Take-Home Quiz 2

Math 133 Section 22

Due Monday, April 17

Problem 1. (3 points). Compute the following:
$$\int \frac{\ln x}{x}\, dx.$$

Problem 2. (3 points). Compute the following:
$$\int (\ln x)^2\, dx.$$

Problem 3. (3 points). Consider the integral $\int \frac{1}{x}\, dx$. I will perform integration by parts, by setting

$$u \;=\; \frac{1}{x} \qquad\qquad v \;=\; x$$

$$du \;=\; -\frac{1}{x^2}\, dx \qquad dv \;=\; dx$$

This gives

$$\int \frac{1}{x}\, dx = \frac{1}{x}\cdot x - \int x\cdot\frac{-1}{x^2}\, dx.$$

Simplifying gives

$$\int \frac{1}{x}\, dx = 1 + \int \frac{1}{x}\, dx.$$

Canceling the integrals on both sides yields

$$0 = 1,$$

which is ridiculous! Where did I make a mistake?

Problem 4. (3 points). Evaluate the limit:
$$\lim_{x\to 0^+} (\sin x)^x$$

Problem 5. (3 points). Evaluate the limit:
$$\lim_{x\to 0} \left(\frac{1}{\sin x} - \frac{1}{x + x^2} \right).$$