Name: Solns / 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. $f(t) = e^t(3-t^4)$

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

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

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

3. $g(z) = (3z-4)(z^2+7)$

$$g'(z) = 3(z^2+7) + (3z-4)(2z)$$

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

$f'(x) = 3\sec x \tan x$

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

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

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

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

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

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

8. $f(x) = \dfrac{2\sec(bx)}{3x^3}$ (where b is a constant)

$$f'(x) = \frac{(3x^3)(2\sec(bx)(\tan bx)(b)) - (2\sec(bx))(9x^2)}{(3x^3)^2}$$

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

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

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

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

11. $g(x) = \arctan(e^{3x})$

$$g'(x) = \frac{3e^{3x}}{1 + (e^{3x})^2}$$

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

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

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

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