ex. Find the distance from the point $B = (1, 0, 2)$ to the line ℓ though the point $A = (3, 1, 1)$ with direction vector $d = \begin{bmatrix} -1 \\ 1 \\ 0 \end{bmatrix}$

Sol

$$v = \overrightarrow{BAB} = \begin{bmatrix} -2 \\ -1 \\ 1 \end{bmatrix}$$

The length $= \| v - \text{proj}_{\vec{d}}(v) \|$

$$\text{proj}_{\vec{d}}(v) = \left(\frac{d \cdot v}{d \cdot d} \right) d = \begin{bmatrix} -1/2 \\ 1/2 \\ 0 \end{bmatrix}$$

$$\text{Ans} = \left\| \begin{matrix} -3/2 \\ -3/2 \\ 1 \end{matrix} \right\| = \frac{1}{2} \sqrt{22}$$

$\|v\| = \| v - p \|$