Solution to Q1.3.4

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Question

Find the intersection **H** of altitudes BE_1 and CF_1

Solution

From question 1.3.3 we know the equation of altitudes BE_1 and CF_1 now to find the point of intersection **H** of altitudes we need to solve these two equations simultaneously

Equation of BE_1

$$\begin{pmatrix}1 & 1\end{pmatrix}\mathbf{x} = \begin{pmatrix}2\end{pmatrix} \tag{1}$$

Equation of CF_1

$$\begin{pmatrix}5 & -7\end{pmatrix}\mathbf{x} = \begin{pmatrix}20\end{pmatrix} \tag{2}$$

Therefore, we need to solve the following equation:

$$\begin{pmatrix}1 & 1\\ 5 & -7\end{pmatrix}\mathbf{x} = \begin{pmatrix}2\\ 20\end{pmatrix} \tag{3}$$

Solving the above equation by Gauss-Jordan method

$$\begin{pmatrix}1 & 1 & 2\\ 5 & -7 & 20\end{pmatrix} \xleftrightarrow{R_2 \leftarrow R_2 - 5R_1} \begin{pmatrix}1 & 1 & 2\\ 0 & -12 & 10\end{pmatrix} \tag{4}$$

$$\xleftrightarrow{R_2 \leftarrow \frac{R_2}{-12}} \begin{pmatrix}1 & 1 & 2\\ 0 & 1 & \frac{-5}{6}\end{pmatrix} \tag{5}$$

$$\xleftrightarrow{R_1 \leftarrow R_1 - R_2} \begin{pmatrix}1 & 0 & \frac{17}{6}\\ 0 & 1 & \frac{-5}{6}\end{pmatrix} \tag{6}$$

Therefore point of intersection **H** is

$$\mathbf{x} = \begin{pmatrix}\frac{17}{6}\\ \frac{5}{6}\end{pmatrix} \tag{7}$$

$$= \begin{pmatrix}2.833\\ -0.833\end{pmatrix} \tag{8}$$