Your Name: Key

Calculus I, Math 151-06, Quiz #7

Evaluate the following limits. Show all of your work.

1. **[8 points]** $\lim_{x\to 0} \dfrac{3-3\cos x}{x^2}$ $= \dfrac{3-3\cos 0}{0^2} = \dfrac{3-3(1)}{0} = \dfrac{0}{0}$

$\overset{L'H}{=} \lim_{x\to 0} \dfrac{3\sin x}{2x} = \dfrac{3\sin 0}{2(0)} = \dfrac{0}{0}$

$\overset{L'H}{=} \lim_{x\to 0} \dfrac{3\cos x}{2} = \boxed{\dfrac{3}{2}}$

2. **[8 points]** $\lim_{x\to\infty} 4x^2 e^{-x^2}$ $= 4(\infty)^2 e^{-\infty^2} = \infty(0)$

$= \lim_{x\to\infty} \dfrac{4x^2}{e^{x^2}} = \dfrac{\infty}{e^{\infty}} = \dfrac{\infty}{\infty}$

$\overset{L'H}{=} \lim_{x\to\infty} \dfrac{8x}{2x e^{x^2}} = \lim_{x\to\infty} \dfrac{4}{e^{x^2}} = \dfrac{4}{\infty} = \boxed{0}$

3. **[9 points]** $\lim_{x\to 0^+} (1+3x)^{1/x} = (1+0)^{1/0^+} = 1^{\infty}$

$L = \lim_{x\to 0^+} (1+3x)^{1/x}$

$\ln L = \lim_{x\to 0^+} \ln(1+3x)^{1/x} = \lim_{x\to 0^+} \frac{1}{x}\ln(1+3x) = \lim_{x\to 0^+} \frac{\ln(1+3x)}{x} = \frac{\ln(1+0)}{0} = \frac{\ln 1}{0} = \frac{0}{0}$

$\overset{LH}{=} \lim_{x\to 0^+} \frac{\frac{3}{1+3x}}{1} = \lim_{x\to 0^+} \frac{3}{1+3x} = \frac{3}{1+3(0)} = \frac{3}{1} = 3$

$\ln L = 3 \qquad e^{\ln L} = e^3 \qquad L = \boxed{e^3}$