Exam 3 MTH 201 Fall 2013

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

1. (10 pts) Calculate the following limits. If the limit does not exist, write "dne".

   (a) $\lim_{t\to\infty} \dfrac{e^t + t}{t^2}$

   (b) $\lim_{x\to 0^+} x^{\sin x}$

2. (10 pts) Find f given $f'(t) = \sin t - 4e^t + 7$ and $f(0) = 3$.

3. (15 pts) A rectangular field bordering a river is to be fenced in on the other three sides. If the area of the field is to be 5000 square feet, find the minimum amount of fencing needed. Be sure to justify your answer completely using calculus.

4. (25 pts) Suppose $f(x) = \dfrac{x}{x^2 - x}$ Find the domain, x and y intercept(s), symmetry, vertical and horizontal asymptotes, intervals of increasing/decreasing, any local maximum and minimum POINTS, intervals of concave upwards/downwards, and any inflection POINTS. Use this information to ACCURATELY draw the graph of $f(x)$.

5. (20 pts) Find the most general antiderivative of

   (a) $f(\theta) = \sec^2\theta - 5\operatorname{sech}\theta\tanh\theta - \pi$

   (b) $f(x) = \dfrac{1}{\sqrt[3]{4x}} + \dfrac{1}{1+x^2} + \dfrac{1}{x}$

6. (10 pts) Verify that the function $f(x) = x^3 - 4$ satisfies the conditions of the Mean Value theorem on the interval $[-3, 0]$. Then find all the numbers c that satisfy the conclusion.

7. (10 pts) Estimate the area under $f(x) = x^2 - 4$ from $x = 2$ to $x = 8$ using three approximating rectangles and left endpoints. Draw the rectangles used to find this approximation.