**Circle your Instructor:** Faudree, Williams, Zirbes ________ / 15

**Name:** Solutions

This is a 30 minute quiz. There are 15 problems. Books, notes, calculators or any other aids are prohibited. Calculators and notes are not allowed. **Your answers should be simplified unless otherwise stated.** They should begin $y' =$ or $f'(x) =$ or $dy/dx =$, etc. There is no partial credit. If you have any questions, please raise your hand.

**Circle your final answer.**

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For each function below, find the derivative.

1. $g(x) = 2x^{4.3} - \sqrt{2x} + \frac{e}{2}$ $= 2x^{4.3} - \sqrt{2}\,x^{1/2} + e/2$

• $g'(x) = 8.6x^{3.3} - \frac{\sqrt{2}}{2}x^{-1/2}$

• $g'(x) = 8.6x^{3.3} - \frac{\sqrt{2}}{2\sqrt{x}}$

• $g'(x) = 8.6x^{3.3} - \frac{1}{\sqrt{2x}}$

2. $f(x) = \csc(4x) + 3^x$

$f'(x) = -4\csc(4x)\cot(4x) + (\ln 3)3^x$

3. $F(\theta) = 6\theta\tan(\theta)$

$F'(\theta) = 6(1\cdot\tan\theta + \theta\cdot\sec^2\theta) = \boxed{6(\tan\theta + \theta\sec^2\theta)}$

or

$F'(\theta) = 6\tan\theta + 6\theta\sec^2\theta$

4. $F(x) = \frac{e^x}{1-x+x^2}$ (Use the Quotient Rule.)

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

either ok.

$$= \frac{e^x(x^2-3x+2)}{(1-x+x^2)^2} \text{ or } \frac{e^x(x-2)(x-1)}{(1-x+x^2)^2}$$

5. $h(x) = (4x+1)(2-x)^5$

$$h'(x) = 4\underline{(2-x)}^5 + (4x+1)\cdot 5\underline{(2-x)}^4(-1) = \underline{(2-x)}^4[4(2-x) - 5(4x+1)]$$

So $\boxed{h'(x) = -3(2-x)^4(8x-1)}$

aside calculation

$8-4x-20x-5$

$=-24x+3$

$=-3(8x-1)$

6. $y = \frac{\sqrt{6}}{5} + \frac{1}{5x} - \frac{x}{3} = \frac{\sqrt{6}}{5} + \frac{1}{5}x^{-1} - \frac{1}{3}x$

$$y' = -\frac{1}{5}x^{-2} - \frac{1}{3}$$

or $\underline{y' = \frac{-1}{5x^2} - \frac{1}{3}}$ or $\underline{y' = \frac{-3-5x^2}{15x^2}}$

7. $y = \frac{-9}{\sqrt{x^2+4}} = -9(x^2+4)^{-1/2}$

either ok.

$$y' = -9\left(\tfrac{-1}{2}\right)(x^2+4)^{-3/2}(2x) = +9x(x^2+4)^{-3/2}$$

or $$\frac{9x}{(x^2+4)^{3/2}}$$

quotient rule is not a good idea!



8. $z = \frac{t^3-7t+2}{\sqrt{t}} = t^{5/2} - 7t^{1/2} + 2t^{-1/2}$

$z' = \frac{5}{2}t^{3/2} - \frac{7}{2}t^{-1/2} - t^{-3/2}$ or $z' = \frac{5}{2}t^{3/2} - \frac{7}{2\sqrt{t}} - \frac{1}{t^{3/2}}$

9. $h(x) = x(\ln x)(\cos x)$

$h'(x) = 1\cdot(\ln x)(\cos x) + x\left[\frac{1}{x}\cdot\cos x + (\ln x)(-\sin x)\right]$

$= (\ln x)(\cos x) + \cos x - x(\ln x)(\sin x)$

10. $y = 9x^{5/3}(x+2) = 9(x^{8/3} + 2x^{5/3})$

$y' = 9\left[\frac{8}{3}x^{5/3} + \frac{10}{3}x^{2/3}\right] = 24x^{5/3} + 30x^{2/3}$ or

$y' = 6x^{2/3}(4x+5)$

11. $G(x) = \ln\left(\frac{xe^x}{(x^3+1)^2}\right) = \ln x + \ln e^x - 2\ln(x^3+1) = \ln x + x - 2\ln(x^3+1)$

$G'(x) = \frac{1}{x} + 1 - 2\cdot\frac{1}{x^3+1}\cdot 3x^2 = \boxed{\frac{1}{x} + 1 - \frac{6x^2}{x^3+1}}$ or

$G'(x) = \frac{1+x}{x} - \frac{6x^2}{x^3+1}$ or $G'(x) = \frac{x^4-2x^3+x+1}{x(x^3+1)}$

12. $g(x) = xe^{1/x}$ $= xe^{x^{-1}}$

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

$$= e^{x^{-1}}\left(1 - x^{-1}\right) = e^{1/x}\left(1 - \frac{1}{x}\right) = e^{1/x}\left(\frac{x-1}{x}\right)$$

all ok

13. $f(x) = (x + \sec(5x))^{-4}$ [You don't need to simplify, but use parentheses correctly.]

$$f'(x) = -4\left(x + \sec(5x)\right)^{-5}\left[1 + \sec(5x)\tan(5x) \cdot 5\right]$$

ok like this.

$$= \frac{-4\left(1 + 5\sec(5x)\tan(5x)\right)}{\left[x + \sec(5x)\right]^{-5}}$$

ok

14. $H(x) = \arctan(e^{3x})$

$$H'(x) = \frac{1}{1 + (e^{3x})^2} \cdot e^{3x} \cdot 3 = \boxed{\frac{3e^{3x}}{1 + e^{6x}}}$$

15. Find $dA/dt$ for $A = C\arccos(kt) + 2Ck$ where $C$ and $k$ are fixed constants.

$$\frac{dA}{dt} = C \cdot \frac{-1}{\sqrt{1 - k^2t^2}} \cdot k = \boxed{\frac{-Ck}{\sqrt{1 - k^2t^2}}}$$

or $\dfrac{dA}{dt} = \dfrac{-Ck}{\sqrt{1 - (kt)^2}}$