1. Let \( f(x, y, z) = xy^3 \). Evaluate the line integral \( \int_C f(x, y)ds \) over the curve \( C(t) = (4 \sin t, 4 \cos t, 3t) \) where \( 0 \leq t \leq \pi/2 \). Is this a line integral or a path integral?

   (a) Write out \( f(C(t)) \) so that \( f \) is a function of only \( t \)?
   (b) Compute \( C'(t) \)
   (c) Evaluate the line integral

2. Let \( g(x, y) = (y, -x) \) Compute \( \oint_C gds \) for a circle with radius 1 centered at the origin using the line integral. (Hint: use polar coordinates for your parameterization).

   (a) Write out \( f(C(t)) \) so that \( f \) is a function of only \( t \)?
   (b) Compute \( C'(t) \)
   (c) Evaluate the line integral (this

3. Consider the integral \( \int_C F \cdot ds \) with \( (F(x, y) = F_1(x, y), F_2(x, y)) \) continuous functions

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

5. Use green’s theorem to replace the line integral \( \oint_C (y - \sin(y) \cos(y)) \, dx + 2x \sin^2(y) \, dy \) with a double integral, where \( C \) is the counterclockwise path around the region bounded by \( x = -1, x = 2, y = 4 - x^2, \) and \( y = x - 2. \)

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

7. 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 \((\pi, \pi, 1)\).