**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. $j(x) = \left(x^4\right)\sec(x)$

$j'(x) = 4x^3 \sec x + x^4 \sec x \tan x$

2. $P(\theta) = \sin(3\theta^5 - 2\theta + 1)$

$P'(\theta) = [\cos(3\theta^5 - 2\theta + 1)][15\theta^4 - 2]$

3. $k(t) = \frac{1}{\sqrt[3]{3t}} + \left(\frac{t-8}{7}\right)^3$ $= \frac{1}{\sqrt[3]{3}} t^{-1/3} + \left(\frac{t}{7} - \frac{8}{7}\right)^3$

$K'(t) = \frac{1}{\sqrt[3]{3}} \cdot \left(-\frac{1}{3}\right) t^{-4/3} + 3\left(\frac{t}{7} - \frac{8}{7}\right)^2 \left(\frac{1}{7}\right)$

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

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

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

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

6. $G(x) = \dfrac{x^5 - x^{\frac{3}{2}} + 7}{\sqrt{x}}$ $= x^{\frac{9}{2}} - x + 7x^{-1/2}$

$$G'(x) = \frac{9}{2}x^{7/2} - 1 - \frac{7}{2}x^{-3/2}$$

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

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

$$= \ln(cz) + 1$$

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

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

$$= \frac{1}{2\left(\sqrt{1-v}\right)\left(\sqrt{v}\right)}$$

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

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

10. $F(x) = \frac{8}{\tan(x)} = 8\cot x$

$F'(x) = -8\csc^2 x$

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

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

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

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

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

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

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