pmatrix}$  lie on a line, show that

$$\frac{a}{h} + \frac{b}{k} = 1$$

## Solution:

Point	Name
$(h, 0)$	Point A
$(0, k)$	Point B
$(a, b)$	Point C

TABLE 0: Variables Used

If the rank of the Collinearity matrix is 1, then the points are collinear  
The Collinearity matrix is given by

$$(\mathbf{C} - \mathbf{A} \quad \mathbf{B} - \mathbf{A})^T = \begin{pmatrix} a-h & b \\ -h & k \end{pmatrix} \quad (0.1)$$

$$\xleftrightarrow{C_1 \rightarrow \frac{C_1}{-h}} \begin{pmatrix} \frac{a-h}{-h} & b \\ 1 & k \end{pmatrix} \quad (0.2)$$

$$\xleftrightarrow{C_2 \rightarrow \frac{C_2}{k}} \begin{pmatrix} \frac{a-h}{-h} & \frac{b}{k} \\ 1 & 1 \end{pmatrix} \quad (0.3)$$

$$\xleftrightarrow{R_1 \rightarrow C_1 - C_2} \begin{pmatrix} \frac{a-h}{-h} - \frac{b}{k} & \frac{b}{k} \\ 0 & 1 \end{pmatrix} \quad (0.4)$$

since the rank of matrix=1

$$\frac{a-h}{-h} - \frac{b}{k} = 0 \implies \frac{a}{h} + \frac{b}{k} = 1$$

Refer to Fig. 0

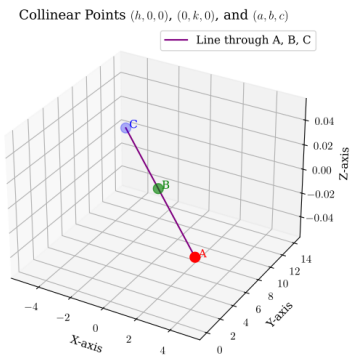


Fig. 0.1