1. Use Green's Theorem in order to evaluate $\int_C x^2y\,dx + xy\,dy$, where C is the triangular path going from $(1,1)$ to $(2,1)$ to $(1,3)$ and back to $(1,1)$.

2. Evaluate $\int_0^1 \int_y^1 y^2\sqrt{1+x^4}\,dxdy$ by interchanging the order of integration.

3. Consider the function $z = xy^4 + e^{2xy}$. Find the equation of the tangent plane at the point $(1,0,1)$ and also find the parametric equations of the normal line at that point.

4. Consider the vector field $\mathbf{F} = (ye^{xy}z + 2xy^2z^3, xe^{xy}z + 2yx^2z^3, e^{xy} + 3x^2y^2z^2)$.

   (a) Compute the curl of $\mathbf{F}$.

   (b) Find a potential function for $\mathbf{F}$.

   (c) Compute the work done by F along the path

   $$\mathbf{r}(t) = \left(t^2\cos(\pi t), \mathrm{e}^{t\cos(t)}(t-1), \frac{t^2+1}{\sqrt{3t^2+1}}\right) \qquad 0 \le t \le 1$$

5. Find the area of the surface $z = 1 + x^2 + y^2$ in the first octant, below $z = 5$.

6. Find the center of mass of the lamina above $y = x^2$ and below $y = 4$, if the density is $\rho(x,y) = x^2$.

7. Find the curvature of the helix $\mathbf{r}(t) = (4\cos(3t), 4\sin(3t), 2t)$, when $t = \pi$.

8. Find the work done by the force $\mathbf{F} = (x + z^2, xy, y^2)$ in moving a particle along the curve $\mathbf{r}(t) = (t, t^2, t^3)$ for $0 \le t \le 1$.

9. Use Stokes' theorem in order to evaluate $\int_C \mathbf{F}\cdot d\mathbf{r}$, where $\mathbf{F} = (-y^2, x, z^2)$ and C is the curve of intersection of the plane $y + z = 2$ and the cylinder $x^2 + y^2 = 1$. (Orient C to be counterclockwise when viewed from above.)

10. Use the Divergence Theorem in order to find the flux of the vector field $\mathbf{F}$ across the surface S, where $\mathbf{F} = (2x, 3y, z)$ and S is the surface of the solid bounded by the cylinder $x^2 + y^2 = 1$ and the planes $z = 0$ and $z = x + 2$.