PRINT Your Name:_____

Quiz 5 — September 16, 2011 – Section 8 – 11:15 – 12:05

Remove everything from your desk except a pencil or pen.

Circle your answer. **Show your work.** Your work should be correct and coherent. **CHECK** your answer.
The quiz is worth 5 points.

Find $\int \frac{dx}{1+e^x} dx$.

Answer: Let $u = e^x$. It follows that $du = e^x dx$; hence $\frac{du}{u} = dx$. The original integral is equal to $\int \frac{du}{u(1+u)}$. We use the technique of partial fractions to write

$$\frac{1}{u(u+1)} = \frac{A}{u} \frac{B}{(1+u)}.$$

So $1 = A(1+u) + Bu$. Plug in $u = 0$ to learn $A = 1$. Plug in $u = -1$ to learn $B = -1$. We conclude $\frac{1}{u(u+1)} = \frac{1}{u} - \frac{1}{1+u}$. (This is correct.) The original integral is equal to

$$\int \left(\frac{1}{u} - \frac{1}{1+u} \right) du = \ln|u| - \ln|1+u| + C = \ln|e^x| - \ln|1+e^x| + C$$

$$= \ln e^x - \ln(1+e^x) + C = \boxed{x - \ln(1+e^x) + C}.$$

(We used the fact that e^x and $1+e^x$ are both always positive.)

Check: The derivative of the proposed answer is:

$$1 - \frac{e^x}{1+e^x} = \frac{1}{1+e^x}. \checkmark$$