Exam 1 MTH 201 Fall 2011

To receive full credit, answers must be accompanied by complete, correct justification that is both legible and organized properly. No Calculators.

1. (40 pts) Calculate the following limits. If the limit does not exist, write "dne".

   (a) $\lim_{x\to 3} \dfrac{x^2 - x - 6}{x^2 - 5x + 6}$

   (b) $\lim_{x\to 3^+} \dfrac{x^2 + 6x + 9}{3x^2 - x^3}$

   (c) $\lim_{h\to 0} \dfrac{\sqrt{11 + 2h} - \sqrt{11}}{h}$

   (d) $\lim_{k\to 2} \left(\dfrac{1}{k - 2} - \dfrac{1}{k^2 - 2k} \right)$

(e) $\lim_{r \to \frac{\pi}{4}} \dfrac{\tan r + \cos r}{\sin 2r}$

(f) $\lim_{t \to \infty} \ln\left(\dfrac{e \cdot x^3}{1000 + x^3}\right)$

(g) $\lim_{x \to -\infty} \dfrac{3x^3 - 9}{5 + x - 8x^2}$

(h) $\lim_{x \to \infty} \cot\left(4 + 2x - 7x^2\right)$

2. (10 pts) Find the vertical and horizontal asymptotes of the the function $f(x) = \dfrac{x^3 + x^2 - 20x}{(2x+1)(x-4)(x-1)}$. Justify completely.

3. (10 pts) Does the Intermediate Value Theorem guarantee that the equation $x^5 = 5x + 2$ has a root in the interval $(-1, 1)$. Justify thoroughly.

4. (10 pts) Use the ϵ, δ definition to show $\lim_{x \to \frac{-1}{3}} 8 + 3x = 7$.

5. (5 pts) Where is the function $f(x) = \dfrac{\cos(x^2 - 5x + 6) + \ln(x^2 - 1)}{e^{5x+7}}$ continuous?

6. (10 pts) Find $f'(a)$ given $f(x) = \dfrac{2}{1+3x}$ using the limit definition given in 2.7.

7. (10 pts) Find $f'(1)$ given $f(x) = \sqrt{6 - 2x}$ using the limit definition given in 2.7.

8. (5 pts) What does the result we get for $f'(1)$ mean? Be as specific as possible.