LECTURE NOTES: 4-4 INDETERMINATE FORMS AND L'HOSPITAL'S RULE (PART 1)

MOTIVATING EXAMPLES: Evaluate the Chapter 2 limits below, justifying each step:

a) $\lim_{x\to 2} \dfrac{x^2-4}{x^2-5x+6}$

b) $\lim_{x\to 0} \dfrac{\sin x}{x}$

L'Hospital's Rule If a limit has the form _____ or _____,

then

$$\lim_{x\to a} \frac{f(x)}{g(x)} =$$

provided

QUESTION 1: Determine whether or not l'Hospital's Rule applies to the MOTIVATING EXAMPLES (copied below) and if it does, apply it. Do you get the same answer?

a) $\lim_{x\to 2} \dfrac{x^2-4}{x^2-5x+6}$

b) $\lim_{x\to 0} \dfrac{\sin x}{x}$

QUESTION 2: Why does l'Hospital's Rule work?

PRACTICE PROBLEMS: Evaluate the following limits.

1. $\lim_{x \to 0} \frac{\tan(5x)}{\sin(3x)}$

3. $\lim_{x \to 0} \frac{\cos(4x)}{e^{2x}}$

2. $\lim_{u \to \infty} \frac{e^{u/10}}{u^2}$

4. $\lim_{x \to 0} \frac{xe^x}{2^x - 1}$

5. $\lim_{x \to 1^+} \big(\ln(x^4 - 1) - \ln(x^9 - 1)\big)$

6. $\lim_{x \to 0^+} \sqrt{x} e^{-x/2}$

★ Articulate explicitly what *trick* was used to evaluate the last limit and state precisely what sort of limits this trick will apply to in general.