Instructions: Show all work. Use exact answers unless specifically asked to round. Be sure to complete all parts of each question.

1. Find the three first partial derivatives for $f(x, y, z) = e^{-xy} \sin(yz)$.

2. Find the total differential for $z = ye^x$ at the point (0,1) and use this information to approximate the function at (0.1, 0.95).

3. Integrate. $\int_1^4 \int_1^{\sqrt{x}} 2ye^{-x} dy dx$

4. Find the gradient of the function $f(x, y) = xy(1 - x^2 - y^2)$.

5. Find the gradient of the function $f(x, y) = \sin(xy^2)$. Sketch key features of the gradient and the general direction of the gradient in each region. Use this information to sketch some level curves of the function.

6. Find $\nabla \times F$ for the vector field $F(x, y, z) = (3x^2y - z)\hat{\imath} + (yz + x^3)\hat{\jmath} + (\frac{1}{2}y^2 - x)\hat{k}$.