VECTORS

1 10^{th} Maths - Chapter 10

This is Problem-3 from Exercise 10.3

1. Find the projection of the vector $\hat{i} - \hat{j}$ on the vector $\hat{i} + \hat{j}$

2 SOLUTION

Given points are

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

The formula of the projection vector :

$$\frac{\mathbf{A}^\top . \mathbf{B}}{\|\mathbf{B}\|^2}\mathbf{B} \tag{2}$$

Find the projection vector $\mathbf{C}$:

$$\mathbf{A}^\top \mathbf{B} = \begin{pmatrix} 1 & -1 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \end{pmatrix} = \big(1 * 1\big) + \big(-1 * 1\big) = 0 \tag{3}$$

$$\left\|\mathbf{B}^2\right\| = (\mathbf{B}^\top \mathbf{B}) = \begin{pmatrix} 1 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \end{pmatrix} = (1 * 1) + (1 * 1) = 2 \tag{4}$$

$$\mathbf{C} = \frac{\mathbf{A}^\top \mathbf{B}}{\|\mathbf{B}\|^2}\mathbf{B} = \frac{0}{2}\begin{pmatrix} 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \tag{5}$$

$$\mathbf{C} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \tag{6}$$

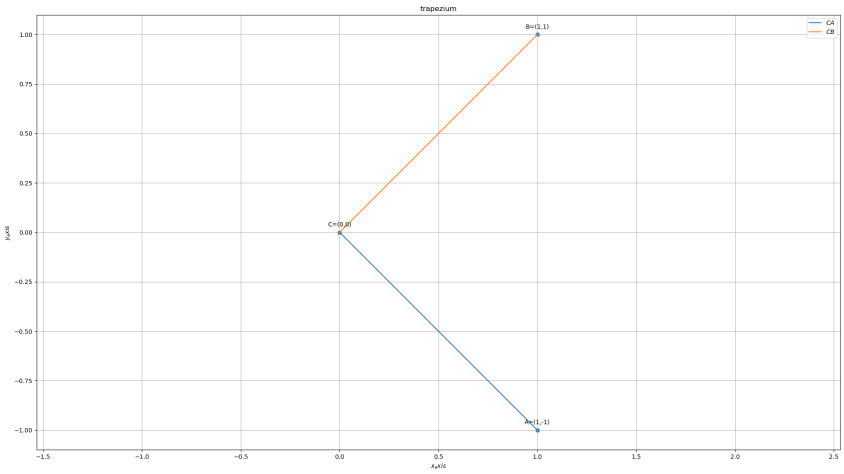
trapezium
CA
CB
B=(1,1)
C=(0,0)
A=(1,-1)
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5
2.0
2.5

Figure 1