MATH 1510 Tutorial Worksheet 6
Oct 23/Oct 25, 2007

Question 1. Find $f'(t)$ if:

(a) $f(t) = \log_{10}(10t + \sqrt{t^2 + 100})$

(b) $f(t) = \mathbf{e}^{t^3-1}(t^4 + 3t)$

(c) $f(t) = \dfrac{\mathbf{e}^t - \ln(t)}{t}$

Question 2.

(a) Find $\dfrac{d\,y}{dx}$ if $\ln(x^2 + y^2) = xy\,.$

(b) Find the value of $\dfrac{d^2\,y}{(dx)^2}$ at the point $\langle\, \mathbf{e},\, 1\,\rangle$ if $x\mathbf{e}^y - y = x^2 - 1\,.$

Question 3. Find $f'(x)$ if

(a) $f(x) = \left(1 + x^2\right)^{1/x^2}$

(b) $f(x) = \dfrac{(x^2 + 2)\sin(x + 1)\mathbf{e}^{x^3}}{x^3\cos(x)}$

Question 4. An enrichmment question for thought and exploration! Don't expect to work this out in full during the tutorial.

Note that we would *NEVER* ask a question like this on a test or exam!

Consider the function $f(x) = \mathbf{e}^x(a\cos(x) + b\sin(x))$, where a and b are non-zero constants. Find $f'(x)$.

You should be able to see how to use the expression for $f'(x)$ to work out $f''(x)$, $f'''(x)$, and $f^{(4)}(x)$ "mechanically", that is, without doing any more differentiation.

Can you see the pattern developing? Can you guess a general formula for $f^{(n)}(x)$? (Actually, you would have to set this up as a family of different formulas. The pattern for $f^{(4n)}(x)$ is the easiest one to figure out.)

[You can find such a formula in many references—maybe even in your textbook!]