2.9.20

AI25BTECH11004-B.JASWANTH

Question:
X and **Y** are two points with position vectors 3**a**+**b** and **a**-3**b**, respectively. Write the position vector of a point Z which divides the line segment **XY** in the ratio 2:1 externally.
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Solution:

$$\mathbf{X} = 3\mathbf{a} + \mathbf{b} \tag{0.1}$$

$$\mathbf{Y} = \mathbf{a} - 3\mathbf{b} \tag{0.2}$$

Now, the matrix form for **Y** and **X** is:

$$\begin{pmatrix}\mathbf{Y} & \mathbf{X}\end{pmatrix} = \begin{pmatrix}\mathbf{a} & \mathbf{b}\end{pmatrix}\begin{pmatrix}1 & 3\\ -3 & 1\end{pmatrix} \tag{0.3}$$

Using the section formula, the point **Z** dividing $\mathbf{Y} - \mathbf{X}$ in ratio 2 : 1 externally is:

$$\mathbf{Z} = \frac{2\mathbf{Y} - \mathbf{X}}{2 - 1} \tag{0.4}$$

$$\mathbf{Z} = \begin{pmatrix}\mathbf{Y} & \mathbf{X}\end{pmatrix}\begin{pmatrix}2\\ -1\end{pmatrix} \tag{0.5}$$

$$\mathbf{Z} = \begin{pmatrix}\mathbf{a} & \mathbf{b}\end{pmatrix}\begin{pmatrix}1 & 3\\ -3 & 1\end{pmatrix}\begin{pmatrix}2\\ -1\end{pmatrix} \tag{0.6}$$

$$\mathbf{Z} = \begin{pmatrix}\mathbf{a} & \mathbf{b}\end{pmatrix}\begin{pmatrix}-1\\ -7\end{pmatrix} \tag{0.7}$$

$$\mathbf{Z} = -\mathbf{a} - 7\mathbf{b} \tag{0.8}$$

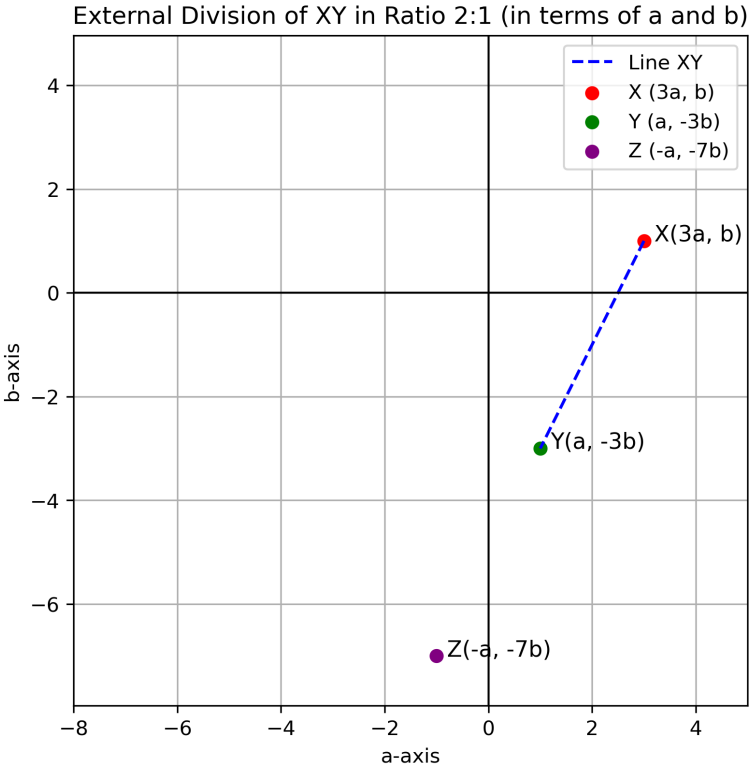

Fig. 0: Caption