#### 1

# Assignment-1(EE5600)

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 $\begin{subarray}{ll} Abstract — This assignment deals with basic coordinate geometry. \end{subarray}$ 

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

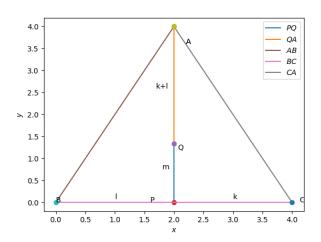


Fig. 0: Triangle ABC with vertices  $\mathbf{A} \begin{pmatrix} 2 \\ 4 \end{pmatrix}$ ,  $\mathbf{B} \begin{pmatrix} 0 \\ 0 \end{pmatrix}$ ,  $\mathbf{C} \begin{pmatrix} 4 \\ 0 \end{pmatrix}$ , and  $\begin{pmatrix} l \\ m \end{pmatrix} = \begin{pmatrix} 0.5 \\ 0.5 \\ 0.5 \end{pmatrix}$  are used for 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

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

The line joining BC divided into the ratio 1:k at point of division **P** can be written as

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

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

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

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

Now,the line joining PA divided into the ratio m:k+1 at point of division  $\mathbf{Q}$  can be written as

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

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

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

From Eq.2.0.5 substitute (l + k) **P** in Eq.2.0.8

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

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

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

Hence,  $\mathbf{Q}$  is the required coordinate of the latter point of section.