LaTeX ASSIGNMENT1

KUNWAR DUSHYANT SINGH EE22BTECH11031

Question 1.3.3 D_1 is a point on BC such that $AD_1 \perp BC$and AD_1 is defined to be the altitude. Find the equations of the altitude BE_1 and CF_1 to the sides AC and AB respectively.

Solutions: Let

$$\mathbf{A} = \begin{pmatrix} 1 \\ -1 \end{pmatrix} \mathbf{B} = \begin{pmatrix} -4 \\ 6 \end{pmatrix} \mathbf{C} = \begin{pmatrix} -3 \\ -5 \end{pmatrix} \tag{1}$$

We know that direction vector is respresented by direction vector $\mathbf{n}_{AB} = \mathbf{B} - \mathbf{A}$

$$\mathbf{n}_{AB} = \begin{pmatrix} 1 \\ -1 \end{pmatrix} - \begin{pmatrix} -4 \\ 6 \end{pmatrix} = \begin{pmatrix} 5 \\ -7 \end{pmatrix} \tag{2}$$

Similarly,

direction vector $\mathbf{n}_{AC} = \mathbf{C} - \mathbf{A}$

$$\mathbf{n}_{AC} = \begin{pmatrix} 1 \\ -1 \end{pmatrix} - \begin{pmatrix} -3 \\ -5 \end{pmatrix} = \begin{pmatrix} 4 \\ 4 \end{pmatrix} \tag{3}$$

We need direction vector perpendicular to line AB, and direction vector perpendicular to line AC We know $n_{\perp}m = -1$

Therefore

$$\mathbf{n}_{AB_{\perp}} = \mathbf{n}_{CF} = \begin{pmatrix} -7 \\ 5 \end{pmatrix} \tag{4}$$

$$\mathbf{n}_{AC_{\perp}} = \mathbf{n}_{BE} = \begin{pmatrix} 4 \\ 4 \end{pmatrix} \tag{5}$$

Equation of line is represented by:

$$\mathbf{n}^T(\mathbf{x} - \mathbf{p}) = 0 \tag{6}$$

Therefore, the equation of line CF

$$\mathbf{n}_{CF}^T(\mathbf{x} - \mathbf{C}) = 0 \tag{7}$$

Therefore, the equation of line BE

$$\mathbf{n}_{BE}^T(\mathbf{x} - \mathbf{b}) = 0 \tag{8}$$

*The author is with the Department of Electrical Engineering, Indian Institute of Technology, Hyderabad 502285 India e-mail: gadepall@iith.ac.in.