

# 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,

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

To check whether the given points are collinear, we find the rank of the matrix  $(\mathbf{A} \ \mathbf{B} \ \mathbf{C})$

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

$$\begin{array}{c} R_2 \leftarrow R_2 - \frac{3}{2}R_1 \\ \hline R_3 \leftarrow R_3 - 2R_1 \end{array} \quad (0.0.3)$$

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

$$\begin{array}{c} R_3 \leftarrow R_3 + 6R_2 \\ \hline \end{array} \quad (0.0.5)$$

$$\begin{pmatrix} 2 & -1 & 5 \\ 0 & -\frac{1}{2} & \frac{1}{2} \\ 0 & 0 & 0 \end{pmatrix} \quad (0.0.6)$$

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