Name: SOLUTIONS ______ / 12

- There are 12 points possible on this proficiency: **One point per problem. No partial credit.**
- 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 your final answer.

Compute the derivatives of the following functions.

1. $f(x) = \sqrt{x} + \sqrt{6} - \frac{e^x}{3}$

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

2. $f(t) = \frac{1+5t-t^{4/3}}{t} = t^{-1} + 5 - t^{1/3}$

$$f'(t) = -t^{-2} - \frac{1}{3}t^{-2/3}$$

3. $y = x^2 \sec(x)$

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

4. $y = e^{-ax}\cos(bx)$, where a and b are fixed constants

$y' = -ae^{-ax}\cos(bx) + e^{-ax}(-\sin(bx))\,b$

5. $f(x) = \arctan(\sin(5x))$

$f'(x) = \dfrac{1}{1+(\sin(5x))^2} \cdot \cos(5x) \cdot 5$

6. $f(x) = \dfrac{\cos(x)}{\sin(x)}$ $= \cot(x)$

$f'(x) = -\csc^2(x)$

7. $y = \dfrac{xe^x}{1-x}$

$$\frac{dy}{dx} = \frac{(1 \cdot e^x + xe^x)(1-x) - xe^x(-1)}{(1-x)^2}$$

8. $y = \tan\left(x + \sqrt{x}\right)$

$$\frac{dy}{dx} = \sec^2(x+\sqrt{x})\left(1 + \tfrac{1}{2}x^{-1/2}\right)$$

9. $f(x) = \sqrt{x}\ln(x)\sin(\pi x)$

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

10. $f(x) = x + \sqrt{x^2+1}$

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

11. $g(t) = \dfrac{\ln 3}{1-t^2}$ $= \ln(3)(1-t^2)^{-1}$

$$g'(t) = -\ln(3)(1-t^2)^{-2}(-2t)$$

12. Compute dy/dx if $2xy^2 - x^3 + y^5 = 0$. You must solve for dy/dx.

$$2y^2 + 2x \cdot 2yy' - 3x^2 + 5y^4 y' = 0$$

$$y'(4xy + 5y^4) = -2y^2 + 3x^2$$

$$\frac{dy}{dx} = \frac{-2y^2 + 3x^2}{4xy + 5y^4}$$