Name: ____

- There are 12 points possible on this proficiency, one point per problem. **No partial credit will be given.**
- A passing score is 10/12.
- You have 30 minutes to complete this proficiency.
- No aids (book, calculator, etc.) are permitted.
- You do **not** need to simplify your expressions.
- Your final answers **must start with** $f'(x) =$, $dy/dx =$, or similar.
- **Circle or box your final answer.**

1. [12 points] Compute the derivatives of the following functions.

a. $f(x) = e^{(3-x^4)}$

$$f'(x) = -4x^3 e^{3-x^4}$$

b. $f(x) = \frac{\sin x}{x^2} = x^{-2}\sin(x)$

$$f'(x) = -2x^{-3}\sin(x) + x^{-2}\cos(x)$$

c. $f(x) = \ln(\sec x + \tan x)$

$$\boxed{f'(x) = \frac{\sec(x)\tan(x) + \sec^2(x)}{\sec x + \tan(x)}}$$

d. $f(x) = \frac{x^3}{4} + \frac{2}{\sqrt{x}} + \sqrt{50}$ $= \frac{1}{4}x^3 + 2x^{-1/2} + \sqrt{50}$

$$\boxed{f'(x) = \frac{3}{4}x^2 + 2\left(\frac{-1}{2}\right)x^{-3/2} + 0 = \frac{3}{4}x^2 - x^{-3/2}}$$

e. $f(x) = \log_b(x^2 \sin x)$ (where $b > 1$)

$$\boxed{f'(x) = \frac{2x\sin(x) + x^2\cos(x)}{(\ln b)(x^2\sin(x))}}$$

f. $f(x) = (e^x + \cos(2x))^{5/4}$

$$f'(x) = \frac{5}{4}\left(e^x + \cos(2x)\right)^{1/4}\left(e^x - 2\sin(2x)\right)$$

g. $y = \pi\left(\frac{x+2}{2}\right)^3$ $= \pi\left(\frac{x}{2}+1\right)^3$

$$y' = \pi \cdot 3\left(\frac{x}{2}+1\right)^2\left(\frac{1}{2}\right) = \boxed{\frac{3\pi}{2}\left(\frac{x}{2}+1\right)^3}$$

h. $f(x) = \arctan(\sqrt{x})$

$$f'(x) = \frac{1}{1+(\sqrt{x})^2} \cdot \left(\frac{1}{2}x^{-1/2}\right) = \boxed{\frac{1}{2\sqrt{x}\,(1+x)}}$$

i. $f(x) = \dfrac{8+x^2}{x\cos(\pi)}$

$$f'(x) = \frac{x\cos(\pi)[2x] - (8+x^2)(\cos(\pi))}{[x \cdot \cos(\pi)]^2}$$

j. $f(x) = x\ln(5+\frac{x}{5})$ $= x\ln(5+\frac{1}{5}x)$

$f'(x) = 1\cdot\ln(5+\frac{1}{5}x) + x\cdot\left(\frac{1/5}{5+\frac{1}{5}x}\right)$

$= \boxed{\ln(5+\frac{x}{5}) + \frac{x}{25+x}}$

k. $f(x) = e^{-x} + e^2 + x^{0.8}$

$f'(x) = -e^{-x} + 0.8x^{-0.2}$

l. Find $\frac{dy}{dx}$ for $x^2 + y^2 = 25 + 2xy^2$. You must solve for $\frac{dy}{dx}$.

$2x + 2y\frac{dy}{dx} = 0 + 2\cdot y^2 + 4x\cdot y\frac{dy}{dx}$

$(2y - 4xy)\left(\frac{dy}{dx}\right) = 2y^2 - 2x$

$\boxed{\frac{dy}{dx} = \frac{2y^2-2x}{2y-4xy}}$