0.1. NCERT 12.10.5.9

Find the position vector of a point \mathbf{R} which divides the line joining two points \mathbf{P} and \mathbf{Q} whose Position Vectors are $2\mathbf{a} + \mathbf{b}$ and $\mathbf{a} - 3\mathbf{b}$ externally in the ratio 1:2.

Solution: let us assume **a** and **b** and the given ratio is

Symbol	Value	Description
a	$\begin{pmatrix} 1 \\ -3 \end{pmatrix}$	vector a
b	$\begin{pmatrix} 0 \\ 2 \end{pmatrix}$	vector b
k	2	ratio

Table 1: Vectors \mathbf{a} and \mathbf{b} , ratio k

using section formula

$$\mathbf{R} = \frac{\mathbf{Q} - k.\mathbf{P}}{1 - k} \tag{1}$$

where ${\bf P}$ and ${\bf Q}$ depends on ${\bf a}$ and ${\bf b}$ then,

$$\mathbf{P} = (2\mathbf{a} + \mathbf{b}) = 2 \begin{pmatrix} 1 \\ -3 \end{pmatrix} + \begin{pmatrix} 0 \\ 2 \end{pmatrix} = \begin{pmatrix} 2 \\ -4 \end{pmatrix}$$
 (2)

$$\mathbf{Q} = (\mathbf{a} - 3\mathbf{b}) = \begin{pmatrix} 1 \\ -3 \end{pmatrix} - 3 \begin{pmatrix} 0 \\ 2 \end{pmatrix} = \begin{pmatrix} 1 \\ -9 \end{pmatrix}$$
 (3)

where ${f R}$ can be calculated as

$$\mathbf{R} = \frac{(\mathbf{a} - 3\mathbf{b}) - k.(2\mathbf{a} + \mathbf{b})}{1 - k} \tag{4}$$

by substituting ${\bf a}$ and ${\bf b}$ values we get ${\bf R}$ as

$$\mathbf{R} = \begin{pmatrix} 3 \\ 1 \end{pmatrix} \tag{5}$$

Symbol	Value	Description
P	$(2\mathbf{a} + \mathbf{b})$	position vector ${f P}$
Q	$(\mathbf{a} - 3\mathbf{b})$	position vector \mathbf{Q}
R	$\frac{\mathbf{Q}-k.(\mathbf{P})}{1-k}$	position vector ${f R}$

Table 2: Vectors $\mathbf{P},\,\mathbf{Q},\,\mathbf{R}$

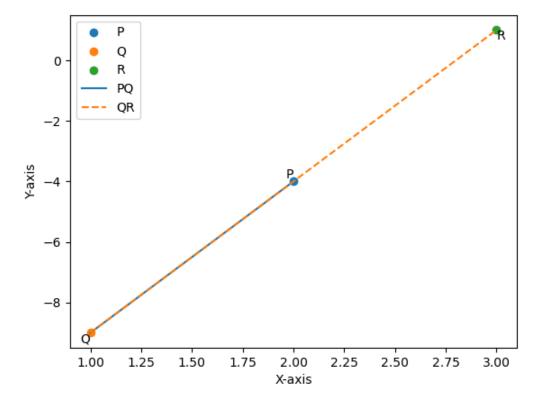


Figure 1: Point vectors $\mathbf{P},\,\mathbf{Q},\,\mathbf{R}$