(Problems are from *Vector Calculus* by Marsden and Tromba, sixth edition.)

1

Find a parametrization of the surface $z = 3x^2 + 8xy$ and use it to find the tangent plane at $x = 1$, $y = 0$, $z = 3$.

2

Let $D = [0, 1] \times [0, \pi]$ and define $\vec{\Phi}(x, y, z) : D \to \mathbb{R}^3$ by $(u, v) \mapsto (e^u \cos v, e^u \sin v, v)$. Denote the image of $\vec{\Phi}$ by S.

(a) Find $\vec{T}_u \times \vec{T}_v$.

(b) Find the equation for the tangent plane to S at $\vec{\Phi}\left(0, \frac{\pi}{2}\right)$.

(c) Find the area of S.

3

Let D be the unit disk in $\mathbb{R}^2$ and define $\vec{\Phi} : D \to \mathbb{R}^3$ by $(u, v) \mapsto (u - v, u + v, uv)$. Find the area of $\vec{\Phi}(D)$.

4

Let S be the surface parametrized by $\vec{\Phi} : [0, 4] \times [0, \pi] \to \mathbb{R}^3$, $(u, v) \mapsto (2u \cos v, 2u \sin v, u)$. Evaluate the integral of $f(x, y, z) = x + y$ over S.