A. Evaluate $\int_C \mathbf{F} \cdot d\mathbf{r}$, where $\mathbf{F} = \langle y + \sin x, z^2 + \cos y, x^3 \rangle$ and $C$ is parameterized by $\mathbf{r}(t) = \langle \sin t, \cos t, \sin(2t) \rangle$, $0 \leq t \leq 2\pi$. Note that the curve lies on the surface $z = 2xy$. Can you do this problem without Stokes' Theorem?

B. Compute the flux of $\mathbf{F} = \langle x^2, y^2, z^2 \rangle$ through the part of the cylinder $y^2 + z^2 = 4$ where $0 \leq x \leq 3$ (oriented "outwards," away from the $x$-axis).

C. Let $S$ be the portion of the sphere $x^2 + y^2 + z^2 = 25$ lying above the plane $z = 4$, oriented upward. Compute $\iint_S (\nabla \times \mathbf{F}) \cdot d\mathbf{S}$, where $\mathbf{F} = \langle z^3 - y^3, x^3 - z^3, y^3 - x^3 \rangle$.

D. Let $S$ be the part of the surface $y = 4 - x^2 - z^2$ where $y \geq 0$, and let $\mathbf{F} = \langle x + y, x^3, x + z \rangle$. Compute $\iint_S (\nabla \times \mathbf{F}) \cdot d\mathbf{S}$.

E. Use Stokes' Theorem to compute the flux of $\mathbf{F} = \langle y^2 z, x - ye^z, e^z \rangle$ through the part of the sphere $x^2 + y^2 + (z - \sqrt{3})^2 = 4$ lying above the $xy$-plane. (Hints: (1) You may assume $\mathbf{F}$ is the curl of some vector field. (2) You don't need to know *what* it is the curl of.)

F. Let $\mathbf{F} = \langle xy, yz^2, zx^3 \rangle + \nabla(e^{x + \sin y})$, and let $S$ be the part of the surface $z = xy^2(1 - x - y)^3$ lying above the triangle with vertices $(0, 0)$, $(1, 0)$, and $(0, 1)$, oriented upward. Compute $\iint_S (\nabla \times \mathbf{F}) \cdot d\mathbf{S}$. Hint: treat the two summands separately.