MATH 115
Exam II

Name ________________________

1. Differentiate

a) $f(x) = 3x^5 + 5\sqrt{x} + \frac{8}{x}$

b) $g(t) = e^{3t+1} + 2^t$

2. Differentiate

a) $f(x) = ln(1 + e^{-x})$

b) $g(x) = sin(x^2 + lnx)$

3. Find the equation of the line tangent to $y = 2x^3 - 5x^2 + 3x - 5$ at $x = 1$.

4. Assume the demand function for a certain product is given by $q = 1000e^{-.02p}$ where p is the price of the product in dollars and q is the quantity sold at that price.

a) Write revenue R as a function of price.

b) Find the rate of change of revenue with respect to price.

5. Choose the constants a and b in the function $f(x) = axe^{bx}$ such that $f(\frac{1}{3}) = 1$ and the function has a maximum at $x = \frac{1}{3}$.

6. Sketch a possible graph of a function $f(x)$ with the following properties:

a) $f'(x) > 0$ for $x < 2$
b) $f'(2) = 0$
c) $f'(x) > 0$ for $2 < x < 5$
d) $f'(5) = 0$
e) $f'(x) < 0$ for $x > 5$

7. Assume the cost function for a product is given by $C(q) = .04q^3 - 3q^2 + 75q + 96$ dollars where q is the number of items produced. Find the minimum average cost.

8. Find the points on the graph of $y = \frac{x^2+3x-1}{x}$ where the slope is 5.

9. A small shop sells ties for $\$3.50$ each. The daily cost function is estimated to be $C(x)$ dollars where x is the number of ties sold on a typical day and $C(x) = .0006x^3 - .03x^2 + 2x + 20$. Find the value of x that will maximize the store's daily profit.

10. A boat at anchor is bobbing up and down in the sea. The vertical distance y, in feet, between the sea floor and the boat is given as a function of time t, in minutes, by $y = 15 + sin(2\pi t)$. Find the vertical velocity of the boat at time t.