

Name: _____

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

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

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

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

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

$$f'(x) = \frac{3x^2 \sqrt{2x-5} - x^3 \frac{1}{\sqrt{2x-5}}}{2x-5} = \frac{3x^2(2x-5) - x^3}{(2x-5)^{3/2}}$$

d. $s(t) = \tan(e^{\cos(t)})$

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

2. [5 points]

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

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

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

$$y'' = -16 \cos(4x)$$

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

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

- b. Using part (a), determine the 47th derivative of
- $y = \cos(4x)$
- .

$$47 = 4 \cdot 11 + 3$$

$$y^{(47)} = 4^{47} \sin(4x)$$

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.

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

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

$$t = 3\frac{\pi}{2} + 2\pi k, \quad k \in \mathbb{Z}$$

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

$$f'\left(\frac{\pi}{2}\right) = 1 + \sin\left(\frac{\pi}{2}\right) = 2.$$

Velocity: 2 ft/s