These problems are for your own benefit, please do not submit solutions for grading.

1) Consider the surface \( S \subset \mathbb{R}^3 \) given by \( x^3 + y^4 + z^5 + e^z = 3 \). Explain why near the point \( p = (1, 1, 0) \) we can write \( S \) as a graph \( z = f(x, y) \), for some smooth function \( f(x, y) \). Then calculate \( \frac{\partial f}{\partial x} \) and \( \frac{\partial f}{\partial y} \) at \( (1, 1) \).

2) Continuing from problem 1, use the values of these partial derivatives to write down a basis of the tangent plane \( T_pS \). Then express \( T_pS \) in the form \( ax + by + cz = 0 \).

3) Construct an explicit diffeomorphism \( F : S_1 \rightarrow S_2 \) where \( S_1 \) is the cylinder \( x^2 + y^2 = 1 \) and \( S_2 \) is the one-sheeted hyperboloid \( x^2 + y^2 - z^2 = 1 \).