

Assignment No.1

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Download all python codes from

<https://github.com/suyogtangade/ASSIGNMENT-01.git>

and latex-tikz codes from

<https://github.com/suyogtangade/ASSIGNMENT-01.git>

1 QUESTION NO.16(B) (CBSE/2006/SET-2)

Find the co-ordinates of the point equidistant from three given points $A\begin{pmatrix} 5 \\ 3 \end{pmatrix}$, $B\begin{pmatrix} 5 \\ -5 \end{pmatrix}$ and $C\begin{pmatrix} 1 \\ -5 \end{pmatrix}$

Solution:

Let the point equidistant from A & B & C be

$$\mathbf{P} = \begin{pmatrix} x \\ y \end{pmatrix} \quad (1.0.1)$$

$$\|\mathbf{P} - \mathbf{A}\|^2 = \|\mathbf{P} - \mathbf{B}\|^2 \quad (1.0.2)$$

$$\mathbf{P} = \begin{pmatrix} x \\ y \end{pmatrix} \quad (1.0.3)$$

$$\|\mathbf{P}\|^2 + \|\mathbf{A}\|^2 - 2\mathbf{A}^T \mathbf{P} \quad (1.0.4)$$

$$= \|\mathbf{P}\|^2 + \|\mathbf{B}\|^2 - 2\mathbf{B}^T \mathbf{P} \quad (1.0.5)$$

$$(\mathbf{A} - \mathbf{B})^T \mathbf{P} = \frac{\|\mathbf{A}\|^2 - \|\mathbf{B}\|^2}{2} \quad (1.0.6)$$

$$(\mathbf{B} - \mathbf{C})^T \mathbf{P} = \frac{\|\mathbf{B}\|^2 - \|\mathbf{C}\|^2}{2} \quad (1.0.7)$$

$$\begin{pmatrix} (\mathbf{A} - \mathbf{B})^T \\ (\mathbf{B} - \mathbf{C})^T \end{pmatrix} \mathbf{P} = \frac{1}{2} \begin{pmatrix} \|\mathbf{A}\|^2 - \|\mathbf{B}\|^2 \\ \|\mathbf{B}\|^2 - \|\mathbf{C}\|^2 \end{pmatrix} \quad (1.0.8)$$

$$\mathbf{A}\begin{pmatrix} 5 \\ 3 \end{pmatrix}, \mathbf{B}\begin{pmatrix} 5 \\ -5 \end{pmatrix}, \mathbf{C}\begin{pmatrix} 1 \\ -5 \end{pmatrix} \quad (1.0.9)$$

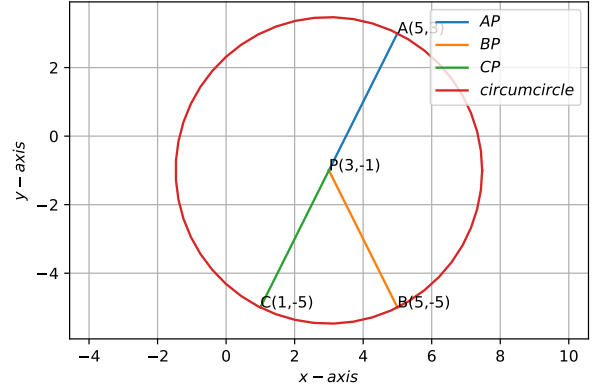


Fig. 1.1: Graphical Solution

$$\begin{pmatrix} \left(\begin{pmatrix} 5 \\ 3 \end{pmatrix} - \begin{pmatrix} 5 \\ -5 \end{pmatrix} \right)^T \\ \left(\begin{pmatrix} 5 \\ -5 \end{pmatrix} - \begin{pmatrix} 1 \\ -5 \end{pmatrix} \right)^T \end{pmatrix} \mathbf{P} = \frac{1}{2} \begin{pmatrix} \left\| \begin{pmatrix} 5 \\ 3 \end{pmatrix} \right\|^2 - \left\| \begin{pmatrix} 5 \\ -5 \end{pmatrix} \right\|^2 \\ \left\| \begin{pmatrix} 5 \\ -5 \end{pmatrix} \right\|^2 - \left\| \begin{pmatrix} 1 \\ -5 \end{pmatrix} \right\|^2 \end{pmatrix} \quad (1.0.10)$$

$$\begin{pmatrix} 0 & 8 \\ 4 & 0 \end{pmatrix} \mathbf{P} = \begin{pmatrix} -8 \\ 12 \end{pmatrix} \quad (1.0.11)$$

$$8\mathbf{P} = -8 \quad (1.0.12)$$

$$\Rightarrow \mathbf{P} = -1 \quad (1.0.13)$$

$$4\mathbf{P} = 12 \quad (1.0.14)$$

$$\Rightarrow \mathbf{P} = 3 \quad (1.0.15)$$

co-ordinates for the point equidistant from three given points $A\begin{pmatrix} 5 \\ 3 \end{pmatrix}$, $B\begin{pmatrix} 5 \\ -5 \end{pmatrix}$ and $C\begin{pmatrix} 1 \\ -5 \end{pmatrix}$ are

$$\mathbf{P} = \begin{pmatrix} 3 \\ -1 \end{pmatrix} \quad (1.0.16)$$