Points and Vectors

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***Abstract* - This document contains solution of finding the coordinates of a point which divides a line segment internally and Externally.**

Vector

Question 21 : Find the coordinates of the points which divide, internally and externally, the line joining the point (a+b, a-b) to the point (a-b, a+b) in the ratio a : b.

Solution :

Let us consider C be the point which divides the AB line segment in the ratio a : b internally and externally.
Given that the coordinates of A point= (a+b, a-b) and coordinates of B point= (a-b, a+b).
Let

$$\mathbf{A} = \begin{pmatrix} a+b \\ a-b \end{pmatrix}, \mathbf{B} = \begin{pmatrix} a-b \\ a+b \end{pmatrix} \tag{1}$$

By internal section formula,

$$\mathbf{C} = \frac{k\mathbf{B} + \mathbf{A}}{k+1} \tag{2}$$

For the given problem, **C** divides AB in the ratio a:b.
So, here k = a : b
Using equation (2), the coordinates of point **C** is :

$$\mathbf{C} = \frac{\frac{a}{b}\begin{pmatrix} a-b \\ a+b \end{pmatrix} + \begin{pmatrix} a+b \\ a-b \end{pmatrix}}{\frac{a}{b}+1} \tag{3}$$

$$\mathbf{C} = \begin{pmatrix} \frac{a(a-b)+b(a+b)}{a+b} \\ \frac{a(a+b)+b(a-b)}{a+b} \end{pmatrix} \tag{4}$$

By external section formula,

$$\mathbf{C} = \frac{k\mathbf{B} - \mathbf{A}}{k-1} \tag{5}$$

Using equation (2), the coordinates of point **C** is :

$$\mathbf{C} = \frac{\frac{a}{b}\begin{pmatrix} a-b \\ a+b \end{pmatrix} - \begin{pmatrix} a+b \\ a-b \end{pmatrix}}{\frac{a}{b}-1} \tag{6}$$

$$\mathbf{C} = \begin{pmatrix} \frac{a(a-b)-b(a+b)}{a-b} \\ \frac{a(a+b)-b(a-b)}{a-b} \end{pmatrix} \tag{7}$$

Result

Plot of coordinates of the points obtained from Python code considering a= 6, b=3 is shown below.

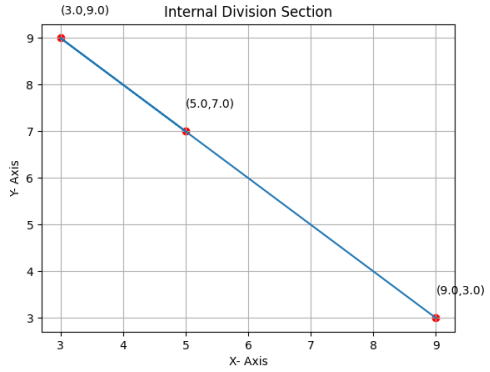

Figure 1: Internal Division Section

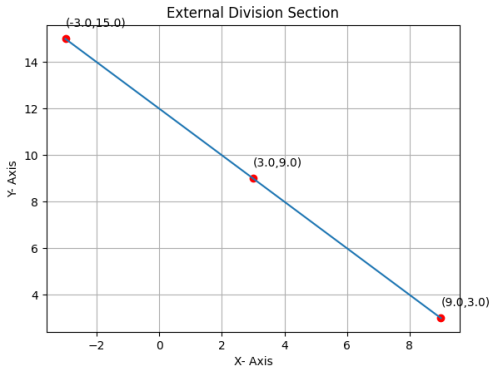

Figure 2: External Division Section