1. Redo H3 problem 6 by first showing that the vector field is conservative and then using CLP4 Theorem 2.4.2 or §2.4 Theorem 1 in my lectures.

2. Redo H3 problem 7 as above.

3. Redo H3 problem 8 as above.

4. Show that the line integral \( I = \int_C (1 + xy)e^{xy}dx + (x^2e^{xy} - 3y^2)dy \), with \( C \) any path from \( (1, 0) \) to \( (2, 1) \), is independent of path and evaluate the integral.

5. Let \( C \) be the curve from \( (0, 0, 0) \) to \( (6, 18, 36) \) along the intersection of the surfaces \( 2y = x^2 \) and \( 6z = x^3 \).
   (a) Find \( \int_C \rho \, ds \) if \( s \) is arc length along \( C \) and \( \rho = 8x \).
   (b) Find \( \int_C \vec{F} \cdot d\vec{r} \) if \( \vec{F} = (2 + y \sin(\pi z))\hat{i} + (-1 + x \sin(\pi z))\hat{j} + \pi xy \cos(\pi z)\hat{k} \).

6. Sketch the given sets and determine whether or not they are (a) open, (b) connected, and (c) simply connected.
   \( D_1 = \{(x, y) \mid 2 < y < 3\} \quad D_2 = \{(x, y) \mid 2 < |y| < 3\} \)
   \( D_3 = \{(x, y) \mid 0 < x^2 + y^2 \leq 3\} \quad D_4 = \{(x, y) \mid 1 < x^2 + y^2 \leq 3, \; x > 0\} \)

7. Let \( \vec{F}(x, y) = \frac{-y}{x^2 + y^2}\hat{i} + \frac{x}{x^2 + y^2}\hat{j} \). Show that
   \[
   \oint_C \vec{F} \cdot d\vec{r} = 0
   \]
   for any closed curve \( C \) in \( \mathbb{R}^2 \) that stays in the lower half plane \( D = \{(x, y) : y < 0\} \).

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8. Among the four vector fields sketched below, exactly one of them is conservative. Determine which three vector fields are not conservative and explain why.