Math 262
Differentiation and Integration Rules Related to e^x and $\ln x$.

A. Differentiation Rules:

1. Let $f(x)$ be a one-to-one function and suppose $g(x) = f^{-1}(x)$. Suppose $f(a) = b$ (so $g(b) = a$). Then $g'(b) = \dfrac{1}{f'(a)} = \dfrac{1}{f'(g(b))}$.

2. $\dfrac{d}{dx}(\ln u) = \dfrac{1}{u}\dfrac{du}{dx}$.

3. $\dfrac{d}{dx}(\log_a u) = \dfrac{1}{\ln a}\dfrac{1}{u}\dfrac{du}{dx}$.

4. $\dfrac{d}{dx}(e^u) = e^u \dfrac{du}{dx}$.

5. $\dfrac{d}{dx}(a^u) = (\ln a)a^u \dfrac{du}{dx}$.

B. Integration Rules:

1. $\displaystyle\int \frac{1}{u}\,du = \ln|u| + C$.

2. $\displaystyle\int \ln u\,du = u\ln u - u + C$.

3. $\displaystyle\int e^u\,du = e^u + C$.

4. $\displaystyle\int a^u\,du = \frac{1}{\ln a}a^u + C$.

5. $\displaystyle\int \tan u\,du = \ln|\sec u| + C$.

6. $\displaystyle\int \cot u\,du = \ln|\sin u| + C$.

7. $\displaystyle\int \sec u\,du = \ln|\sec u + \tan u| + C$.

8. $\displaystyle\int \csc u\,du = -\ln|\csc u + \cot u| + C$.