1. Find the curl and div of \( \mathbf{F} = (xz, xy, yz) \).

2. Find \( f \) so that \( \mathbf{F} = \nabla f \) and use it to find the line integral \( \int_C \mathbf{F} \cdot d\mathbf{r} \). Here \( \mathbf{F} = (4xe^z, \cos y, 2x^2e^z) \) and \( C \) is a curve from \((0,0,0)\) to \((1,\pi,2)\).

3. Write down and simplify but do NOT evaluate the double integral obtained from using Green’s Theorem to change \( \int_C (y + e^{\sqrt{x}})dx + (3x^2 + \cos y^2)dy \) into a double integral. \( C \) is the boundary of the region enclosed by the parabolas \( y = x^2 \) and \( x = y^2 \).

4. Write down and simplify but do NOT evaluate the surface integral \( \iint_S \mathbf{F} \cdot d\mathbf{S} \). Where \( S \) is the hemisphere \( z = \sqrt{16 - x^2 - y^2} \) with upward normal and \( \mathbf{F} = (-y, x, 3z) \).

5. Let \( f \) be a scalar field and \( \mathbf{F} \) a vector field. State whether each expression is a scalar field, a vector field or meaningless. A. \( \text{curl } f \)  B. \( \text{grad } f \)  C. \( \text{div } \mathbf{F} \)  D. \( \text{curl} (\text{grad } f) \)  E. \( \text{grad } \mathbf{F} \)  F. \( \text{grad} (\text{div } \mathbf{F}) \)  G. \( \text{div} (\text{grad } f) \)  H. \( \text{grad} (\text{div } f) \)  I. \( \text{curl} (\text{curl } \mathbf{F}) \)  J. \( \text{div} (\text{div } \mathbf{F}) \)