1. Use Green’s Theorem to evaluate the line integral along the given positively oriented curve.

\[ \int_C \cos y \, dx + x^2 \sin y \, dy, \]

where \( C \) is the rectangle with vertices \((0,0), (5,0), (5,2), \) and \((0,2)\).

2. Use Green’s Theorem to evaluate \( \int_C \mathbf{F} \cdot dr \).

\[ \mathbf{F}(x,y) = \langle e^{-x} + y^2, e^{-y} + x^2 \rangle, \]

\( C \) consists of the arc of the curve \( y = \cos x \) from \((-\pi/2, 0)\) to \((\pi/2, 0)\) and the line segment from \((\pi/2, 0)\) to \((-\pi/2, 0)\).

3. Let \( D \) be a region bounded by a simple closed path \( C \) in the \( xy \)-plane. Use Green’s Theorem to prove that the coordinates of the centroid \((\bar{x}, \bar{y})\) of \( D \) are

\[ \bar{x} = \frac{1}{2A} \oint_C x^2 \, dy \quad \bar{y} = -\frac{1}{2A} \oint_C y^2 \, dx \]

where \( A \) is the area of \( D \).
4. Find the curl and the divergence of the vector field.

\[ \mathbf{F}(x, y, z) = e^{xy} \sin z \mathbf{j} + y \tan^{-1}(x/z) \mathbf{k} \]

5. Determine whether or not the vector field is conservative. If it is conservative, find a function \( f \) such that \( \mathbf{F} = \nabla f \).

\[ \mathbf{F}(x, y, z) = e^{yz} \mathbf{i} + xze^{yz} \mathbf{j} + ye^{yz} \mathbf{k} \]

\[ \mathbf{F}(x, y, z) = \mathbf{i} + \sin z \mathbf{j} + y \cos z \mathbf{k} \]