Math 140   **Session 4 (Limits 3)**   **Date: October 16th, 2015**   **Omidali Jazi**

Problem 1. Evaluate the following limits, if it exists.

a. $\lim\limits_{x\to 0} \frac{\sin(4x)}{6x}$

b. $\lim\limits_{x\to 0} \frac{1-\cos(x)}{x}$

c. $\lim\limits_{x\to 0} \frac{\tan(5x)}{\sin(3x)}$

d. $\lim\limits_{x\to 0} \sqrt{x^3 + x^2}\sin\left(\frac{\pi}{x}\right)$

e. $\lim\limits_{x\to 0^+} \sqrt{x}e^{\sin\left(\frac{\pi}{x}\right)}$

f. $\lim\limits_{x\to 0} x^4 \cos\left(\frac{2}{x}\right)$

Problem 2. What value must be chosen for a to make the following function continuous at $x = 2$.

$$f(x) = \begin{cases} \frac{5x^3 - 4x^2 - 10x - 4}{x-2} & x < 2 \\ -3x^2 + 3x + a & x \geq 2 \end{cases}$$

Problem 3. Where each function is continuous.

a. $f(x) = \frac{x^2 - 9}{x^2 - 9x + 18}$

b. $f(x) = \begin{cases} \frac{2x^2 - 5x - 3}{x-3} & x \neq 3 \\ 6 & x = 3 \end{cases}$

Problem 4. Evaluate the following limits at infinity.

a. $\lim\limits_{x\to\pm\infty} \frac{10x^4 - 7x^2}{5x^2 + 8}$

b. $\lim\limits_{x\to\pm\infty} \frac{5x^3 - 4x^2 - 11x}{-5x^2 - 9x + 11}$

c. $\lim\limits_{x\to\pm\infty} \frac{\sqrt{3 + 10x^2}}{8x + 4}$

d. $\lim\limits_{x\to\pm\infty} \left(\sqrt{x^2 + 10x + 1} - x\right)$

e. $\lim\limits_{x\to\pm\infty} \left(\sqrt{x^2 + 8} - \sqrt{x^2 - 7}\right)$

f. $\lim\limits_{x\to\pm\infty} \frac{\sqrt{x^4 + 9x^2 - 4}}{3x^2 + 2x + 6}$

g. $\lim\limits_{x\to\pm\infty} \frac{\sqrt{x^2 + 3x + 2}}{3 + x}$

h. $\lim\limits_{x\to\pm\infty} \frac{\sqrt{x^6 - 4x^3 + 2x + 6}}{7x^3 - 3x + 2}$

Problem 5. Find the horizontal and vertical asymptotes of each function.

a. $f(x) = \frac{4x}{x-2}$

b. $f(x) = \frac{x^6}{x^2 + 8}$

c. $f(x) = \frac{|x-2|}{|x+2|}$

d. $f(x) = \frac{1}{|x|}$