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. $f(x) = \frac{x - \ln 2}{5} - \sqrt[3]{x}$

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

2. $g(x) = \frac{1}{\sin(x)}$ $= \csc x$

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

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

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

4. $h(x) = e^{-x/4}\cos(x)$

$$h'(x) = -\frac{1}{4}e^{-x/4}\cos x + e^{-x/4}(-\sin x)$$

5. $y = \arcsin\left(2x + \sqrt{6}\right)$

$$\frac{dy}{dx} = \frac{1}{\sqrt{1-(2x+\sqrt{6})^2}}(2)$$

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

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

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

$$y' = \frac{\sec^2(x)(1+\ln x) - \tan(x)\left(\frac{1}{x}\right)}{(1+\ln(x))^2}$$

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

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

9. $y = \sin^2\left(x - \sqrt{x^2+1}\right)$

$$y' = 2\sin\left(x - \sqrt{x^2+1}\right) \cdot \cos\left(x - \sqrt{x^2+1}\right)\left(1 - \tfrac{1}{2}(x^2+1)^{-1/2} \cdot 2x\right)$$

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

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

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

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

12. Compute dy/dt if $e^y + t^3 = y\cos(y)$. You must solve for dy/dt.

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

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

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