Question 4-4.4-35

EE24BTECH11015 - Dhawal

1) Find the value of x such that the four points $\mathbf{A}\,(x, 5, -1)\,, \mathbf{B}\,(3, 2, 1)\,, \mathbf{C}\,(4, 5, 5)$ and $\mathbf{D}\,(4, 2, -2)$ are coplanar.

Variable	Description	Values
A	Point	$(x, 5, -1)$
B	Point	$(3, 2, 1)$
C	Point	$(4, 5, 5)$
D	Point	$(4, 2, -2)$
AC	**C** − **A**	$(4 - x, 0, 6)$
BC	**C** − **B**	$(1, 3, 4)$
DC	**C** − **D**	$(0, 3, 7)$

TABLE 1: Variables given

Solution:
Matrix with all 3 vectors:

$$\begin{pmatrix} DC & BC & AC \end{pmatrix}^T \tag{1.1}$$

If these points are coplaner, the matrix should have rank less than 3,

$$\begin{pmatrix} 0 & 3 & 7 \\ 1 & 3 & 4 \\ 4-x & 0 & 6 \end{pmatrix} \tag{1.2}$$

$R_2 \to R_2 - R_1$

$$\begin{pmatrix} 0 & 3 & 7 \\ 1 & 0 & -3 \\ 4-x & 0 & 6 \end{pmatrix} \tag{1.3}$$

$R_3 \to R_3 + 2R_2$

$$\begin{pmatrix} 0 & 3 & 7 \\ 1 & 0 & -3 \\ 6-x & 0 & 0 \end{pmatrix} \tag{1.4}$$

The last row should be zero,

$$6 - x = 0 \to x = 6 \tag{1.5}$$

Plot:

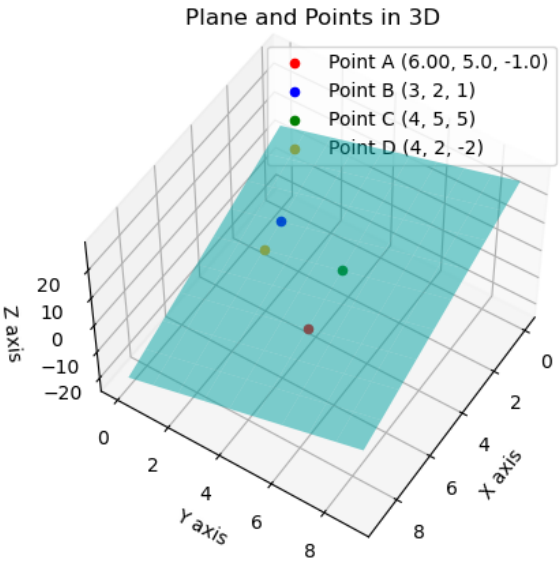

Fig. 1.1: ΔABC