

Exercise 3Evaluate: (a) $[(\boldsymbol{\delta}_1 \times \boldsymbol{\delta}_2) \cdot \boldsymbol{\delta}_3]$ (b) $[(\boldsymbol{\delta}_2 \times \boldsymbol{\delta}_3) \times (\boldsymbol{\delta}_1 \times \boldsymbol{\delta}_3)]$.**Solution**

$$(a) \quad [(\boldsymbol{\delta}_1 \times \boldsymbol{\delta}_2) \cdot \boldsymbol{\delta}_3] = \begin{vmatrix} \hat{\mathbf{x}} & \hat{\mathbf{y}} & \hat{\mathbf{z}} \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{vmatrix} \cdot \langle 0, 0, 1 \rangle = \langle 0, 0, 1 \rangle \cdot \langle 0, 0, 1 \rangle = \boldsymbol{\delta}_3 \cdot \boldsymbol{\delta}_3 = 1$$

$$(b) \quad [(\boldsymbol{\delta}_2 \times \boldsymbol{\delta}_3) \times (\boldsymbol{\delta}_1 \times \boldsymbol{\delta}_3)] = \left[\begin{vmatrix} \hat{\mathbf{x}} & \hat{\mathbf{y}} & \hat{\mathbf{z}} \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix} \times \begin{vmatrix} \hat{\mathbf{x}} & \hat{\mathbf{y}} & \hat{\mathbf{z}} \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{vmatrix} \right] = [\langle 1, 0, 0 \rangle \times \langle 0, -1, 0 \rangle]$$
$$= \begin{vmatrix} \hat{\mathbf{x}} & \hat{\mathbf{y}} & \hat{\mathbf{z}} \\ 1 & 0 & 0 \\ 0 & -1 & 0 \end{vmatrix} = \langle 0, 0, -1 \rangle = -\boldsymbol{\delta}_3$$