

$$\begin{aligned} \text{(a) } \operatorname{curl} \mathbf{F} &= \nabla \times \mathbf{F} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ xyz & 0 & -x^2y \end{vmatrix} \\ &= (-x^2 - 0)\mathbf{i} - (-2xy - xy)\mathbf{j} + (0 - xz)\mathbf{k} \\ &= -x^2\mathbf{i} + 3xy\mathbf{j} - xz\mathbf{k} \end{aligned}$$

$$\begin{aligned} \text{(b) } \operatorname{div} \mathbf{F} &= \nabla \cdot \mathbf{F} = \frac{\partial}{\partial x}(xyz) + \frac{\partial}{\partial y}(0) + \frac{\partial}{\partial z}(-x^2y) \\ &= yz + 0 + 0 = yz \end{aligned}$$