Assignment-1($EE5600$)

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EE20MTECH14015

***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+1.Find the coordinates of the latter point of section.

2 Solution

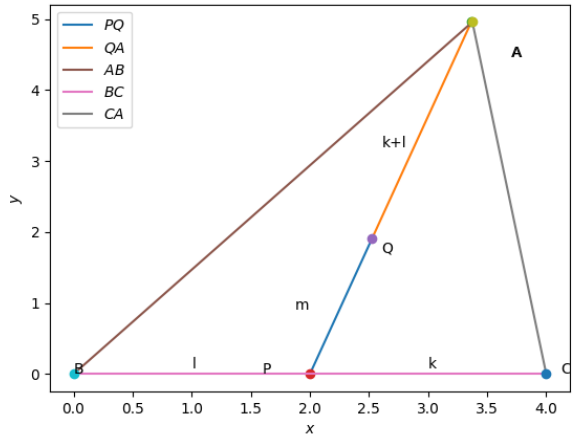

Fig. 0: Triangle ABC with vertices A(3.366,4.96), B(0,0), C(4,0), and P(2,0), Q(2.5,1.98) are used for python plot.

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

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

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

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

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

$$\mathbf{P} = \frac{1}{l + k} \begin{pmatrix} x_2 & x_1 \\ y_2 & y_1 \end{pmatrix} \begin{pmatrix} l \\ k \end{pmatrix} \tag{2.0.6}$$

$$\mathbf{P} = \frac{1}{l + k} \begin{pmatrix} x_2 l + x_1 k \\ y_2 l + y_1 k \end{pmatrix} \tag{2.0.7}$$

$$\mathbf{P} = \begin{pmatrix} \frac{x_2 l + x_1 k}{l+k} \\ \frac{y_2 l + y_1 k}{l+k} \end{pmatrix} \tag{2.0.8}$$

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

$$(l + k)\,(\mathbf{PQ}) = m\,(\mathbf{QA}) \tag{2.0.9}$$

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

$$(l + k + m)\,\mathbf{Q} = m\mathbf{A} + (l + k)\,\mathbf{P} \tag{2.0.11}$$

$$(l + k + m)\,\mathbf{Q} = \begin{pmatrix} \mathbf{A} & \mathbf{P} \end{pmatrix} \begin{pmatrix} m \\ l + k \end{pmatrix} \tag{2.0.12}$$

$$\mathbf{Q} = \frac{1}{l + k + m} \begin{pmatrix} x_3 & \frac{x_2 l + x_1 k}{l+k} \\ y_3 & \frac{y_2 l + y_1 k}{l+k} \end{pmatrix} \begin{pmatrix} m \\ k + l \end{pmatrix} \tag{2.0.13}$$

$$\mathbf{Q} = \frac{1}{l + k + m} \begin{pmatrix} m x_3 + (k + l)\frac{x_2 l + x_1 k}{l+k} \\ m y_3 + (k + l)\frac{y_2 l + y_1 k}{l+k} \end{pmatrix} \tag{2.0.14}$$

$$\mathbf{Q} = \frac{1}{l+k+m}\begin{pmatrix} mx_3 + x_2 l + x_1 k \\ my_3 + y_2 l + y_1 k \end{pmatrix} \qquad (2.0.15)$$

$$\mathbf{Q} = \begin{pmatrix} \frac{mx_3 + x_2 l + x_1 k}{l+k+m} \\ \frac{my_3 + y_2 l + y_1 k}{l+k+m} \end{pmatrix} \qquad (2.0.16)$$

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