4.12.8

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Question

Distance of the point (α, β, γ) from y-axis is

a) β

b) $|\beta|$

c) $|\beta + \gamma|$

d) $\sqrt{\alpha^2 + \gamma^2}$

Theoretical Solution

Let $\mathbf{A} = \begin{pmatrix} \alpha \\ \beta \\ \gamma \end{pmatrix}$

Let $\mathbf{B}$ be an arbitrary point on the y-axis.

$$\text{Equation of y-axis: } \mathbf{r} = t\mathbf{e_2} \; OR \; \mathbf{r} = t \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} \tag{1}$$

$$\therefore \mathbf{B} = \begin{pmatrix} 0 \\ t \\ 0 \end{pmatrix} \tag{2}$$

For minimum distance from y-axis: $(\mathbf{A} - \mathbf{B})$ should be perpendicular to $\mathbf{e_2}$ (3)

OR

Theoretical Solution

$$(\mathbf{A}-\mathbf{B})^T\mathbf{e_2} = 0 \Rightarrow \begin{pmatrix} \alpha \\ \beta - t \\ \gamma \end{pmatrix}^T \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} = 0 \tag{4}$$

Therefore, from Equation 4,

$$t = \beta \tag{5}$$

Therefore the distance between y-axis and **A** is:

$$\|\mathbf{B}-\mathbf{A}\| = \left\| \begin{pmatrix} \alpha \\ 0 \\ \gamma \end{pmatrix} \right\| = \sqrt{\alpha^2+\gamma^2} \tag{6}$$

$$\boxed{\text{Therefore, Option D is Correct.}} \tag{7}$$

Image