

# ASSIGNMENT 1

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Download all latex-tikz codes from

[https://github.com/vishwahurakadli/EE3900/blob/main/Assignment\\_1/Assignment\\_1.tex](https://github.com/vishwahurakadli/EE3900/blob/main/Assignment_1/Assignment_1.tex)

## 1 PROBLEM

(Vectors-2.20) If

$$\mathbf{P} = 3\mathbf{a} - 2\mathbf{b} \quad (1.0.1)$$

$$\mathbf{Q} = \mathbf{a} + \mathbf{b} \quad (1.0.2)$$

find  $\mathbf{R}$  which divides PQ in the ratio 2 : 1

- 1) internally
- 2) externally

## 2 SOLUTION

Vector  $\mathbf{P}$  and  $\mathbf{Q}$  can be represented using  $\mathbf{a}$  and  $\mathbf{b}$  as

$$\mathbf{P} = \begin{pmatrix} 3 & -2 \end{pmatrix} \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix} = 3\mathbf{a} - 2\mathbf{b} \quad (2.0.1)$$

$$\mathbf{Q} = \begin{pmatrix} 1 & 1 \end{pmatrix} \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix} = \mathbf{a} + \mathbf{b} \quad (2.0.2)$$

- 1) section formula for internal division for ratio  $m : n$  is given by

$$\mathbf{I} = \left( \frac{m}{m+n} \quad \frac{n}{m+n} \right) \begin{pmatrix} \mathbf{P} \\ \mathbf{Q} \end{pmatrix} \quad (2.0.3)$$

$$= \frac{m\mathbf{P} + n\mathbf{Q}}{m+n} \quad (2.0.4)$$

so for ratio 2 : 1 R will be given by

$$\mathbf{R} = \left( \frac{2}{2+1} \quad \frac{1}{2+1} \right) \begin{pmatrix} \mathbf{P} \\ \mathbf{Q} \end{pmatrix} \quad (2.0.5)$$

$$= \frac{2}{3}\mathbf{P} + \frac{1}{3}\mathbf{Q} \quad (2.0.6)$$

$$= \begin{pmatrix} 2 & -\frac{4}{3} \end{pmatrix} \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix} + \begin{pmatrix} \frac{1}{3} & \frac{1}{3} \end{pmatrix} \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix} \quad (2.0.7)$$

$$= \begin{pmatrix} \frac{7}{3} & -1 \end{pmatrix} \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix} \quad (2.0.8)$$

$$\mathbf{R} = \frac{7}{3}\mathbf{a} - \mathbf{b} \quad (2.0.9)$$

$\mathbf{R}$  will divide PQ internally

- 2) similarly section formula for external division for ratio  $m : n$  is given by

$$\mathbf{E} = \left( \frac{m}{m-n} \quad \frac{n}{m-n} \right) \begin{pmatrix} \mathbf{P} \\ \mathbf{Q} \end{pmatrix} \quad (2.0.10)$$

$$= \frac{m\mathbf{P} - n\mathbf{Q}}{m-n} \quad (2.0.11)$$

so for ratio 2 : 1 R will be given by

$$\mathbf{R} = \left( \frac{2}{2-1} \quad -\frac{1}{2-1} \right) \begin{pmatrix} \mathbf{P} \\ \mathbf{Q} \end{pmatrix} \quad (2.0.12)$$

$$= 2\mathbf{P} - \mathbf{Q} \quad (2.0.13)$$

$$= \begin{pmatrix} 6 & -4 \end{pmatrix} \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix} + \begin{pmatrix} -1 & -1 \end{pmatrix} \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix} \quad (2.0.14)$$

$$= \begin{pmatrix} 5 & -5 \end{pmatrix} \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix} \quad (2.0.15)$$

$$\mathbf{R} = 5\mathbf{a} - 5\mathbf{b} \quad (2.0.16)$$

$\mathbf{R}$  will divide PQ externally