1. Consider the surface given parametrically by the position vector
\[ \mathbf{r}(u, v) = (u^2 + v^2)i + u \sin(v)j + (u + 1)k. \]
Find the equation of the tangent plane to this surface at \( (1 + \pi^2/16, \sqrt{2}/2, \sqrt{2}) \).

2. Let \( z = f(x, y), \) \( x = s + t \) and \( y = s - t \). Show that
\[ \left( \frac{\partial z}{\partial x} \right)^2 - \left( \frac{\partial z}{\partial y} \right)^2 = \frac{\partial z}{\partial s} \frac{\partial z}{\partial t}. \]

3. Find the maximum value of \( f(x, y, z) = x^2y^2z^2 \) subject to the constraint \( x^2 + y^2 + z^2 = 1 \).

4. Evaluate
\[ \iint_D ye^x dA \]
where \( D \) is the triangular region having vertices \( (0, 0), (2, 4) \) and \( (6, 0) \).

5. Find the area of the surface having parametric equations
\[ x = uv, y = u + v, z = u - v, \]
where \( u^2 + v^2 \leq 1 \).

6. Evaluate
\[ \iint_D \frac{x + 2y}{\cos(x - y)} dA \]
where \( D \) is the region bounded by the lines \( y = x, y = x - 1, x + 2y = 0 \) and \( x + 2y = 2 \).

7. Evaluate
\[ \int_C \mathbf{F} \cdot d\mathbf{r}, \]
where
\[ \mathbf{F}(x, y, z) = y^2 \cos(z)i + 2xy \cos(z)j - xy^2 \sin(z)k \]
and \( C \) has position vector
\[ \mathbf{r}(t) = t^2i + \sin(t)j + tk, \]
where \( 0 \leq t \leq \pi \).

8. Evaluate
\[ \iint_S (x \mathbf{i} - y \mathbf{j} + (x^2 + y^2)z^2 \mathbf{k}) \cdot d\mathbf{S}, \]
where \( S \) is the entire surface of the solid cylinder described by \( x^2 + y^2 \leq b^2, \) \( c \leq z \leq d \). Here \( c, d, \) and \( b \) are arbitrary positive numbers.