1.9.12

EE25BTECH11023 - Venkata Sai

Question:
Find the length of the segment joining $\mathbf{A}(-6,7)$ and $\mathbf{B}(-1,-5)$. Also, find the midpoint of AB.
Solution:

Variable	Description
x	x coordinate of P
y	y coordinate of P

TABLE 0: Variables Used

Let the given points be

$$\mathbf{A} = \begin{pmatrix} -6 \\ 7 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} -1 \\ -5 \end{pmatrix} \tag{0.1}$$

The direction vector of the segment joining A and B is given by:

$$\mathbf{B} - \mathbf{A} = \begin{pmatrix} -1-(-6) \\ -5-7 \end{pmatrix} = \begin{pmatrix} 5 \\ -12 \end{pmatrix} \tag{0.2}$$

The length of the segment is the magnitude of the direction vector:

$$\mathbf{B} - \mathbf{A} = \begin{pmatrix} -1-(-6) \\ -5-7 \end{pmatrix} = \begin{pmatrix} 5 \\ -12 \end{pmatrix} \tag{0.3}$$

$$d = \|\mathbf{B} - \mathbf{A}\| = \sqrt{(B-A)^{\top}(B-A)} \tag{0.4}$$

$$(\mathbf{B} - \mathbf{A})^{\top}(\mathbf{B} - \mathbf{A}) = \begin{pmatrix} 5 & -12 \end{pmatrix}\begin{pmatrix} 5 \\ -12 \end{pmatrix} \tag{0.5}$$

$$= 5 \times 5 + -12 \times -12 = 169 \tag{0.6}$$

$$d = \sqrt{169} = 13 \tag{0.7}$$

Hence the length of the segment is 13 units.
To find midpoint of segment **AB**:
Let the required point be **P**

$$\mathbf{P} = \frac{k(\mathbf{B}) + (\mathbf{A})}{k+1} \tag{0.8}$$

Here according to problem value of k is 1

$$\mathbf{P} = \frac{\mathbf{B}+\mathbf{A}}{2} = \frac{\begin{pmatrix}-6\\7\end{pmatrix}+\begin{pmatrix}-1\\-5\end{pmatrix}}{2} = \frac{\begin{pmatrix}-7\\2\end{pmatrix}}{2} \tag{0.9}$$

(0.10)

$$\mathbf{P} = \begin{pmatrix}\frac{-7}{2}\\1\end{pmatrix} \tag{0.11}$$

Hence the coordinates of $\mathbf{P}$ are $\left(\frac{-7}{2}, 1\right)$

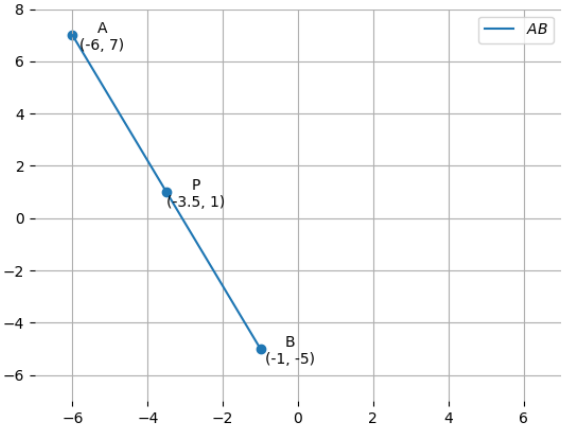

Fig. 0.1: Stem Plot of y(n)