Solution to 1.2.1

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Question: If $\mathbf{D}$ divides BC in the ratio $k : 1$,

$$\mathbf{D} = \frac{k\mathbf{C} + \mathbf{B}}{k + 1} \tag{1}$$

Find the mid points $\mathbf{D}, \mathbf{E}, \mathbf{F}$ of the sides BC, CA and AB respectively.

Given:

$$\mathbf{A} = \begin{pmatrix} 1 \\ -1 \end{pmatrix} \tag{2}$$

$$\mathbf{B} = \begin{pmatrix} -4 \\ 6 \end{pmatrix} \tag{3}$$

$$\mathbf{C} = \begin{pmatrix} -3 \\ -5 \end{pmatrix} \tag{4}$$

Solution: Since $\mathbf{D}$ is the midpoint of BC,

$$k = 1 \tag{5}$$

$$\implies \mathbf{D} = \frac{\mathbf{C} + \mathbf{B}}{2} \tag{6}$$

$$= \frac{1}{2}\begin{pmatrix} -7 \\ 1 \end{pmatrix} \tag{7}$$

Similarly,

$$\mathbf{E} = \frac{\mathbf{A} + \mathbf{C}}{2} \tag{8}$$

$$= \begin{pmatrix} -1 \\ -3 \end{pmatrix} \tag{9}$$

$$\mathbf{F} = \frac{\mathbf{A} + \mathbf{B}}{2} \tag{10}$$
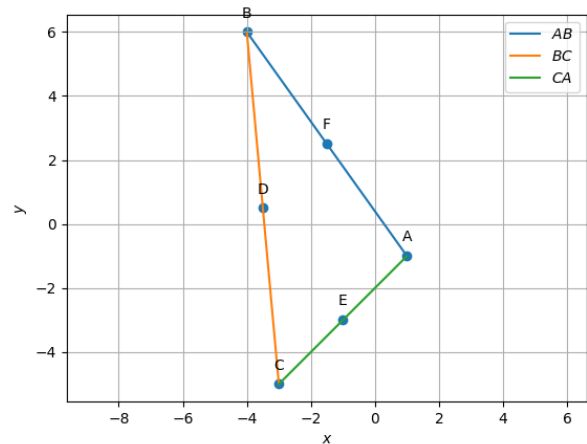
$$= \frac{1}{2}\begin{pmatrix} -3 \\ 5 \end{pmatrix} \tag{11}$$

Fig. 0. Triangle ABC with midpoints D,E and F