SI Session: February, 26th, 2009
Tuesdays: 3:30 PM – 5:00 PM
Thursdays: 1:30 PM – 3:00 PM
& 3:30 PM – 5:00 PM
Room 1245 SNAD

Prof. Stockton : Calculus I
Spring 2009
SI Leader : Neil Jody

[1] Find the derivative of each function. DO NOT simplify your answer.

a) $f(x) = \dfrac{\sin(x)}{x+3}$

b) $f(x) = 2\sqrt{x}\sin x$

c) $f(x) = \dfrac{4x}{\tan(x)}$

d) $f(x) = \dfrac{\sqrt{x}-\sqrt{2}}{x-2}$

e) $f(x) = (3x^2+11x-4)(2x^2+13x-15)$

f) $f(x) = \dfrac{\sin(x)}{1-\cos(x)}$

g) $f(x)=\frac{\tan(x)}{x}$

h) $f(x)=\frac{x^4-16}{x^2-x-2}$

i) $f(x)=x\cos(x)$

j) $f(x)=2\sin(x)\cos(x)$

k) $f(x)=\frac{x^2}{\csc(x)}$

l) $f(x)=\frac{\cos(x)-1}{5x}$

m) $f(x)=(x^2+3)(x^3-3x+1)$

n) $f(x)=(x^3-2x^2+5)(x^4-3x^2+2)$

o) $f(x)=(\sqrt{x}+3x)\left(5x^2-\frac{3}{x}\right)$

p) $f(x)=\left(x^{\frac{3}{2}}-4x\right)\left(x^4-\frac{3}{x^2}+2\right)$

q) $f(x)=\frac{3x-2}{5x+1}$

r) $f(x)=\frac{x^2+2x+5}{x^2-5x+1}$

s) $f(x)=\frac{3x-6\sqrt{x}}{5x^2-2}$

t) $f(x)=\frac{(x+1)(x-2)}{x^2-5x+1}$

u) $f\left(x\right)=\frac{x^2-2x}{x^2+5x}$

v) $f\left(x\right)=\frac{2x}{x^2+1}$

w) $f\left(x\right)=\sin\left(x\right)\sec\left(x\right)$

x) $f\left(x\right)=\frac{x^2+\tan\left(x\right)}{3x+2\tan\left(x\right)}$

y) $f\left(x\right)=\frac{2+\sin\left(x\right)}{x+2}$

z) $f\left(x\right)=\frac{\sec\left(x\right)}{2-\cos\left(x\right)}$

aa) $f(x)=\dfrac{1+\sin(x)}{\sqrt{x}}$

[2] Find the indicated derivative. DO NOT simplify your answer.

a) $\dfrac{d}{dx}\left[\tan^4\left(x^3\right)\right]$

b) $\dfrac{d}{dx}\left[\cos^3\left(\dfrac{x}{x+1}\right)\right]$

c) $\dfrac{d}{dx}\left[\sqrt{\cos(5x)}\right]$

d) $\dfrac{d}{dx}\left[\sqrt{3x-\sin^2(4x)}\right]$

e) $\frac{d}{dx}\left\{\left[x+\csc(x^3+3)\right]^{-3}\right\}$

f) $\frac{d}{dx}\left[\sqrt{x}\tan^3\left(\sqrt{x}\right)\right]$

g) $\frac{d}{dx}\left[x^5\sec\left(\frac{1}{x}\right)\right]$

h) $\frac{d}{dx}\left[\frac{1+\csc\left(x^2\right)}{1-\cot\left(x^2\right)}\right]$

i) $\frac{d}{dx}\left[\frac{(2x+3)^3}{(4x^2-1)^8}\right]$

j) $\frac{d^2}{dx^2}\left[x\cos(5x)-\sin^2(x)\right]$

k) $\frac{d^2}{dx^2}\left[x\tan\left(\frac{1}{x}\right)\right]$

Differentiation Properties and Rules:

1. $\frac{d}{dx}\left[c\, f(x)\right] = c\frac{d}{dx}\left[f(x)\right]$
2. $\frac{d}{dx}\left[f(x) \pm g(x)\right] = \frac{d}{dx}\left[f(x)\right] \pm \frac{d}{dx}\left[g(x)\right]$
3. $\frac{d}{dx}\left[\mathrm{f}(x)g(x)\right] = \mathrm{f}'(x)g(x) + \mathrm{f}(x)g'(x)$
4. $\frac{d}{dx}\left[\frac{\mathrm{f}(x)}{g(x)}\right] = \frac{\mathrm{f}'(\mathrm{x})g(x) - \mathrm{f}(\mathrm{x})g'(x)}{\left(g(x)\right)^2}$
5. $\frac{d}{dx}\left[x^n\right] = nx^{n-1}$
6. $\frac{d}{dx}\left[f(g(x))\right] = f'(g(x))g'(x)$
7. $\frac{d}{dx}\left[\sin x\right] = \cos x$
8. $\frac{d}{dx}\left[\cos x\right] = -\sin x$
9. $\frac{d}{dx}\left[\tan x\right] = \sec^2 x$
10. $\frac{d}{dx}\left[\csc x\right] = -\csc x \cot x$
11. $\frac{d}{dx}\left[\sec x\right] = \sec x \tan x$
12. $\frac{d}{dx}\left[\cot x\right] = -\csc^2 x$

Trigonometric Identities (you <u>should</u> know):

1. $\sin^2(\theta) + \cos^2(\theta) = 1$
2. $\tan^2(\theta) + 1 = \sec^2(\theta)$
3. $1 + \cot^2(\theta) = \csc^2(\theta)$
4. $\sin(2\theta) = 2\sin(\theta)\cos(\theta)$

$$\cos(2\theta) = \begin{cases} \cos^2(\theta) - \sin^2(\theta) \\ 2\cos^2(\theta) - 1 \\ 1 - 2\sin^2(\theta) \end{cases}$$

$$\cos(\alpha \pm \beta) = \cos\alpha\cos\beta \mp \sin\alpha\sin\beta$$

$$\sin(\alpha \pm \beta) = \sin\alpha\cos\beta \pm \sin\beta\cos\alpha$$

Properties of Exponents:

$(a^m)^n = a^{mn}$

$(ab)^n = a^n b^n$

$a^m \cdot a^n = a^{m+n}$

$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}, b \neq 0$

$a^{-n} = \frac{1}{a^n}$

$\frac{a^m}{a^n} = a^{m-n}$

$a^0 = 1$

$a^1 = a$

$a^{\frac{m}{n}} = \left(a^{\frac{1}{n}}\right)^m = \left(\sqrt[n]{a}\right)^m = \sqrt[n]{a^m}$

$\sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt[n]{a \cdot b}$

$\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}, b \neq 0$

$b\sqrt[n]{a} \pm c\sqrt[n]{a} = (b \pm c)\sqrt[n]{a}$

Properties of Logarithms:

For all real numbers y, and all positive numbers a and x, where $a \neq 1$:

$\log_b x = y \Leftrightarrow b^y = x$

For $x > 0$, $y > 0$, $a > 0$, $a \neq 1$, and any real number r:

$\log_b x^r = r \cdot \log_b x$

$\log_b xy = \log_b x + \log_b y$

$\log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y$

For any positive real numbers x, a, and b, where $a \neq 1$ and $b \neq 1$:

$\log_b x = \frac{\log x}{\log b} = \frac{\ln x}{\ln b} = \frac{\log_a x}{\log_a b}$