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

**Name:** ________________________________

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. $g(x) = 4x^e + \ln(10)$

$\boxed{g'(x) = 4e\,x^{e-1}}$

2. $f(x) = \cot(6x) - 2^x$

$\boxed{f'(x) = -6\csc^2(6x) - (\ln 2)2^x}$

3. $F(\theta) = \theta\sec(\theta)$

$\boxed{F'(\theta) = \sec\theta + \theta\sec\theta\tan\theta}$

$= \boxed{\sec\theta(1 + \theta\tan\theta)}$

4. $F(x) = \dfrac{e^x}{x^2+3}$ (Use the Quotient Rule.)

$$F'(x) = \frac{(x^2+3)e^x - e^x \cdot 2x}{(x^2+3)^2}$$

$$= \boxed{\frac{e^x(x^2-2x+3)}{(x^2+3)^2}}$$

5. $h(x) = (4x+3)(5-x)^3$

$$h'(x) = 4(5-x)^3 + (4x+3)3(5-x)^2(-1)$$

$$= (5-x)^2(4(5-x) - 3(4x+3))$$

$$= (5-x)^2(20-4x-12x-9)$$

$$= \boxed{(5-x)^2(11-16x)}$$

6. $y = \dfrac{1}{2x} - \dfrac{x}{5}$

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

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

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

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

$$y' = -5(-1/2)(x^2+9)^{-3/2}(2x)$$

$$= \boxed{5x(x^2+9)^{-3/2}}$$

$$= \boxed{\frac{5x}{(x^2+9)^{3/2}}}$$

8. $y = \dfrac{x^3 - 5x + 4}{\sqrt{x}}$

$= x^{5/2} - 5x^{1/2} + 4x^{-1/2}$

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

$\boxed{y' = \frac{5}{2}x^{3/2} - \frac{5}{2\sqrt{x}} - \frac{2}{x^{3/2}}}$

9. $h(x) = x^2(\ln x)(\sin x)$

$h'(x) = 2x \ln x \sin x + x^2 \cdot \frac{1}{x}\sin x + x^2 \ln x \cos x$

$= \boxed{2x \ln x \sin x + x \sin x + x^2 \ln x \cos x}$

$= \boxed{x(2 \ln x \sin x + \sin x + x \ln x \cos x)}$

10. $y = 4x^{3/2}(x+2)$

$= 4x^{5/2} + 8x^{3/2}$

$y' = 4(5/2)x^{3/2} + 8(3/2)x^{1/2}$

$= \boxed{10x^{3/2} + 12x^{1/2}}$

$= \boxed{2x^{1/2}(5x+6)}$

11. $G(x) = \ln\left(\dfrac{xe^{2x}}{(x^2+1)^4}\right)$

$= \ln x + \ln e^{2x} - 4\ln(x^2+1)$

$= \ln x + 2x - 4\ln(x^2+1)$

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

$= \boxed{\frac{1}{x} + 2 - \frac{8x}{x^2+1}}$

12. $g(x) = x^2 e^{1/x}$

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

13. $f(x) = (2x + \cos(5x))^{-3}$ [You don't need to simplify, but use parentheses correctly.]

$$\boxed{f'(x) = -3(2x+\cos(5x))^{-4}(2-5\sin(5x))}$$
$$= \boxed{\frac{-3(2-5\sin(5x))}{(2x+\cos(5x))^4}}$$

14. $H(x) = \arcsin(e^{5x})$

$$H'(x) = \frac{5e^{5x}}{\sqrt{1-(e^{5x})^2}}$$
$$= \boxed{\frac{5e^{5x}}{\sqrt{1-e^{10x}}}}$$

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

$$\frac{dA}{dt} = \frac{c}{1+(kt)^2} \cdot k$$
$$= \boxed{\frac{ck}{1+k^2t^2}}$$
$$= \boxed{\frac{ck}{1+(kt)^2}}$$