Name: ______________________________ ________ / 12

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

1. $f(t) = e^t(4 - t^3)$

$f'(t) = e^t(4-t^3) + e^t(-3t^2)$

2. $r(\theta) = \tan\left(\sqrt{3} + \theta^5\right)$

$r'(\theta) = \left(\sec^2(\sqrt{3}+\theta^5)\right)(5\theta^4)$

3. $f(x) = \dfrac{5}{\cos x}$ $= 5\sec x$

$f'(x) = 5\sec x \tan x$

4. $f(r) = \dfrac{r^4 + \sqrt{r} - 9}{r}$ $= r^3 + r^{-1/2} - 9r^{-1}$

$f'(r) = 3r^2 - \frac{1}{2} r^{-3/2} + 9r^{-2}$

5. $G(x) = \left(\dfrac{x - \ln(4)}{2}\right)^3 + x\sqrt{x+1}$ $= \left(\frac{x}{2} - \frac{\ln 4}{2}\right)^3 + x(x+1)^{1/2}$

$G'(x) = 3\left(\frac{x}{2} - \frac{\ln 4}{2}\right)^2\left(\frac{1}{2}\right) + 1(x+1)^{1/2} + x\left(\frac{1}{2}\right)(x+1)^{-1/2}$

6. $g(z) = (6 - z)(z^2 + 3)$

$g'(z) = (-1)(z^2+3) + (6-z)(2z)$

7. $f(y) = \pi + \cos(y^e)$

$$f'(y) = \left(-\sin(y^e)\right)\left(ey^{e-1}\right)$$

8. $y = x^{1/4}e^{-x}\sin(x)$

$$y' = \frac{1}{4}x^{-3/4}e^{-x}\sin x + x^{1/4}(-e^{-x})(\sin x) + x^{1/4}e^{-x}(\cos x)$$

9. $f(x) = \dfrac{2\sec(ax)}{3x^3}$ (where a is a constant)

$$f'(x) = \frac{(3x^3)\left(2\sec(ax)\tan(ax)\right)(a) - 2\sec(ax)(9x^2)}{(3x^3)^2}$$

10. $y(t) = \ln(3t + \sin(t^2))$

$$y'(t) = \frac{3 + 2t\cos(t^2)}{3t + \sin(t^2)}$$

11. $g(x) = \arctan(e^{2x})$

$$g'(x) = \frac{2e^{2x}}{1 + (e^{2x})^2}$$

12. Compute $\frac{dy}{dt}$ if $\ln y - 5t = t^2 y$. You $\boxed{\text{must}}$ solve for $\frac{dy}{dt}$.

$$\frac{1}{y}\frac{dy}{dt} - 5 = 2ty + t^2\frac{dy}{dt}$$

$$\left(\frac{1}{y} - t^2\right)\frac{dy}{dt} = 2ty + 5$$

$$\frac{dy}{dt} = \frac{2ty + 5}{\frac{1}{y} - t^2}$$