HOMEWORK SET #1: Due in One week

#1 (10 pts.) Find $f'(x)$ for each of the following functions:
   a) $xe^{-x}$
   b) $\frac{x^2}{x^2+1}$
   c) $e^{3x}$
   d) $(3x + 2)^{-2}$
   e) $\ln x^3$

#2 (10 pts.) Find the first and second-order partial derivatives for $f(x_1, x_2) = x_1^2 e^{x_2}$

#3 (10 pts.) Find the second-order Taylor series expansion of $\ln x$ about $x = 1$.

#4 (10 pts.) Suppose that if $x$ dollars are spent on advertising during a given year, $k(1 - e^{-cx})$ customers will purchase a product ($c > 0$).
   a) As $x$ grows large, the number of customers purchasing the product approaches a limit. Find this limit.
   b) Can you give an interpretation for $k$?
   c) Show that the sales response from a dollar of advertising is proportional to the number of potential customers who are not purchasing the product at present.

#5 (10 pts.) The present is $t = 0$. At a time $t$ years from now, I earn income at a rate $e^{2t}$. How much money do I earn during the next 5 years?

#6 (10 pts.) If money is continuously discounted at a rate $r$% per year, then $\$1$ earned $t$ years in the future is equivalent to $e^{-rt}$ dollars earned at the present time. Use this fact to determine the present value of the income earned in problem #5.

#7 (10 pts.) For the following function, use Leibniz’s rule to determine $H'(y)$

$$H(y) = \int_0^y yx^2\,dx$$