**Name:** _____ _____ / 25

**Instructor:** **Bueler | Jurkowski | Maxwell**

There are 25 points possible on this quiz. No aids (book, calculator, etc.) are permitted. Show all work for full credit.

**1. [16 points]** Compute the derivatives of the following functions. You need not simplify your answers.

**a.** $r(\theta) = \theta \sec(\theta)\tan(\theta)$

$r'(\theta) = \sec(\theta)\tan(\theta) + \theta\sec(\theta)\tan^2(\theta) + \theta\sec^3(\theta)$

**b.** $g(t) = e^{t^2}\sec(t)$

$g'(t) = 2te^{t^2}\sec(t) + e^{t^2}\sec(t)\tan(t)$

**c.** $f(x) = \dfrac{x^2}{\sqrt{2x+3}}$

$$f'(x) = \frac{2x\sqrt{2x+3} - x^2\frac{1}{\sqrt{2x+3}}}{2x+3} = \frac{2x(2x+3) - x^2}{(2x+3)^{3/2}} = \frac{3x^2+3x}{(2x+3)^{3/2}}$$

**d.** $s(t) = \tan\left(e^{\sin(t)}\right)$

$s'(t) = \sec^2\left(e^{\sin(t)}\right)\cdot e^{\sin(t)}\cdot\cos(t)$

**2. [5 points]**

**a**. Find the first four derivatives of $y = \cos(4x)$.

$y' = -4\sin(4x)$

$y'' = -4^2\cos(4x)$

$y''' = 4^3\sin(4x)$

$y'''' = 4^4\cos(4x)$

**b**. Using part (a), determine the 49th derivative of $y = \cos(4x)$.

$49 = 4 \cdot 12 + 1$

$y^{(49)} = \frac{d}{dx} 4^{48}\cos(4x) = -4^{49}\sin(4x)$

**3. [4 points]** Consider the function $f(t) = t - \cos t$.

**a**. Find all $t$ values for which $f(t)$ has a horizontal tangent line.

$f'(t) = 1 + \sin(t)$

$f'(t) = 0 \Rightarrow \sin(t) = -1$

$t = \frac{3\pi}{2} + 2\pi k$, $k$ an integer

**b**. Suppose $f(t)$ represents the position in feet of some particle at time $t$ seconds. Find the velocity of the particle at time $t = \frac{\pi}{2}$.

$f'(\pi/2) = 1 + \sin(\pi/2) = 2$ ft/s