1. Compute curl of the following vector fields. Use the curl to decide whether each vector field is conservative. If the vector field is conservative, find the potential function.

(a) \( F(x, y, z) = (x + y, y + z, x + z) \)

(b) \( F(x, y, z) = (\sin(x^3) + xz, x - yz, \cos(z^4)) \)

(c) \( F(x, y) = (ye^x, e^x) \)

2. Consider the integral \( \int_C F \cdot ds \) in two dimensions with \( F(x, y) = (F_1(x, y), F_2(x, y)) \)

(a) What conditions on the curve \( C \) and/or the vector field \( F \) do you need to use the fundamental theorem for line integrals to evaluate the integral.

(b) What conditions on the curve \( C \) and/or the vector field \( F \) do you need to use Green’s Theorem to evaluate the integral.
3. Use Green’s theorem to replace the line integral \( \oint_C \left( y - \sin(y) \cos(y) \right) dx + 2x \sin^2(y) dy \) with a double integral, where \( C \) is the counterclockwise path around the region bounded by \( x = -1, x = 2, y = 4 - x^2, \) and \( y = x - 2. \)

4. Find the area between the ellipse \( \frac{x^2}{9} + \frac{y^2}{4} = 1 \) and the circle \( x^2 + y^2 = 25 \)

5. Find the area of the region enclosed by the parametric equation

\[
p(\theta) = (\cos(\theta) - \cos^2(\theta), \sin(\theta) - \cos(\theta) \sin(\theta)) \text{ for } 0 \leq \theta \leq 2\pi
\]

6. Evaluate \( \int_C -e^y \sin(x) dx + e^y \cos(x) dy + dz \) over the curve \( C \) where \( C \) is the straight line from the point \( (0, 0, 0) \) to \( (\pi, \pi, 1) \).