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Math 153H-01 **Quiz 9** **April 7, 2016**

No calculators, no notes, no books. Only pens, pencils and erasers are allowed.

1. Find $\lim_{x\to 1} \frac{\ln x}{e^x-1}$.

Solution: The function $f(x) = \frac{\ln x}{e^x-1}$ is well-defined and continuous at the point 1, so one should just plug in the value 1 in this function in order to get the limit, which is $f(1) = \frac{0}{e-1} = 0$.

2. Say for each of the following integrals if it is convergent or divergent, and if it is convergent, calculate its limit:

$\int_0^1 \frac{1}{x^2} dx$

Solution: This integral is by definition $\lim_{a\to 0^+} \int_a^1 \frac{dx}{x^2} dx = \lim_{a\to 0^+} (-\frac{1}{x}|_a^1) = \lim_{a\to 0^+} (\frac{1}{a} - 1)dx = \infty$. Therefore this integral is divergent.

$\int_1^\infty \frac{1}{x^2} dx$

Solution: This integral is by definition $\lim_{b\to\infty} \int_1^b \frac{dx}{x^2} dx = \lim_{b\to\infty} (-\frac{1}{x}|_1^b) = \lim_{b\to\infty} (1-\frac{1}{b})dx = 1$. Therefore this integral is convergent.