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

$$g'(x) = 2\left(\tfrac{3}{2}\right)x^{1/2} - \tfrac{5}{2}x^{3/2}$$

$$\boxed{g'(x) = 3x^{1/2} - \tfrac{5}{2}x^{3/2}}$$

2. $r(\theta) = \dfrac{1}{\sin(\theta)}$ $= \csc(\theta)$ $\boxed{r'(\theta) = -\cot\theta\csc\theta}$

$$r'(\theta) = \frac{\sin\theta(0) - 1(\cos\theta)}{\sin^2\theta} = -\frac{\cos\theta}{\sin^2\theta} \boxed{= -\cot\theta\csc\theta}$$

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

$$\boxed{f'(x) = \frac{3}{x^4}}$$

4. $y = ax^3 + e^{(bx^2)}$, where a and b are fixed constants

$$\boxed{y' = 3ax^2 + 2bxe^{bx^2}}$$

5. $s(t) = \tan\left(\ln\left(-t^2\right)\right)$

$$s'(t) = \sec^2(\ln(-t^2)) \cdot \frac{1}{-t^2}(-2t)$$

$$\boxed{= \frac{2}{t}\sec^2(\ln(-t^2))}$$

6. $g(x) = \left(\frac{1}{x} - x^2\right)^3 (2x-1)$

$$\boxed{g'(x) = \left(\frac{1}{x} - x^2\right)^3(2) + 3\left(\frac{1}{x} - x^2\right)^2\left(-\frac{1}{x^2} - 2x\right)(2x-1)}$$

7. $h(y) = (\ln(y) + y)^{5/4}$

$$\boxed{h'(y) = \frac{5}{4}\left(\ln(y) + y\right)^{1/4}\left(\frac{1}{y} + 1\right)}$$

8. $f(x) = \dfrac{\cos(\pi x)}{e^{2x} - 1}$

$$f'(x) = \frac{(e^{2x} - 1)(-\sin(\pi x)\pi) - \cos(\pi x) \cdot 2e^{2x}}{(e^{2x} - 1)^2}$$

9. $y = \ln(x)\tan(3x)\cos(x - \pi)$

$$y' = \frac{1}{x}\tan(3x)\cos(x-\pi) + \ln(x)\left[3\sec^2(3x)\cos(x-\pi) + \tan(3x)(-\sin(x-\pi))\right]$$

10. $f(x) = \ln(e^x + \ln(3))$

$$\boxed{f'(x) = \frac{1}{e^x + \ln(3)} \cdot e^x}$$

11. $f(x) = \left(\sqrt{1-x^2}\right)\arcsin(x)$

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

$$\boxed{= \frac{-x \arcsin x}{\sqrt{1-x^2}} + 1}$$

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

$$2x = e^y \frac{dy}{dx} + y^2 + 2xy\frac{dy}{dx}$$

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

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