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. $f(x) = \sqrt{8} - \sin(3x)$

$$\boxed{f'(x) = -3\cos(3x)}$$

2. $f(x) = x^3 \cos(x)$

$$\boxed{f'(x) = 3x^2\cos(x) - x^3\sin(x)}$$

3. $y = \dfrac{t^3 - 3t^2 - t^{\frac{1}{3}}}{t}$ $= t^2 - 3t - t^{-2/3}$

$$\boxed{y' = 2t - 3 + \frac{2}{3}t^{-5/3}}$$

4. $y = \dfrac{1}{\cos(x)}$

$$y' = \frac{-1}{\cos^2(x)} \cdot \frac{d}{dx}\left(\cos(x)\right)$$

$$= \frac{\sin(x)}{\cos^2(x)} = \boxed{\tan(x)\sec(x)}$$

5. $g(r) = \sqrt{1+r^a}$ where a is a fixed constant.

$$g'(r) = \frac{1}{2\sqrt{1+r^a}} \cdot \left(a r^{a-1}\right)$$

6. $h(w) = \sec\left(\frac{w}{1+w}\right)$

$$h'(w) = \sec\left(\frac{w}{1+w}\right)\tan\left(\frac{w}{1+w}\right) \cdot \left[\frac{1\cdot(1+w) - w\,(1)}{(1+w)^2}\right]$$

$$= \boxed{\sec\left(\frac{w}{1+w}\right)\tan\left(\frac{w}{1+w}\right) \cdot \frac{1}{(1+w)^2}}$$

7. $v(\theta) = \dfrac{\sin(\theta)}{\theta}$

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

$$= \boxed{\frac{\theta\cos(\theta) - \sin(\theta)}{\theta^2}}$$

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

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

9. $y = x^3\tan(x)\ln(x)$

$$y' = 3x^2\tan(x)\ln(x) + x^3\sec^2(x)\ln(x) + \frac{x^3\tan(x)}{x}$$

$$\boxed{= x^2\left[3\tan(x)\ln(x) + x\sec^2(x)\ln(x) + \tan(x)\right]}$$

10. $y = \arctan(\ln(1-3x))$

$$y' = \frac{1}{1+(\ln(1-3x))^2} \cdot \frac{1}{1-3x} \cdot (-3)$$

11. $y = \sin(x)\cos(1-3x^2)$

$$y' = \cos(x)\cos(1-3x^2) - \sin(x)\sin(1-3x^2)\cdot(-6x)$$

$$= \boxed{\cos(x)\cos(1-3x^2) + 6x\sin(x)\sin(1-3x^2)}$$

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

$$\sin(y) + x\cos(y)y' + y^2 + x\,2yy' = e^x$$

$$[x\cos(y) + 2xy]\,y' = e^x - \sin(y) - y^2$$

$$\boxed{y' = \frac{e^x - \sin(y) - y^2}{x\cos(y) + 2xy}}$$