

Probability and Random Processes

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Q) Find the intersection **G** of *BC* and *CF*

A) **A**, **B** and **C** are vertices of triangle:

$$\mathbf{A} = \begin{pmatrix} 1 \\ -1 \end{pmatrix} \quad (1)$$

$$\mathbf{B} = \begin{pmatrix} -4 \\ 6 \end{pmatrix} \quad (2)$$

$$\mathbf{C} = \begin{pmatrix} -3 \\ -5 \end{pmatrix} \quad (3)$$

Since *E* and *F* are midpoints of *CA* and *AB*,

$$\mathbf{E} = \frac{\mathbf{A} + \mathbf{C}}{2} \quad (4)$$

$$= \begin{pmatrix} -1 \\ -3 \end{pmatrix} \quad (5)$$

$$\mathbf{F} = \frac{\mathbf{B} + \mathbf{A}}{2} \quad (6)$$

$$= \begin{pmatrix} -1.5 \\ 2.5 \end{pmatrix} \quad (7)$$

The direction vector **CF** and equation of *CF* are given by

$$\mathbf{F} - \mathbf{C} = \begin{pmatrix} 1.5 \\ 7.5 \end{pmatrix} \quad (8)$$

$$\mathbf{CF} = \begin{pmatrix} -3 \\ -5 \end{pmatrix} + k \begin{pmatrix} 1.5 \\ 7.5 \end{pmatrix} \quad (9)$$

The direction vector **BE** and equation of *BE* are given by

$$\mathbf{E} - \mathbf{B} = \begin{pmatrix} 3 \\ -9 \end{pmatrix} \quad (10)$$

$$\mathbf{BE} = \begin{pmatrix} -4 \\ 6 \end{pmatrix} + k \begin{pmatrix} 3 \\ -9 \end{pmatrix} \quad (11)$$

The augmented matrix is:

$$\begin{pmatrix} 3 & 1 & -6 \\ 5 & -1 & -10 \end{pmatrix} \quad (12)$$

Using Gauss-Elimination method:

$$\begin{pmatrix} 3 & 1 & -6 \\ 5 & -1 & -10 \end{pmatrix} \xrightarrow{R_1 \rightarrow R_1 + R_2} \begin{pmatrix} 8 & 0 & -16 \\ 5 & -1 & -10 \end{pmatrix} \quad (13)$$

$$\begin{pmatrix} 8 & 0 & -16 \\ 5 & -1 & -10 \end{pmatrix} \xrightarrow{R_1 \rightarrow R_1/8} \begin{pmatrix} 1 & 0 & -2 \\ 5 & -1 & -10 \end{pmatrix} \quad (14)$$

$$\begin{pmatrix} 1 & 0 & -2 \\ 5 & -1 & -10 \end{pmatrix} \xrightarrow{R_2 \rightarrow R_2 - 5R_1} \begin{pmatrix} 1 & 0 & -2 \\ 0 & -1 & 0 \end{pmatrix} \quad (15)$$

$$\begin{pmatrix} 1 & 0 & -2 \\ 0 & -1 & 0 \end{pmatrix} \xrightarrow{R_2 \rightarrow -R_2} \begin{pmatrix} 1 & 0 & -2 \\ 0 & 1 & 0 \end{pmatrix} \quad (16)$$

Therefore, $\mathbf{G} = \begin{pmatrix} -2 \\ 0 \end{pmatrix}$