Name: ______________________________ ________ / **12**

- There are 12 points possible on this proficiency: one point per problem with no partial credit.
- 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 should start with $f'(x) =$, $dy/dx =$ or something similar.
- $\boxed{\text{Box}}$ your final answer.

1. $P(\theta) = \cos(3\theta^4 - 3\theta + 1)$

$$P'(\theta) = \left(-\sin(3\theta^4 - 3\theta + 1)\right)(12\theta^3 - 3)$$

2. $k(t) = \dfrac{1}{\sqrt[3]{3t}} + \left(\dfrac{t-8}{6}\right)^4 = \dfrac{1}{\sqrt[3]{3}} t^{-1/3} + \left(\dfrac{t}{6} - \dfrac{8}{6}\right)^4$

$$k'(t) = -\frac{1}{3} \cdot \frac{1}{\sqrt[3]{3}} t^{-4/3} + 4\left(\frac{t}{6} - \frac{8}{6}\right)^3 \cdot \frac{1}{6}$$

3. $j(x) = \left(x^3\right)\sec(x)$

$$j'(x) = 3x^2 \sec x + x^3 \sec x \tan x$$

4. $f(x) = \dfrac{x^{1/5}}{\pi^2} + 6e^x + \sqrt{2}$

$$f'(x) = \left(\frac{1}{\pi^2}\right)\left(\frac{1}{5}x^{-4/5}\right) + 6e^x$$

5. $f(t) = \sqrt{t + \tan(\pi t)}$ $= \left(t + \tan(\pi t)\right)^{1/2}$

$$f'(t) = \frac{1}{2}\left(t + \tan(\pi t)\right)^{-1/2}\left(1 + \sec^2(\pi t)\cdot\pi\right)$$

6. $G(x) = \dfrac{x^7 - x^{\frac{3}{2}} + 5}{\sqrt{x}}$ $= x^{\frac{13}{2}} - x + 5t^{-1/2}$

$$G'(x) = \frac{13}{2}x^{11/2} - 1 - \frac{5}{2}x^{-3/2}$$

7. $f(v) = \arcsin(\sqrt{v})$ $= \arcsin(v^{1/2})$

$$f'(v) = \frac{1}{\sqrt{1-(v^{1/2})^2}} \cdot \left(\frac{1}{2} v^{-1/2}\right)$$

8. $f(x) = (2x+1)\tan(x)\ln(7x)$

$$f'(x) = 2\tan x \ln(7x) + (2x+1)\sec^2 x \ln(7x) + (2x+1)\tan x \left(\frac{1}{7x}\right)(7)$$

9. $h(z) = z\ln(cz) + c^2$ (where c is a constant)

$$h'(z) = \ln(cz) + z\left(\frac{1}{cz}\right)(c)$$

10. $F(x) = \dfrac{9}{\sin(x)}$ $= 9\csc x$

$F'(x) = -9\cot x \csc x$

11. $g(t) = \dfrac{1+e^{t}}{1+e^{-9t}}$

$g'(t) = \dfrac{(1+e^{-9t})(e^{t}) - (1+e^{t})(-9e^{-9t})}{(1+e^{-9t})^2}$

12. Compute $\frac{dy}{dx}$ if $\cos(x^2+y^2) = 5xy$. You $\boxed{\text{must}}$ solve for $\frac{dy}{dx}$.

$-\sin(x^2+y^2)\left(2x+2y\frac{dy}{dx}\right) = 5y + 5x\frac{dy}{dx}$

$-2x\sin(x^2+y^2) - 2y\sin(x^2+y^2)\frac{dy}{dx} = 5y + 5x\frac{dy}{dx}$

$-2x\sin(x^2+y^2) - 5y = \left(2y\sin(x^2+y^2) + 5x\right)\frac{dy}{dx}$

$\frac{dy}{dx} = \dfrac{-2x\sin(x^2+y^2) - 5y}{2y\sin(x^2+y^2) + 5x}$