

- Find $\text{curl } \vec{F}$ and $\text{div } \vec{F}$ if $\vec{F}(x, y, z) = e^{-x} \sin y \mathbf{i} + e^{-y} \sin z \mathbf{j} + e^{-z} \sin x \mathbf{k}$
- Evaluate the line integral $\int_C x^3 z ds$ where C is the curve
 $\vec{r}(t) = (2 \sin t) \mathbf{i} + t \mathbf{j} + (2 \cos t) \mathbf{k}$ for $0 \leq t \leq \pi/2$.
- Evaluate $\iint_S (x^2 z + y^2 z) dS$ where S is part of the plane $z = 4 + x + y$ that lies inside the rectangle $0 \leq x \leq 1$, $0 \leq y \leq 1$.
- Use Green's Theorem to evaluate $\int x^2 y dx - xy^2 dy$ where C is the circle $x^2 + y^2 = 4$ with counterclockwise orientation.
- Use Stokes' Theorem to evaluate $\iint_S (\text{curl } \vec{F}) \cdot \vec{n} dS$ where
 $\vec{F}(x, y, z) = \langle x^2 yz, yz^2, z^3 e^{xy} \rangle$, S is part of the sphere $x^2 + y^2 + z^2 = 5$ that lies above the plane $z = 1$ and S is oriented upward.
- Use the Divergence Theorem to calculate the surface integral $\iint_S \vec{F} \cdot \vec{n} dS$ where
 $\vec{F}(x, y, z) = x^3 \mathbf{i} + y^3 \mathbf{j} + z^3 \mathbf{k}$ and S is the surface bounded by the cylinder $x^2 + y^2 = 1$ and the planes $z = 0$ and $z = 2$.
- Evaluate the line integral $\int_C \vec{F} \cdot d\vec{r}$ where $\vec{F} = (4x^3 y^2 - 2xy^3) \mathbf{i} + (2x^4 y - 3x^2 y^2 + 4y^3) \mathbf{j}$ and $C: \vec{r}(t) = (t + \sin \pi t) \mathbf{i} + (2t + \cos \pi t) \mathbf{j}$, $0 \leq t \leq 1$.
- Evaluate the line integral $\int_C (xy + \ln x) dy$ where C is the arc of the parabola $y = x^2$ from $(1, 1)$ to $(3, 9)$.
- Use Green's Theorem to evaluate the line integral $\int_C (y + e^{\sqrt{x}}) dx + (2x + \cos y^2) dy$ along the positively oriented curve C where C is the boundary of the region enclosed by the parabolas $y = x^2$ and $x = y^2$.
- Show that the vector field $\vec{F}(x, y, z) = (2xz + y^2) \mathbf{i} + 2xy \mathbf{j} + (x^2 + 3z^2) \mathbf{k}$ is conservative and evaluate $\int_C \vec{F} \cdot d\vec{r}$ where $C: x = t^2$, $y = t + 1$, $z = 2t - 1$ for $0 \leq t \leq 1$.

11. Evaluate the surface integral $\iint_S (x^2 + y^2) dS$ where S is the surface $z = xy$ inside $x^2 + y^2 = 4$ for $x \geq 0, y \geq 0$.
12. Evaluate $\iint_S \text{curl } \vec{F} \cdot \vec{n} dS$ where $\vec{F}(x, y, z) = x\mathbf{i} + y^2\mathbf{j} + xyz\mathbf{k}$ and S is part of the paraboloid $z = 4 - x^2 - y^2$ with $z \geq 0$. Use the upward unit normal vector.
13. Find the surface area of the cap cut from the paraboloid $y^2 + z^2 = 3x$ by the plane $x = 1$.