MATH 104 HOUR 3a PRINT NAME ____________________

March 31, 2006 SIGNATURE ____________________

YOU MAY NOT SHARE CALCULATORS. SHOW ALL YOUR WORK.
Cross out work that you don't want graded. Circle your answers.

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(8) 1. Find an equation of the tangent line to the graph of $y = f(x) = \ln(x^2 e^{2x})$ at the point $(1, 2)$.

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(8) 2. If $g(x) = x^2 \ln(2x)$, find $g''(e)$.

(9) 3. Given the cost function $C = C(x) = 4x^2 + 21x + 576$ dollars, use calculus methods to determine the number of units x that should be produced in order to minimize the average cost per unit.

(10) 4. Let $y = f(x)$ be a function such that $f''(x) = x^3(x+6)(x-5)^2$ for all $x \epsilon (-\infty, +\infty)$.

(a) List the open interval(s) where the graph of f is concave up. (Hint: Chart f'')

(b) List the number(s) x where $(x, f(x))$ is a point of inflection on the graph of f.

(15) 5. Let $y = f(x) = (x+1)^3(x+3)$.

(a) Find all critical points of f.

(b) Determine the intervals of concavity and the inflection points for f.

(c) Determine the relative maxima and relative minima of f.

(10) 7. If $f(x) = xe^{-\frac{x2}{2}}$, the derivative is $f'(x) = e^{-\frac{x2}{2}}(1 - x^2)$. Use this information to find all critical points (or critical numbers) of the graph $y = f(x)$. For each critical point, say whether it is a relative minimum, a relative maximum, or neither. (Hint: Chart $f'(x)$).

(15) 8. Suppose that a manufacturer can sell x widgets at a price of $80 - .02x$ dollars each and assume that it costs $40x + 1500$ dollars to produce all x of them.

(a) Find the revenue function, and the profit function.

(b) Determine the value of x which will maximize the revenue function.

(c) Determine the value of x that will maximize the profit function.

(6) 9. If the total profit function is modeled by $P = 0.003x^2 + 0.019x - 1200$, use differentials to approximate the change in profit corresponding to an increase in sales of one unit when $x = 600$.

(8) 10. Find two nonnegative numbers x, y, whose difference is 75 and whose product is a minimum.

(6) 11. Use calculus methods to find the absolute maximum value M and the absolute minimum value m of the function $f(x) = x^3 - 12x + 4$ on the closed interval $[0, 3]$.

(5) 12. Use differentials to approximate $\sqrt{47}$