

(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 $\vec{\Phi}(x, y, z) : D \rightarrow \mathbb{R}^3$ 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 $\vec{\Phi}(0, \frac{\pi}{2})$.
- (c) Find the area of S .

3

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