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November 19, 2002. Show all work.

Math 75 – Fall 2002 – Practice quiz #3 – Warren D. Smith

1. Suppose $F(y)$ is the inverse function of $G(x) = x^3 + x + 1$ (defined when $x < 0$). Write a formula, solely in terms of y and $F(y)$, for $F'(y)$.
2. Suppose x and y are related by $x^3 \cos(y) - \sin(xy) = 3x$. Write a formula, in terms of y and x , for $y'(x)$.
3. The voltage $V(t)$ coming out of a wall socket at time t is $V(t) = 170 \sin(120\pi t)$ where t is in seconds.
 - (a) What is the maximum voltage ever achieved (at the worst possible time to stick your finger in the socket)?
 - (b) The “average height” of a curve $y = F(x)$ in the region $a < x < b$ is the area under that curve divided by $b - a$. What is the area under the curve $y = V(t)$, in the t, y plane, when $0 < t < 1/120$? (c) What is the average voltage during the timespan $0 < t < 1/120$? (d) What about during the timespan $0 < t < 1/60$?
4. What is the derivative (d/dx) of the following functions of x :
 - (a) $\arcsin(x^2) \sin(x)$
 - (b) $x^{2^{\sin(x)}}$
 - (c) $\sin(x)^{99}$
 - (d) $\arctan(x^3)$
5. Find the Taylor series (only necessary to include terms up to and including x^3) of $\ln(1 + e^x)$ based at $x = 0$.
6. Minimize $y = \sqrt{x^3 - x + 1}$ when $x \geq 0$. What is x and what is y at the minimum?
7. For which real x is $x^3 - x + 1$ concave- \cup ?
8. What is $9!$ (the factorial of 9)?