1. Find the curl and div of \( \mathbf{F} = \langle x^2y, yz^2, zx^2 \rangle \).

2. Find \( f \) so that \( \mathbf{F} = \nabla f \) and use it to find the line integral \( \int_C \mathbf{F} \cdot d\mathbf{r} \). Here \( \mathbf{F} = \langle 2xz + \sin y, x \cos y, x^2 \rangle \) and \( C \) is a curve from \((1, 0, 0)\) to \((1, 0, 2\pi)\).

3. Evaluate the line integral \( \int_C x^2ydx - 3y^2dy \) using Green’s Theorem when \( C \) is the curve which goes around the perimeter of the region \( \{(x, y) : 0 \leq x \leq 1, 0 \leq y \leq 1\} \) in the backwards (clockwise) direction.

4. Find the equation of the tangent plane to the parametric surface given by \( \langle u^2, u - v^2, v^2 \rangle \) at the point \((1, 0, 1)\).

5. Rewrite but do NOT evaluate the surface integral \( \iint_S \mathbf{F} \cdot d\mathbf{S} \) as an usual double iterated integral (including limits of integration and a simplified integrand). Here \( \mathbf{F} = \langle y, x, xy \rangle \) and \( S \) is the portion of the paraboloid \( z = x^2 + 2y^2 \) over the region \( \{(x, y) : 1 \leq x \leq 2, \ln x \leq y \leq \pi\} \) Use the upward pointing normal of \( S \).

6. Set up but do NOT evaluate a double iterated integral for the surface area of the surface \( z = y^2 - x^2 \) that lies between the cylinders \( x^2 + y^2 = 1 \) and \( x^2 + y^2 = 4 \). The double iterated integral needs to have limits of integration and a simplified integrand.

7. Use cylindrical co-ordinates to evaluate \( \int \int_E x^2dV \) when \( E \) is the solid within \( x^2 + y^2 = 1 \), above \( z = 0 \) and below \( z^2 = 4x^2 + 4y^2 \).

8. Evaluate the line integral \( \int_C \mathbf{F} \cdot d\mathbf{r} \) if \( \mathbf{F} = \langle x^2y, -xy \rangle \), and \( \mathbf{r}(t) = \langle t^3, t^4 \rangle, 0 \leq t \leq 1 \).

9. Use the given transformation to evaluate \( \int \int_R x\,dA \) where \( R \) is the region in the FIRST quadrant where \( 9x^2 + 4y^2 \leq 36 \) and the transformation is \( x = 2u, y = 3v \). Also explicitly draw \( R \) and \( S \), the region in the \( uv \) plane that maps to \( R \) in the \( xy \) plane by this transformation. Clearly label the Jacobian of the transformation.

10. Rewrite the the limits of \( \int_0^1 \int_{\sqrt{\pi}}^{1-y} f(x, y, z)dzdydx \) in the orders \( dxdydz \) and \( dydzdx \).