4.25

1. Evaluate the surface integral $\iint_S \mathbf{F} \cdot d\mathbf{S}$ for the given vector field $\mathbf{F}$ and the oriented surface S. $\mathbf{F}(s, y, z) = x\mathbf{i} + y\mathbf{j} + 5\mathbf{j}$, S is the boundary of the region enclosed by the cylinder $x^2 + z^2 = 1$ and the planes $y = 0$ and $x + y = 2$.

2. Use Stokes' Theorem to evaluate $\iint_S curl\mathbf{F} \cdot d\mathbf{S}$. $\mathbf{F}(x, y, z) = ze^y\mathbf{i} + x\cos y\mathbf{j} + xz\sin y\mathbf{k}$, S is the hemisphere $x^2 + y^2 + z^2 = 16$, $y \geq 0$, oriented in the direction of the positive y-axis.

3. Use the Divergence Theorem to calculate the surface integral $\iint_S \mathbf{F} \cdot d\mathbf{S}$. $\mathbf{F}(x, y, z) = xe^y\mathbf{i} + (z - e^y)\mathbf{j} - xy\mathbf{k}$, S is the ellipsoid $x^2 + 2y^2 + 3z^2 = 4$.