Name: ______________________ ________ / 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. $f(x) = \dfrac{x - \ln 3}{5} - \sqrt[3]{x}$

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

2. $h(x) = e^{-x/3}\cos(x)$

$$h'(x) = -\frac{1}{3}e^{-x/3}\cos(x) + e^{-x/3}(-\sin(x))$$

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

$$f'(t) = -t^{-2} + 2t^{-3/2} + 2t$$

4. $g(x) = \dfrac{1}{\sin(x)}$ $= \csc(x)$

$$g'(x) = -\csc(x)\cot(x)$$

5. $y = \arccos\left(2x^{1/4} + \sqrt{6}\right)$

$$y' = \frac{-1}{\sqrt{1-(2x^{1/4}+\sqrt{6})^2}}\left(\frac{1}{2}x^{-3/4}\right)$$

6. $f(x) = x^k + e^{-kx}$, where k is a fixed constant

$$f'(x) = kx^{k-1} - ke^{-kx}$$

7. $y = \dfrac{\tan(x)}{1+\ln(x)}$

$$\frac{dy}{dx} = \frac{\sec^2(x)\,(1+\ln(x)) - \tan(x)\left(\frac{1}{x}\right)}{(1+\ln(x))^2}$$

8. $y = e^x \ln(2x)\sec(x)$

$$y' = e^x \cdot \ln(2x) \cdot \sec(x) + e^x \cdot \frac{1}{2x} \cdot 2 \cdot \sec(x) + e^x \cdot \ln(2x) \cdot \sec(x)\tan(x)$$

9. $y = \sin^2\left(x - \sqrt{x}\right)$

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

10. $h(x) = \dfrac{\pi}{x^2} + \left(\dfrac{x-1}{4}\right)^3$

$$h'(x) = -2\pi x^{-3} + 3\left(\frac{x-1}{4}\right)^2\left(\frac{1}{4}\right)$$

11. $g(x) = \dfrac{\cos(2x)}{x^3+x}$

$$g'(x) = \frac{-\sin(2x)\cdot 2\,(x^3+x) - \cos(2x)\,(3x^2+1)}{(x^3+x)^2}$$

12. Compute dy/dt if $\quad ye^y + 5 = 2\sin(y)t^3$. $\quad$ You must solve for dy/dt.

$$y'e^y + ye^y y' = 2\cos(y)y't^3 + 2\sin(y)3t^2$$

$$y'\left(e^y + ye^y - 2t^3\cos(y)\right) = 6t^2\sin(y)$$

$$\frac{dy}{dt} = \frac{6t^2\sin(y)}{e^y(1+y) - 2t^3\cos(y)}$$