Review Problems (II)

1. Find an equation for the tangent plane to the surface

\[ 3xy - 4y^3z^3 + x^4z = 6 \]

at the point (2, 1, 2).

2. Let \( F(x, y, z) = y^2z^3 i + 2xyz^2 j + 3xy^2 z^2 k \), and \( C \) is the path \( r(t) = e^t i + (t^2 + 1) j + \cos(\pi t) \) from \( t = 0 \) to \( t = 1 \). Calculate

\[ \int_C F \cdot dr \]

3. Determine whether the force field \( F(x, y, z) = 2xzi + (x^2 - y)j + (2z - x^2)k \) is conservative or non-conservative.

4. Evaluate

\[ \int \int_S (F \cdot n) dS \]

over the entire surface of the region bounded by \( z = 4 - x^2 - y^2 \) and the \( xy \)-plane, if \( F(x, y, z) = xy^2 i + x^2 y j + z^2 k \).

5. Let \( F(x, y, z) = xz^2 i + xyz^3 j + xy^2 z^3 k \), and \( S \) be the upper half of the unit sphere centered at the origin. Calculate

\[ \int \int_S (\text{curl} F \cdot n) dS. \]