Loyola University Chicago **Sample Quiz 2**
Math 161, Section 001, Fall 2010

Name (print): ______________________ **Signature:** ______________________

You have 30 minutes. Show your work. Notes, calculators not allowed! Problems are on both pages.

Problem 1. (5 pts) Find horizontal and vertical asymptotes (if any exist) for the function $f(x) = \dfrac{x^2 - x - 6}{2x^2 - 8}$

Solution:

$$f(x) = \frac{x^2 - x - 6}{2x^2 - 8} = \frac{(x+2)(x-3)}{2(x+2)(x-2)} = \frac{x-3}{2(x-2)}$$

for all $x \neq -2$*. Hence:* $\lim_{x\to -2} f(x) = 5/8$, $\lim_{x\to 2^-} f(x) = \infty$, $\lim_{x\to 2^+} f(x) = -\infty$*. This means that* $x = 2$ *is a vertical asymptote. For horizontal, one has*

$$\lim_{x\to\pm\infty} f(x) = \lim_{x\to\pm\infty} \frac{x-3}{2(x-2)} = \lim_{x\to\pm\infty} \frac{1-\frac{3}{x}}{2(1-\frac{2}{x})} = \frac{1}{2}$$

Horizontal asymptote: $y = 1/2$.

Problem 2. (4 pts) For what values of the constant k is the following function continuous:

$$g(x) = \begin{cases} x^2 - kx - 1 & \text{for} \quad x \leq 3 \\ -2x + 3k & \text{for} \quad x > 3 \end{cases}$$

Solution: Need $x^2 - kx - 1 = -2x + 3k$ *when* $x = 3$*. So* $9 - 3k - 1 = -6 + 3k$, $14 = 6k$, $k = 7/3$.

Problem 3. (3 pts) Find

$$\lim_{x\to 3} 4x^2 - 7x + \sin(x-3).$$

Solution: the function is continuous, so $\lim_{x\to 3} 4x^2 - 7x + \sin(x-3) = 4\cdot 3^2 - 7\cdot 3 + \sin(3-3) = 15.$

Problem 4. (4 pts) Find

$$\lim_{x\to -\infty} \frac{3x+7}{\sqrt{4x^2-9x+1}}.$$

Solution:

$$\lim_{x\to -\infty} \frac{3x+7}{\sqrt{4x^2-9x+1}} \frac{\frac{1}{x}}{\frac{1}{x}} = \lim_{x\to -\infty} \frac{3+\frac{7}{x}}{\sqrt{4-\frac{9}{x}+\frac{1}{x^2}}} = \frac{3}{2}$$

Problem 5. (4 pts) Find

$$\lim_{h\to 0} \frac{\sqrt{x+h+1}-\sqrt{x+1}}{h}$$

Solution:

$$\lim_{h\to 0} \frac{\sqrt{x+h+1}-\sqrt{x+1}}{h} \frac{\sqrt{x+h+1}+\sqrt{x+1}}{\sqrt{x+h+1}+\sqrt{x+1}} = \lim_{h\to 0} \frac{h}{h(\sqrt{x+h+1}+\sqrt{x+1})} = \frac{1}{2\sqrt{x+1}}$$