# MATH 119 FINAL EXAM

SHOW ALL WORK

1) Extremize the following functions.
   a) $f_1(x) = \sqrt{x} + \sqrt{4-x}$
   b) $f_2(x) = \frac{x}{x+1}$
   c) $f_3(x) = e^{x^2+1}$
   d) $f_4(x) = x^2 e^x$
   e) $f_5(x) = \ln(x^2+1)$

2) Find the domain and range of $f(x) = (1+\sqrt{x-2})^3$. Differentiate $f$ and find its critical points.

3) Given $f(x) = \sqrt{x}$ and $g(x) = \frac{2x^3}{x-1}$ find the composition $h(x) = f(g(x))$. Then determine the domain and range of $h$, its derivative and critical points (recall that the critical points are those for which the derivative is zero or undefined).

4) Find, for $h$ from the previous problem, $\lim_{x\to\infty} \dfrac{h(x)}{x}$.

5) Evaluate the following limits:
   a) $\lim_{x\to 2} 3$
   b) $\lim_{x\to 2} 3^x$
   c) $\lim_{x\to 2^+} \dfrac{3^x}{x-2}$
   d) $\lim_{x\to 2} \dfrac{x^2-4}{x-2}$
   e) $\lim_{x\to\infty} \dfrac{x^2-4}{3x^3-2}$

6) Find the equation of the line tangent to $f(x) = (2x^2-1)\ln(x)$ at the point $(1,0)$.

7) *The Price of Wine* The monthly demand for a certain brand of table wine is given by the demand equation

$$p(x) = 240\ \{1 - \frac{3}{3+e^{-0.0005x}}\}$$

where $p$ denotes the wholesale price per case (in dollars) and $x$ denotes the number of cases demanded. Find the rate of change of the price when the number of cases demanded is one thousand.

| Function | Critical Points $x =$ | Maximum/Minimum $y =$ |
|---|---|---|
| $f_1$ | | |
| $f_2$ | | |
| $f_3$ | | |
| $f_4$ | | |
| $f_5$ | | |

| Function (Probs 2 & 3) | Domain | Range | Derivative | Critical Points, $x =$ |
|---|---|---|---|---|
| | | | | |
| | | | | |

| Problem | Correct Solution |
|---|---|
| 5 a | |
| 5 b | |
| 5 c | |
| 5 d | |
| 5 e | |
| 6 | |
| 7 | |