

1-1.5-22

AI24BTECH11014
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QUESTION

X and **Y** are two points with position vectors $3\vec{a} + \vec{b}$ and $\vec{a} - 3\vec{b}$ respectively. Write the position vector of a point **V** which divides the line segment XY in the ratio 2 : 1 externally.

Solution: Given,

Variable	Description
point X	$(3 \quad 1) \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix}$
point Y	$(1 \quad -3) \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix}$
Ratio of $\frac{VX}{VY}$	$\frac{2}{1}$
point V	Point on line XY

FORMULA

$$\mathbf{Y} = \frac{V+nX}{1+n}$$

As, the point **V** divides the line XY externally,

$$XY = VX - VY \quad (0.1)$$

$$\frac{VX}{VY} = \frac{2}{1} \quad (0.2)$$

$$\frac{VY}{YX} = \frac{1}{1} \quad (0.3)$$

$$n = 1 \quad (0.4)$$

$$(0.5)$$

Y divides the line joining the points V and X internally in the ratio $n : 1$

By section formula, **Y** can be expressed as

$$\mathbf{Y} = \frac{1}{2}(\mathbf{V} + \mathbf{X}) \quad (0.6)$$

$$\mathbf{V} = 2\mathbf{Y} - \mathbf{X} \quad (0.7)$$

$$\mathbf{V} = 2 \begin{pmatrix} 1 & -3 \end{pmatrix} \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix} - \begin{pmatrix} 3 & 1 \end{pmatrix} \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix} \quad (0.8)$$

$$\mathbf{V} = \begin{pmatrix} -1 & -7 \end{pmatrix} \begin{pmatrix} \mathbf{a} \\ \mathbf{b} \end{pmatrix} \quad (0.9)$$

$$(0.10)$$

Therefore the position vector of point \mathbf{V} is $-\vec{a} - 7\vec{b}$

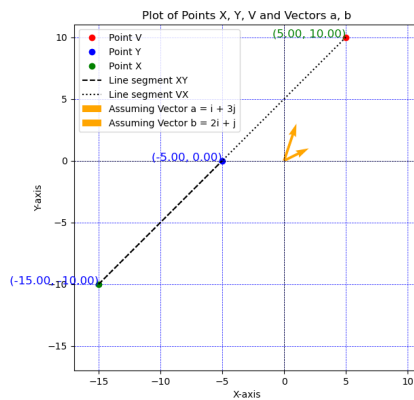


Fig. 0.1