Math 225-01 Quiz 1 Solutions Spring 2008

Show your work! Use extra paper if necessary. **Name:**

1. Compute the first derivative $f'(t) = \frac{df}{dt}$ of the following functions.

   a. $f(t) = 2t^3 - 3t$

   From linearity of the derivative, $f'(t) = 2\frac{d}{dt}t^3 - 3\frac{d}{dt}t = 6t^2 - 3$.

   b. $f(t) = \sin(t) - \cos(4t)$

   $f'(t) = \frac{d}{dt}\sin(t) - \frac{d}{dt}\cos(4t) = \cos(t) - -\sin(4t) \cdot 4 = \cos(t) + 4\sin(4t)$. We've used the chain rule on $\cos(4t)$.

   c. $f(t) = e^{-2t}$

   By the chain rule, $f'(t) = -2e^{-2t}$.

   d. $f(t) = te^{-2t}$

   By the product rule and part c, $f'(t) = \left(\frac{d}{dt}t\right)e^{-2t} + t\frac{d}{dt}e^{-2t} = e^{-2t} - 2te^{-2t}$

2. Find the antiderivative, or indefinite integral, of $f(t) = e^{4t}$.

$$\int e^{4t}dt = \frac{1}{4}\int \underbrace{e^{4t}}_{e^u}\underbrace{4dt}_{du} = \frac{1}{4}e^{4t} + C$$

where C is an arbitrary constant.

3. Evaluate $\int_0^1 e^{4t}\,dt$. From problem 2,

$$\int_0^1 e^{4t}\,dt = \frac{1}{4}e^{4t}\Big|_{t=0}^{t=1} = \frac{1}{4}e^{4\cdot 1} - \frac{1}{4}e^{4\cdot 0} = \frac{1}{4}(e^4 - 1).$$