1.7.4

AI25BTECH11018-Hemanth Reddy

Question:
Using vectors, prove that the points(2,-1,3), (3,-5,1),and(-1,11,9) are collinear.

Solution:

Let $\mathbf{A}\begin{pmatrix} 2 \\ -1 \\ 3 \end{pmatrix}$ $\mathbf{B}\begin{pmatrix} 3 \\ -5 \\ 1 \end{pmatrix}$ $\mathbf{C}\begin{pmatrix} -1 \\ 11 \\ 9 \end{pmatrix}$ be vectors

Points $\mathbf{A}$,$\mathbf{B}$, $\mathbf{C}$ are defined to be collinear if

$$\text{rank}\,(\mathbf{B} - \mathbf{A} \quad \mathbf{C} - \mathbf{A}) = 1 \tag{0.1}$$

$$\text{Let } (\mathbf{B} - \mathbf{A} \quad \mathbf{C} - \mathbf{A}) = \mathbf{D} \tag{0.2}$$

$$\text{rank}\mathbf{D} = \text{rank}\mathbf{D}^T \tag{0.3}$$

$$\mathbf{D}^T = \begin{pmatrix} 1 & -4 & -2 \\ -3 & 12 & 6 \end{pmatrix} \tag{0.4}$$

$$R_2 = R_2 + 3R_2 \tag{0.5}$$

$$\mathbf{D}^T = \begin{pmatrix} 1 & -4 & -2 \\ 0 & 0 & 0 \end{pmatrix} \tag{0.6}$$

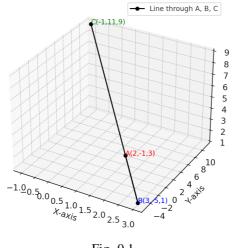which has rank 1.So we can conclude that the given points are collinear.

Fig. 0.1