Name: ______________________ ________ / 12

Instructor: **Bueler | Jurkowski | Maxwell**

- There are 12 points possible on this proficiency: **One point per problem. No partial credit.**
- A passing score is 10/12.
- You have 60 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. $g(t) = \dfrac{3\sin(t)}{\cos(t)}$ $= 3\tan(t)$

$$g'(t) = 3\sec^2(t)$$

2. $f(x) = (\sec x + e^x)(x^2 - 5)$

$$f'(x) = (\sec(x)\tan(x) + e^x)(x^2-5) + (\sec(x) + e^x)(2x)$$

3. $f(x) = \dfrac{\pi^2}{x^3 - 4}$

$$f'(x) = \frac{0(x^3-4) - \pi^2(3x^2)}{(x^3-4)^2} = -\pi^2(x^3-4)^{-2}(3x^2)$$

4. $y = e^{4x}\tan(x)$

$$\frac{dy}{dx} = 4e^{4x}\tan(x) + e^{4x}\sec^2(x)$$

5. $f(x) = ax^b\cos(\pi x)\ln(x)$, where a and b are fixed constants.

$$f'(x) = abx^{b-1}\cos(\pi x)\ln(x) + ax^b(-\sin(\pi x))(\pi)\ln(x) + ax^b\cos(\pi x)\frac{1}{x}$$

6. $g(w) = \dfrac{2w^2 - w^{5/4} + 3w}{w}$ $= 2w - w^{1/4} + 3$

$$g'(w) = 2 - \frac{1}{4}w^{-3/4} + 0$$

7. $f(x) = \dfrac{1-2x^4}{x^2-\sqrt{6}}$

$$f'(x) = \frac{(-8x^3)(x^2-\sqrt{6})-(1-2x^4)(2x)}{(x^2-\sqrt{6})}$$

8. $r(\theta) = \sqrt{\sin(\theta)}$

$$r'(\theta) = \frac{1}{2}(\sin\theta)^{-1/2}(\cos\theta)$$

9. $y = e^{\arctan(4x)}$

$$\frac{dy}{dx} = e^{\arctan(4x)} \cdot \frac{1}{1+(4x)^2} \cdot 4$$

10. $f(x) = \dfrac{x}{\ln(2)} + \dfrac{4}{x}$ $= \dfrac{1}{\ln(2)} x + 4x^{-1}$

$$f'(x) = \frac{1}{\ln(2)} - 4x^{-2}$$

11. $g(x) = \ln(\sqrt{x} + \ln(x))$

$$g'(x) = \frac{1}{\sqrt{x} + \ln x} \cdot \left(\tfrac{1}{2}x^{-1/2} + \tfrac{1}{x}\right)$$

12. Compute dy/dx if $x^2 e^x + y\ln(x) = e^y$. You must solve for dy/dx.

$$2xe^x + x^2e^x + \frac{dy}{dx}\ln x + y \cdot \frac{1}{x} = e^y \frac{dy}{dx}$$

$$\frac{dy}{dx}(\ln x - e^y) = -2xe^x - x^2e^x - \frac{y}{x}$$

$$\frac{dy}{dx} = \frac{-e^x(2x + x^2) - \frac{y}{x}}{\ln x - e^y}$$