1. Evaluate the integral
\[ \int_C x^2 y \, ds, \]
where \( C \) is the line segment from \((0, 1, -1)\) to \((2, 0, 2)\).
2. (a) Find the value of the integral

\[ \int_{C} ((2xy + 1)i + (x^2 + 3y^2)j) \cdot dr, \]

where \( C \) is the path \( y = x^2 - 1 \) from \((0, -1)\) to \((1, 0)\).

(b) Now find the value of the same integral, but now let \( C \) be the path \( x^2 + y^2 = 1 \) between \((0, -1)\) and \((1, 0)\).

(c) Next, find the value of the same integral, but let \( C \) be the straight-line path connecting the points \((0, -1)\) and \((1, 0)\).

(d) Is this integral path-independent? Explain.
3. Consider the triangle with vertices \((1, 1), (2, 1)\) and \((2, 4)\). Let \(C\) be the negatively oriented closed path along the boundary of the triangle. Consider the vector field \(\mathbf{F}(x, y) = (\cos(x^3) - xy^2, e^{y^2} \sin y + 3x^2 y)\). Compute

\[
\int_C \mathbf{F} \cdot d\mathbf{r}.
\]
4. Find the work done by the force field \( \mathbf{F} = \langle xy^2, y \rangle \) in moving an object from the point \((0, 2)\) to \((2, 0)\) along the curve \(x^2 + y^2 = 4\).
5. Consider the vector field

\[ \mathbf{F}(x, y) = < e^{x^2y}(2x^2y + 1), x^3e^{x^2y} >. \]

Is \( \mathbf{F} \) conservative? If so, find a function \( f(x, y) \) such that \( \nabla f(x, y) = \mathbf{F}(x, y) \).
6. Compute the integral 
\[ \int_C x^2 y \, dy, \]
where \( C \) is the curve \( y = 3x^2 + 1 \) from \((-1, 4)\) to \((0, 1)\).