

Assignment 1

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Download all python codes from

https://github.com/Bharat437/Matrix_Theory/tree/master/Assignment1/Codes

and latex-tikz codes from

https://github.com/Bharat437/Matrix_Theory/tree/master/Assignment1

1 QUESTION No. 41

Find the equation of the right bisector of the line segment joining the points $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$ and $\begin{pmatrix} -1 \\ 2 \end{pmatrix}$

2 EXPLANATION

The right bisector of the line segment joining two points passes through mid-point between two points and it is perpendicular to the line segment.

Let \mathbf{M} be the midpoint of two points $\mathbf{A} = \begin{pmatrix} 3 \\ 4 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$.

$$\begin{aligned} \mathbf{M} &= \frac{\mathbf{A} + \mathbf{B}}{2} = \frac{1}{2} \begin{pmatrix} 2 \\ 6 \end{pmatrix} \\ \Rightarrow \mathbf{M} &= \begin{pmatrix} 1 \\ 3 \end{pmatrix} \end{aligned} \quad (2.0.1)$$

The direction vector of line AB is

$$\begin{pmatrix} -1 \\ 2 \end{pmatrix} - \begin{pmatrix} 3 \\ 4 \end{pmatrix} = \begin{pmatrix} -4 \\ -2 \end{pmatrix} \quad (2.0.2)$$

The direction vector of line AB is normal vector of right bisector. Then

$$\mathbf{n} = \begin{pmatrix} -4 \\ -2 \end{pmatrix} \quad (2.0.3)$$

The equation of line in terms of normal vector is then obtained as

$$\mathbf{n}^T(\mathbf{x} - \mathbf{M}) = 0 \quad (2.0.4)$$

$$\Rightarrow \begin{pmatrix} -4 & -2 \end{pmatrix} \left(\mathbf{x} - \begin{pmatrix} 1 \\ 3 \end{pmatrix} \right) = 0 \quad (2.0.5)$$

$$\Rightarrow \begin{pmatrix} -4 & -2 \end{pmatrix} \mathbf{x} = -10 \quad (2.0.6)$$

$$\Rightarrow \begin{pmatrix} 2 & 1 \end{pmatrix} \mathbf{x} = 5 \quad (2.0.7)$$

We got equation of the right bisector of line segment joining points \mathbf{A} and \mathbf{B} . The line also passes through point \mathbf{M} .

See Fig. 1 for plot of line segment and right bisector.

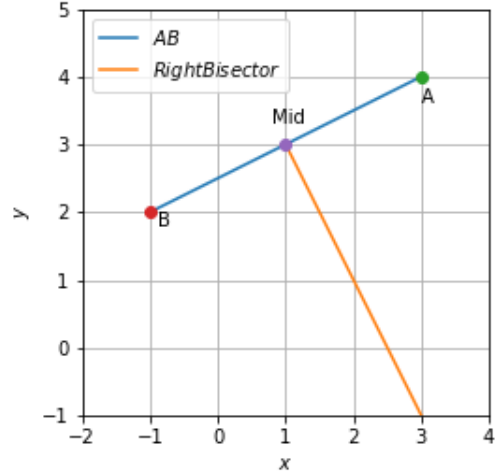


Fig. 1: Right bisector of line AB