**MA 141** FINAL EXAM Name: _____
June 28, 1998 SS #: _____
*Show All Work* Seat #: _____

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1. (10 pts each) Find the derivative of each function. Do not simplify your answer.
   (a) $f(x) = \sqrt{\frac{ax+b}{cx+d}}$.
   (b) $f(x) = x^2\sqrt{1-5x^3}(1-2x)^3$.
   (c) $f(x) = \cot(3x^2-7)$.
   (d) $f(x) = \left(t^3 + sqrtt + 2\right)^{1/5}$.
   (e) $f(x) = \frac{x}{\sqrt{x^2-1}}$.
   (f) $f(x) = \sin^{5/7}(4t-1)$.
2. (10 pts) If $x^3 - 3x^2y^4 + 4y^3 = 6x + 1$, use implicit differentiation to find $dy/dx$.
3. (5 pts each) Let $f(x) = 3x^4 + 8x^3 - 18x^2 + 12$.
   (a) Find the interval on which $f$ is increasing or decreasing.
   (b) Find the intervals on which the graph of $f$ is concave upward or downward.
   (c) Find all numbers where relative extrema of $f$ occur.
   (d) Sketch the graph of $f$.
4. (10 pts) Find the line tangent to the curve $y = 1 + x + x^4$ at the pont $(-1, 1)$.
5. (10 pts) Equal squares are cut off at each corner of a rectangular piece of cardboard 8 inches wide by 15 inches long and an open-topped box is formed by turning up the sides. Find the length $x$ of the sides of the squares that must be cut off to produce a box of maximum volume.
6. (10 pts each) Evaluate each integral.
   (a) $\int (1+2t)^5\,dt$.
   (b) $\int x\sqrt{(7+x)}\,dx$.
   (c) $\int x(x^2+4)^{-1/3}\,dx$.
   (d) $\int x\sqrt{9-5x^2}\,dx$.
7. (10 pts) Sketch the graph of $f(x) = x + \frac{1}{x}$. Locate all relative extrema, if there is any.
8. (10 pts each) Find the limit.
   (a) $\lim_{x\to\infty}(\sqrt{x^2+x+1} - \sqrt{x^2-x})$.
   (b) $\lim_{x\to 0}\frac{x-\arctan x}{x-\arcsin x}$.
   (c) $\lim_{x\to\infty} 1 - \cos 2/xtan3/x$.
9. (10 pts) Find the area of the largest rectangle that can be inscribed in a right triangle with legs of length a $cm$ and b $cm$ if two sides of the rectangle lie along the legs.