MATH 205 – Calculus I **SQ 3.9**

Name: Nathan Hallan Date: 10/07/2020

1. Fill in the following derivative rules:

$\frac{d}{dx}\sqrt{x} = \frac{1}{2}(x)^{-1/2}$

$\frac{d}{dx}\csc x = -\csc(x)\cot(x)$

$\frac{d}{dx}x^n = nx^{n-1}$

$\frac{d}{dx}\tan x = (\sec x)^2$

$\frac{d}{dx}\frac{1}{x} = \frac{x(0)-1(1)}{x^2} = \frac{-1}{x^2}$

$\frac{d}{dx}b^x = e^{x\ln b}$

$= b^x \cdot \ln b + x(0)$

$d/dx = b^x \cdot \ln b$

$\frac{d}{dx}e^x = e^x$

$\frac{d}{dx}\cot x = -(\csc x)^2$

$\frac{d}{dx}\cos x = -\sin x$

$\frac{d}{dx}x = 1$

$\frac{d}{dx}\sin x = \cos x$

$\frac{d}{dx}\sec x = \sec(x)\tan(x)$

$\frac{d}{dx}c = 1$

$\frac{d}{dx}\log_b x = \frac{1}{\ln(b)\cdot x}$

$\frac{d}{dx}\ln x = \frac{1}{x}$

Chain Rule: $\frac{d}{dx}f(g(x)) = f'(g(x))g'(x)$

Product Rule: $\frac{d}{dx}f(x)g(x) = f(x)g'(x)+g(x)f'(x)$

Quotient Rule: $\frac{d}{dx}\frac{f(x)}{g(x)} = \left[\frac{[g(x)f'(x)-f(x)g(x)]}{(g(x))^2}\right]$

Instructions: Though calculators can be used for the entire daily question, all problems require you to show your work. Any answer without proper justification will receive ***ZERO*** credit. Only **EXACT** answers will receive full credit unless otherwise noted.

2. Determine $f'(x)$ for $f(x) = 5\ln(\cos(x)) + 3^{\sqrt{x^4+1}}$

$$f(x) = \frac{-5}{\cos x}(\sin x) + e^{\sqrt{x^4+1}\,\ln 3}$$

$$f'(x) = \frac{-5\sin(x)}{\cos(x)} + \left[3^{\sqrt{x^4+1}}\right]\left[\sqrt{x^4+1}\,(0) + (\ln(3))\left(\tfrac{1}{2}(x^4+1)^{-1/2}(4x^3)\right)\right]$$

$$f'(x) = -5\tan(x) + \left[3^{\sqrt{x^4+1}}\right]\left[\ln(3)\frac{4x^3}{2\sqrt{x^4+1}}\right]$$

3. Use logarithmic differentiation to determine $f'(x)$ for $f(x) = (\tan x)^{\sin x}$

$$f(x) = e^{\sin(x)\ln(\tan(x))}$$

$$f'(x) = (\tan x)^{\sin x}\left[\sin(x)\left(\frac{1}{\tan x}\right)(\sec x)^2 + \ln(\tan x)\cos x\right]$$

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$$f'(x) = (\tan x)^{\sin x}\left[\sec x + \ln(\tan x)\cos x\right]$$