Math2E - Practice Midterm 1

1. Use the chain rule to find $g'(t)$, where $g(t) = f(x(t), y(t)), f(x, y) = x^2y + y^2, x(t) = e^{4t}$ 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 $\int_C 2xds$, 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 $(2, 4)$.