1. Use the chain rule to find \( g'(t) \), where \( g(t) = f(x(t), y(t)) \), \( f(x, y) = x^2 y + y^2 \), \( x(t) = e^{4t} \) and \( y(t) = \sin t \).
2. Evaluate \( \int \int_{R} (y - 4x) \, dA \), where \( R \) is bounded by \( y = 4x + 2, y = 4x + 5, y = 3 - 2x, \) and \( y = 1 - 2x. \)
3. Evaluate $\int_C 2x\,ds$, where $C$ is the portion of $y = x^2$ from $(-2, 4)$ to $(2, 4)$. 
4. Evaluate $\int_C 3y^2\,dy$, where $C$ is the quarter-circle $x^2 + y^2 = 4$ from $(0, 2)$ to $(-2, 0)$. 
5. \( \mathbf{F}(x, y) = (xe^{x^2} - 2, \sin y) \)
   (a): Find a function \( f \) such that \( \mathbf{F} = \nabla f \);
   (b): Evaluate \( \int_C \mathbf{F} \cdot d\mathbf{r} \), where \( C \) is the portion of the parabola \( y = x^2 \) from \((-2, 4)\) to \((2, 4)\).