Problem 1 (10 points)

Part A (5 points)
Compute
\[
\frac{\partial}{\partial x} e^{\sin(x^2 + y^2)}
\]

Part B (5 points)
Compute
\[
\frac{\partial^2}{\partial x \partial y} (x^2 e^x - 6x^3 + y) \cos(x)
\]

Problem 2 (12 points)

Consider the vector-valued function:
\[
r(t) = \langle \cos(3t), \sin(3t), \sqrt{7} \rangle
\]

Part A (3 points)
Compute \(r'(t)\)

Part B (3 points)
Compute \(r''(t)\)

Part C (6 points)
Find the arc length of \(r(t)\) from \(0 \leq t \leq 2\pi\).
Problem 3 (13 points)
Consider the plane \( P \) given by the equation \( 3x - 10y + 2z = 5 \)

Part A (3 points)
Find a normal vector for the plane \( P \).

Part B (5 points)
Using the answer from Part A, find a parametrization of a line (in the form \( c(t) = p_0 + tv \)) that is perpendicular to the plane \( P \).

Part C (5 points)
Using the answer from Part A, find a parametrization of a line (in the form \( c(t) = p_0 + tv \)) that is contained in the plane \( P \).

Problem 4 (8 points)
Let \( u = \langle 1, 5, 2 \rangle \) and \( v = \langle 2, 1, -1 \rangle \).

Part A (4 points)
Compute \( u \times v \).

Part B (4 points)
Compute the projection of \( u \) onto \( v \).

Problem 5 (6 points)
Find a parametrization of the tangent line (in the form \( c(t) = p_0 + tv \)) to the curve:
\[
c(t) = \langle e^{2t}, t^4 - 1, 5t \rangle
\]
at the point \( t = 2 \)