Math 251: Quiz 5 **February 26, 2019**

Name: Solutions _____ / 25

Circle one: **Rhodes (F01)** | **Bueler (F02)**

25 points possible. No aids (book, calculator, etc.) are permitted. You need not simplify, but show all work and use proper notation for full credit.

1. [15 points] Differentiate the following. Use proper notation to indicate your answer.

a. $f(t) = \sqrt{2+\sin x}$ $= (2+\sin x)^{\frac{1}{2}}$

$$f'(x) = \tfrac{1}{2}(2+\sin x)^{-\frac{1}{2}}(\cos x) = \frac{\cos x}{2\sqrt{2+\sin x}}$$

b. $g(x) = \sec^2(5x)$

$$\frac{dg}{dx} = 2\sec(5x)\,\sec(5x)\tan(5x)\cdot 5 = 10\sec^2(5x)\tan(5x)$$

c. $f(x) = e^{x\tan x}$

$$f'(x) = e^{x\tan x}\left(1\cdot\tan x + x\sec^2 x\right)$$
$$= e^{x\tan x}\left(\tan x + x\sec^2 x\right)$$

d. $f(\theta) = \theta\sin\theta\cos\theta$

$$f'(\theta) = 1\cdot\sin\theta\cos\theta + \theta\frac{d}{d\theta}(\sin\theta\cos\theta)$$
$$= \sin\theta\cos\theta + \theta(\cos^2\theta - \sin^2\theta)$$

e. $y = x10^x$ $= xe^{(\ln 10)x}$

$$y' = e^{(\ln 10)x} + xe^{(\ln 10)x}\ln(10)$$
$$= 10^x + x10^x\ln(10)$$

2. [4 points] An object is at position $s(t) = \sqrt{t^2 - 4t + 7}$ meters at time $t \geq 0$ seconds. When, if ever, is its instantaneous velocity 0?

$s(t) = (t^2 - 4t + 7)^{1/2}$

$s'(t) = \frac{1}{2}(t^2 - 4t + 7)^{-1/2}(2t - 4) = 0$

$2t - 4 = 0$

$t = 2$

3. [6 points] Find an equation of the tangent line to the curve $y = \dfrac{2}{(\sin x + 1)^2}$ at the point where $x = \pi$.

$y = 2(\sin x + 1)^{-2}$ $\qquad y|_{x=\pi} = 2(\sin \pi + 1)^{-2} = 2(1)^{-2} = 2$

$y' = 2(-2)(\sin x + 1)^{-3}(\cos x)$ $\qquad y'|_{x=\pi} = -4(\sin(\pi) + 1)^{-3}\cos(\pi)$

$= -4(-1) = 4$

$y - 2 = 4(x - \pi)$

$y = 2 + 4(x - \pi)$