

$$\begin{aligned}
 \text{(a) } \operatorname{curl} \mathbf{F} &= \nabla \times \mathbf{F} = \begin{vmatrix} \mathbf{i} & \mathbf{j} & \mathbf{k} \\ \partial/\partial x & \partial/\partial y & \partial/\partial z \\ \ln x & \ln(xy) & \ln(xyz) \end{vmatrix} \\
 &= \left(\frac{xz}{xyz} - 0 \right) \mathbf{i} - \left(\frac{yz}{xyz} - 0 \right) \mathbf{j} + \left(\frac{y}{xy} - 0 \right) \mathbf{k} = \left\langle \frac{1}{y}, -\frac{1}{x}, \frac{1}{x} \right\rangle
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) } \operatorname{div} \mathbf{F} &= \nabla \cdot \mathbf{F} = \frac{\partial}{\partial x} (\ln x) + \frac{\partial}{\partial y} (\ln(xy)) + \frac{\partial}{\partial z} (\ln(xyz)) \\
 &= \frac{1}{x} + \frac{x}{xy} + \frac{xy}{xyz} = \frac{1}{x} + \frac{1}{y} + \frac{1}{z}
 \end{aligned}$$