

# 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

$$\mathbf{C} = \left( \frac{\frac{a(a-b)-b(a+b)}{a-b}}{\frac{a(a+b)-b(a-b)}{a-b}} \right) \quad (7)$$

## 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  $\mathbf{C}$  be the point which divides the  $\mathbf{AB}$  line segment in the ratio  $a : b$  internally and externally. Given that the coordinates of  $\mathbf{A}$  point =  $(a+b, a-b)$  and coordinates of  $\mathbf{B}$  point =  $(a-b, a+b)$ .

Let

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

By internal section formula,

$$\mathbf{C} = \frac{k\mathbf{B} + \mathbf{A}}{k+1} \quad (2)$$

For the given problem,  $\mathbf{C}$  divides  $\mathbf{AB}$  in the ratio  $a:b$ . So, here  $k = a : b$

Using equation (2), the coordinates of point  $\mathbf{C}$  is :

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

$$\mathbf{C} = \left( \frac{\frac{a(a-b)+b(a+b)}{a+b}}{\frac{a(a+b)+b(a-b)}{a+b}} \right) \quad (4)$$

By external section formula,

$$\mathbf{C} = \frac{k\mathbf{B} - \mathbf{A}}{k-1} \quad (5)$$

Using equation (2), the coordinates of point  $\mathbf{C}$  is :

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

## Result

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

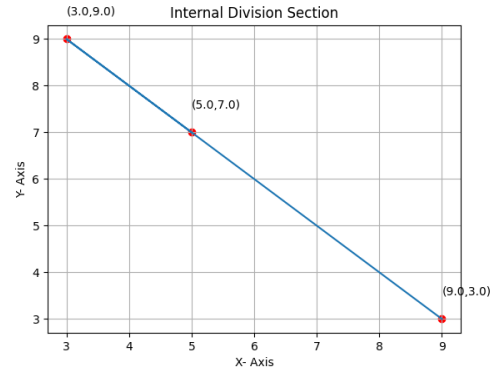


Figure 1: Internal Division Section

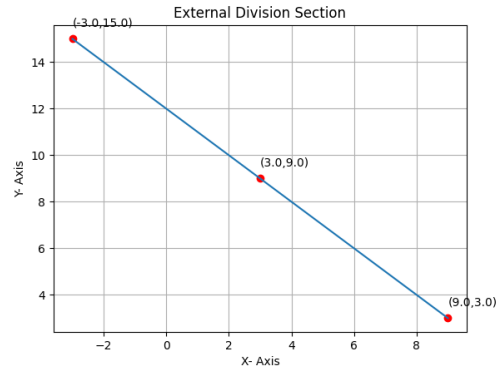


Figure 2: External Division Section