Math 105 C Quiz 06 ver 02 page 1 11/01/2013 **Name** suggested soln

1. Let $f(x) = \cos(3x)\,x^5$.

1A. Find $f'(x)$ using the product and chain rules in the usual way.

$$f'(x) = (-\sin 3x)(3)x^5 + (\cos 3x)5x^4$$

1B. Find $f'(x)$ using logarithmic differentiation, and simplify the result so it's the same as in 1A. *Show all your steps!*

let $y = (\cos 3x)\,x^5$

so $\ln y = \ln(\cos(3x)\cdot x^5)$

$= \ln(\cos(3x)) + \ln(x^5)$

$= \ln(\cos(3x)) + 5\ln x$

now take derivatives :

$$\frac{1}{y}y' = \frac{1}{\cos 3x}\cdot(-\sin 3x)\cdot 3 + \frac{5}{x}$$

so $y' = \left[\frac{(-\sin 3x)(3)}{\cos 3x} + \frac{5}{x}\right](\cos 3x)\,x^5$

$= (-\sin 3x)(3)\,x^5 + 5\cos 3x\; x^4$

2. Consider the function $f(x) = x^{(x^3-5x)}$ (You can write $y = x^{(x^3-5x)}$ if you prefer).

2A: Use logarithmic differentiation to find the derivative f' of f. (You can write y' and y if you like). Express the result in terms of x).

with $y = x^{(x^3-5x)}$

we have $\ln y = \ln\left(x^{x^3-5x}\right) = (x^3-5x)(\ln x)$

so $\frac{1}{y}y' = (3x^2-5)(\ln x) + \frac{x^3-5x}{x}$ by the product rule on this

next, $y' = \left[(3x^2-5)(\ln x) + \frac{x^3-5x}{x}\right]\cdot\left[x^{x^3-5x}\right]$ where we've multiplied both sides of the previous equality by $y = x^{(x^3-5x)}$

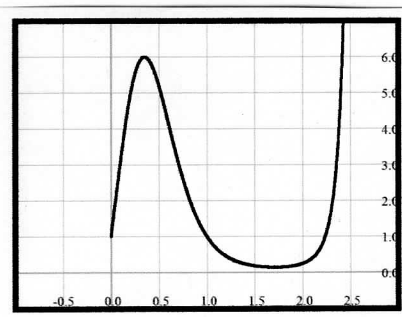
2B: Use the answer to 2A to find the slope of the line tangent to the graph of f at the point $(1, f(1))$. Show all your steps.

we need $y'\big|_{x=1} = \left[(3-5)(\ln 1) + \left(\frac{1-5}{1}\right)\right]\cdot\left[1^{1-5}\right]$

$= [-2\cdot 0 + -4]\,(1)$

$= -4$

1C: Have your calculator draw the graph of f in the window [Xmin, Xmax] $\times$ [Ymin, Ymax] $= [-1, 3] \times [-1, 7]$ and make an excellent facsimile of the result in the space to the right:



2D: Using the calculator's "maximum" function (it's on the same menu as the "zero" function) to locate the x-coordinate of the local max you see in 2C. Tell me what you used for your LeftBound, RightBound and your Guess, then also give me the value of x and y at that point (to as many places as your calculator gives you).

LeftBound = $\boxed{0.1}$ RightBound= $\boxed{0.6}$ Guess= $\boxed{0.35}$ } there are MANY possible choices ; mine are representative

x coord of local max: $\boxed{0.34904031}$ y coord of local max: $\boxed{6.0025503}$

note that the calculator will produce slightly different results from different (but all valid) choices of L Bound & R Bound!