Math 1232: Single-Variable Calculus 2
George Washington University Fall 2025
Recitation 4

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Problem 1. (a) In class, we saw that $\lim_{x\to+\infty} \frac{\ln(x)}{x} = 0$. What is $\lim_{x\to+\infty} \frac{\ln(x^2)}{x}$?

(b) Compute $\lim_{x\to+\infty} \frac{\ln(x^n)}{x}$ for $n > 0$.

(c) Compute $\lim_{x\to+\infty} \frac{\ln(x)}{x^\epsilon}$ for $\varepsilon > 0$.

(d) What do parts (a-c) tell you about the relationship between polynomials and $\ln(x)$?

(a) In class we saw that $\lim_{x\to+\infty} \frac{e^x}{x} = +\infty$. Compute $\lim_{x\to+\infty} \frac{e^x}{x^2}$.

(b) Compute $\lim_{x\to+\infty} \frac{e^x}{x^n}$ for $n > 0$.

(c) What do parts (e-f) tell you about the relationship between e^x and polynomials?

Problem 2. (a) We want to compute $\lim_{x\to\pi/2} \sec(x) - \tan(x)$.

(b) Can we use L'Hospital's Rule on this as written? Can we change it to a form where L'Hospital's Rule works?

(c) What is the limit?

Problem 3. Let's compute $\lim_{x\to0^+} x^{\frac{1}{\ln(x)-1}}$

(a) What indeterminate form is this?

(b) If $y = x^{\frac{1}{\ln(x)-1}}$, what is $\ln|y|$?

(c) Compute $\lim_{x\to0^+} \ln|y|$.

(d) Compute $\lim_{x\to 0^+} x^{\frac{1}{\ln(x)-1}}$.

Problem 4. (a) We want to compute $\int x^2 e^{-3x}\,dx$. Why do we want to use integration by parts? What should be our u and dv, and why?

(b) Compute the integral.

(c) Now we want to compute $\int \cos(3x)e^{2x}\,dx$. Why do we want to use integration by parts? What should be our u and dv, and why? When we need to make another choice, what forces us to make that choice?

(d) Compute the integral.

Problem 5. Compute $\int \arctan(x)\,dx$. (Hint: this is integration by parts, even though it doesn't look like a product!)