Assignment 1

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1) Show that the points (2, 3, 4), (–1, –2, 1), (5, 8, 7) are collinear.
Solution: The points given are,

$$\mathbf{A} = \begin{pmatrix}2\\3\\4\end{pmatrix}, \mathbf{B} = \begin{pmatrix}-1\\-2\\1\end{pmatrix}, \mathbf{C} = \begin{pmatrix}5\\8\\7\end{pmatrix} \tag{0.0.1}$$

To check whether the given points are collinear, we find the rank of the matrix $\begin{pmatrix}\mathbf{A} & \mathbf{B} & \mathbf{C}\end{pmatrix}$

$$\begin{pmatrix}2 & -1 & 5\\3 & -2 & 8\\4 & 1 & 7\end{pmatrix} \tag{0.0.2}$$

$$\xleftrightarrow[R_3 \leftarrow R_3 - 2R_1]{R_2 \leftarrow R_2 - \frac{3}{2}R_1} \tag{0.0.3}$$

$$\begin{pmatrix}2 & -1 & 5\\0 & -\frac{1}{2} & \frac{1}{2}\\0 & 3 & -3\end{pmatrix} \tag{0.0.4}$$

$$\xleftrightarrow{R_3 \leftarrow R_3 + 6R_2} \tag{0.0.5}$$

$$\begin{pmatrix}2 & -1 & 5\\0 & -\frac{1}{2} & \frac{1}{2}\\0 & 0 & 0\end{pmatrix} \tag{0.0.6}$$

The matrix has a rank of 2. Hence the given points are collinear.