LaTeX ASSIGNMENT1

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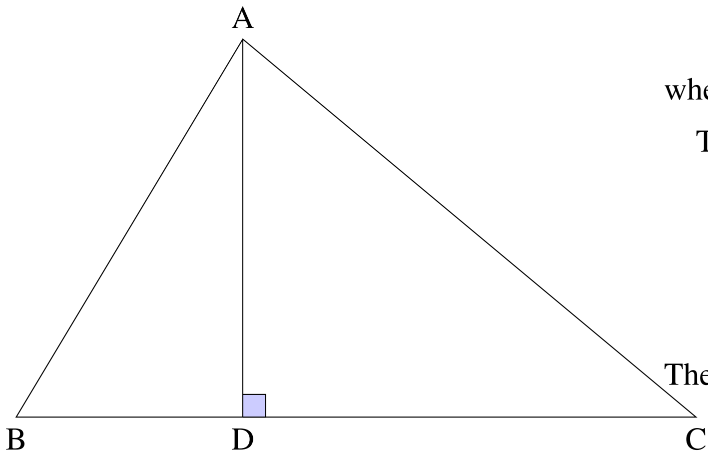
Question 1.3.3 D_1 is a point on BC such that $AD_1 \perp BC$and AD_1 is defined to be the altitude. Find the equations of the altitude BE_1 and CF_1 to the sides AC and AB respectively. article tikz



Solution: 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 equation of slope is respresented by

$$m = \mathbf{vector_1} - \mathbf{vector_2} \tag{2}$$

Slope of line $AB = \mathbf{B} - \mathbf{A}$

$$m_{AB} = \begin{pmatrix} 1 \\ -1 \end{pmatrix} - \begin{pmatrix} -4 \\ 6 \end{pmatrix} = \begin{pmatrix} 5 \\ -7 \end{pmatrix} \tag{3}$$

Similarily,
slope of line $AC = \mathbf{C} - \mathbf{A}$

$$m_{AC} = \begin{pmatrix} 1 \\ -1 \end{pmatrix} - \begin{pmatrix} -3 \\ -5 \end{pmatrix} = \begin{pmatrix} 4 \\ 4 \end{pmatrix} \tag{4}$$

We need slope perpendicular to line AB, and slope perpendicular to line AC We know $m_{\perp}m = -1$
Therefore

$$m_{AB_{\perp}} = m_{CF} = \begin{pmatrix} -7 \\ 5 \end{pmatrix} \tag{5}$$

$$m_{AC_{\perp}} = m_{BE} = \begin{pmatrix} 4 \\ 4 \end{pmatrix} \tag{6}$$

Equation of line is represented by:

$$m^T(\mathbf{X} - \mathbf{p}) = 0 \tag{7}$$

where $\mathbf{X} = \begin{pmatrix} x \\ y \end{pmatrix}$p $= \begin{pmatrix} x_1 \\ y_1 \end{pmatrix}$
Therefore, the equation of line CF

$$m_{CF}^T(\mathbf{X} - \mathbf{A}) = 0 \tag{8}$$

$$\begin{pmatrix} 4 & 4 \end{pmatrix} \begin{pmatrix} x + 4 \\ y + -6 \end{pmatrix} = 0 \tag{9}$$

Therefore, the equation of line BE

$$m_{BE}^T(\mathbf{X} - \mathbf{A}) = 0 \tag{10}$$

$$\begin{pmatrix} -7 & 5 \end{pmatrix} \begin{pmatrix} x + 3 \\ y + 5 \end{pmatrix} = 0 \tag{11}$$

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