CPSC 031 — Mathematics Review for CPSC 413

Exercise #2 — Limits and Derivatives

September, 2000

Please try these exercises before the 6pm lecture on September 7.

1. Compute each of the following limits or explain why it does not exist.

   (a) $\lim\limits_{x \to 2} \dfrac{x^3 - 8}{x - 2}$

   (b) $\lim\limits_{x \to +\infty} \dfrac{x^2 + 2x + 1}{3x^2 + 5}$

   (c) $\lim\limits_{x \to 0} \dfrac{x}{\cos(x) - 1}$

   (d) $\lim\limits_{x \to +\infty} \dfrac{\ln(4x)}{\ln(3x)}$

2. Compute the derivative (with respect to x) of each of the following functions.

   (a) $f(x) = 3x^2 + 2x + 1$

   (b) $f(x) = x \ln x$

   (c) $f(x) = x / \ln x$

   (d) $f(x) = e^{x^2 \ln x}$

3. Prove that
$$\lim_{x \to +\infty} \frac{(\ln x)^n}{x} = 0$$
for every natural number $n \geq 1$.