

$$\sigma_1 = 117.5, \quad \sigma_2 = 28.7, \quad \sigma_3 = -56.2$$

$$T = \begin{bmatrix} -40 & -50 & 0 \\ -50 & 12 & 12 \\ 0 & 12 & 30 \end{bmatrix}$$

ii) $\sigma_1 = 117.5$

$$\begin{bmatrix} -157.5 & -50 & 0 \\ -50 & -17.5 & 12 \\ 0 & 12 & -87.5 \end{bmatrix} \begin{bmatrix} p \\ s \\ w \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$$\begin{cases} -157.5p - 50s = 0 \rightarrow p = -0.3175s \\ -50p - 17.5s + 12w = 0 \\ 12s - 87.5w = 0 \rightarrow w = 0.1375s \end{cases}$$

$$(p, s, w) = (-0.3175s, s, 0.1375s)$$

eigenvector!

$$(-0.3175s)^2 + s^2 + (0.1375s)^2 = 1 \rightarrow s = 0.9451$$

$$(-0.3, 0.9451, 0.13)$$

$$\theta_x = \cos^{-1}\left(\frac{-0.3}{1}\right) = 107.5^\circ, \quad \theta_y = 19.1^\circ, \quad \theta_z = 82.5^\circ$$

Ans.

iii) $\sigma_2 = 28.7$

$$\begin{bmatrix} -68.7 & -50 & 0 \\ -50 & 71.3 & 12 \\ 0 & 12 & 1.3 \end{bmatrix} \begin{bmatrix} p \\ s \\ w \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$$\begin{cases} -68.7p - 50s = 0 \rightarrow s = -1.374p \\ -50p + 71.3s + 12w = 0 \\ 12s + 1.3w = 0 \rightarrow w = -9.23s = (-9.23) \cdot (-1.374p) = 12.68p \end{cases}$$

$$(p, -1.374p, 12.68p)$$

$$p^2 + (-1.374p)^2 + (12.68p)^2 = 1 \rightarrow p = 0.08$$

$$\therefore (0.08, -0.11, 1) \rightarrow \theta_x = 85.4^\circ, \quad \theta_y = 96.3^\circ, \quad \theta_z = 0^\circ \text{ Ans.}$$

iii) $\sigma_3 = -56.2$

$$\begin{bmatrix} 16.2 & -50 & 0 \\ -50 & 156.2 & 12 \\ 0 & 12 & 86.2 \end{bmatrix} \begin{bmatrix} p \\ s \\ w \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$$\therefore (0.95, 0.308, -0.0426)$$

$$\theta_x = 18.2^\circ, \quad \theta_y = 72.1^\circ, \quad \theta_z = 92.4^\circ$$

Ans.

$$\begin{cases} 16.2p - 50s = 0 \rightarrow s = 0.324p \\ -50p + 156.2s + 12w = 0 \\ 12s + 86.2w = 0 \rightarrow w = -0.1392s = -0.045p \end{cases}$$

$$p^2 + (0.324p)^2 + (-0.045p)^2 = 1 \rightarrow p = 0.95$$