Assignment-1($EE5600$)

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***Abstract*—This assignment deals with basic coordinate geometry.**

Download tex file from

https://github.com/satyam463/EE5600Ass1/blob/main/Ass1.tex

1 Problem Statement

22.The coordinates of vertices of a triangle are (x_1, y_1),(x_2, y_2),and (x_3, y_3).The line joining the first two is divided into the ratio l:k, and line joining this point of division to the opposite angular point is then divided in the ratio m:k+l.Find the coordinates of the latter point of section.

2 Solution

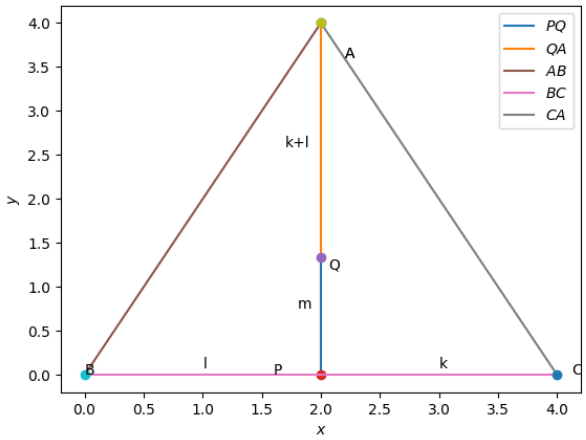

Fig. 0: Triangle ABC with vertices $\mathbf{A}\begin{pmatrix}2\\4\end{pmatrix}$, $\mathbf{B} = \begin{pmatrix}0\\0\end{pmatrix}$, $\mathbf{C} = \begin{pmatrix}4\\0\end{pmatrix}$, and $\begin{pmatrix}l\\m\\k\end{pmatrix} = \begin{pmatrix}0.5\\0.5\\0.5\end{pmatrix}$ are used for python plot.The point of section $\mathbf{P} = \begin{pmatrix}2\\0\end{pmatrix}$, $\mathbf{Q} = \begin{pmatrix}2\\1.33\end{pmatrix}$.

Consider Fig.0

$$\mathbf{B} = \begin{pmatrix}x_1\\y_1\end{pmatrix}, \mathbf{C} = \begin{pmatrix}x_2\\y_2\end{pmatrix}, \mathbf{A} = \begin{pmatrix}x_3\\y_3\end{pmatrix} \tag{2.0.1}$$

The line joining **BC** divided into the ratio l:k at point of division **P** can be written as

$$l\,(\mathbf{CP}) = k\,(\mathbf{PB}) \tag{2.0.2}$$

$$l\,(\mathbf{P} - \mathbf{C}) = k\,(\mathbf{B} - \mathbf{P}) \tag{2.0.3}$$

$$(l + k)\,\mathbf{P} = l\mathbf{C} + k\mathbf{B} \tag{2.0.4}$$

$$(l + k)\,\mathbf{P} = \begin{pmatrix}\mathbf{C} & \mathbf{B}\end{pmatrix}\begin{pmatrix}l\\k\end{pmatrix} \tag{2.0.5}$$

Now,the line joining **PA** divided into the ratio m:k+l at point of division **Q** can be written as

$$(l + k)\,(\mathbf{PQ}) = m\,(\mathbf{QA}) \tag{2.0.6}$$

$$(l + k)\,(\mathbf{Q} - \mathbf{P}) = m\,(\mathbf{A} - \mathbf{Q}) \tag{2.0.7}$$

$$(l + k + m)\,\mathbf{Q} = (l + k)\,\mathbf{P} + m\mathbf{A} \tag{2.0.8}$$

From Eq.2.0.5 substitute $(l + k)\,\mathbf{P}$ in Eq.2.0.8

$$(l + k + m)\,\mathbf{Q} = \begin{pmatrix}\mathbf{C} & \mathbf{B}\end{pmatrix}\begin{pmatrix}l\\k\end{pmatrix} + m\mathbf{A} \tag{2.0.9}$$

$$(l + k + m)\,\mathbf{Q} = l\mathbf{C} + k\mathbf{B} + m\mathbf{A} \tag{2.0.10}$$

$$\mathbf{Q} = \frac{1}{l + k + m}\begin{pmatrix}\mathbf{C} & \mathbf{B} & \mathbf{A}\end{pmatrix}\begin{pmatrix}l\\k\\m\end{pmatrix} \tag{2.0.11}$$

Hence, Q is the required coordinate of the latter point of section.