

ASSIGNMENT 1

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Download all latex-tikz codes from

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

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

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

$\begin{pmatrix} \mathbf{P} \\ \mathbf{Q} \end{pmatrix}$ in terms of \mathbf{a} and \mathbf{b} is given by

$$\begin{pmatrix} \mathbf{P} \\ \mathbf{Q} \end{pmatrix} = \begin{pmatrix} 3 & -2 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix} \quad (2.0.3)$$

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

$$\mathbf{I} = \left(\frac{m}{m+n} \quad \frac{n}{m+n} \right) \begin{pmatrix} \mathbf{P} \\ \mathbf{Q} \end{pmatrix} \quad (2.0.4)$$

$$= \left(\frac{m}{m+n} \quad \frac{n}{m+n} \right) \begin{pmatrix} 3 & -2 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix} \quad (2.0.5)$$

so for ratio 2 : 1 \mathbf{R} will be given by

$$\mathbf{R} = \left(\frac{2}{2+1} \quad \frac{1}{2+1} \right) \begin{pmatrix} \mathbf{P} \\ \mathbf{Q} \end{pmatrix} \quad (2.0.6)$$

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

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

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

\mathbf{R} will divide PQ internally

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

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

$$= \left(\frac{m}{m-n} \quad \frac{n}{m-n} \right) \begin{pmatrix} 3 & -2 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix} \quad (2.0.11)$$

so for ratio 2 : 1 \mathbf{R} will be given by

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

$$= \begin{pmatrix} 2 & -1 \end{pmatrix} \begin{pmatrix} 3 & -2 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix} \quad (2.0.13)$$

$$= \begin{pmatrix} 5 & -5 \end{pmatrix} \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix} \quad (2.0.14)$$

$$\mathbf{R} = 5\mathbf{a} - 5\mathbf{b} \quad (2.0.15)$$

\mathbf{R} will divide PQ externally