Derivative Practice II

2) $f(x) = 3x^2(2^{3x})$ product rule / a^u

$f'(x) = 3x^2(2^{3x}\ln 2(3)) + (2^{3x})6x$

$f'(x) = (3x)(2^{3x})[3\ln 2 + 2]$

4) $g(x) = \frac{e^{x^2}}{(2x-1)^3}$ quotient rule / e^u / chain

$g'(x) = \frac{(2x-1)^3(e^{x^2})(2x) - e^{x^2}(3)(2x-1)^2(2)}{(2x-1)^6}$

$g'(x) = \frac{2e^{x^2}(x(2x-1) - 3)}{(2x-1)^4} = \boxed{\frac{2e^{x^2}(2x^2 - x - 3)}{(2x-1)^4}}$

6) $f(x) = \frac{(2-3x^2)^5}{5x}$ quotient / chain

$f'(x) = \frac{5x(5)(2-3x^2)^4(-6x) - (2-3x^2)^5(5)}{(5x)^2}$

$f'(x) = \frac{5(2-3x^2)^4[-30x^2 - (2-3x^2)]}{25x^2}$

$= \boxed{\frac{(2-3x^2)^4(-27x^2-2)}{5x^2}}$

8) $y = \left(\frac{\cos x}{1-\sin x}\right)^3$ chain / quotient / trig

$y' = 3\left(\frac{\cos x}{1-\sin x}\right)^2\left(\frac{(1-\sin x)(-\sin x) - (\cos x)(-\cos x)}{(1-\sin x)^2}\right)$

$= 3\left(\frac{\cos x}{1-\sin x}\right)^2\left(\frac{-\sin x + \sin^2 x + \cos^2 x}{(1-\sin x)^2}\right)$

$= 3\left(\frac{\cos x}{1-\sin x}\right)^2\left(\frac{-\sin x + 1}{(1-\sin x)^2}\right) = \boxed{\frac{3\cos^2 x}{(1-\sin x)^2}}$

10) $y = e^{2x}(\sin(3x))$ product/e...

$y' = e^{2x}(\cos(3x))3 + \sin(3x)e^{2x}(2)$

$\boxed{y' = e^{2x}(3\cos(3x) + 2\sin(3x))}$

12) $y = \frac{\tan x}{x^2-1}$ quotient rule/trig

$\boxed{y' = \frac{(x^2-1)(\sec^2 x) - \tan x(2x)}{(x^2-1)^2}}$

14) $y = (x^2+1)\arctan(x)$ product/inv. trig

$y' = (x^2+1)\left(\frac{1}{1+x^2}\right) + \arctan x(2x)$

$\boxed{y' = 1 + 2x\arctan x}$

16) $y = \tan(6x)$ trig/chain

$y' = \sec^2(6x)(6)$

$\boxed{y' = 6\sec^2(6x)}$

18) $y = \frac{\sin x}{x^2}$ quotient/trig

$y' = \frac{x^2\cos x - \sin x(2x)}{(x^2)^2}$

$\boxed{y' = \frac{x\cos x - 2\sin x}{x^3}}$

20) $y = 3\cos(5x) + 3\sin(x^9)$ chain/trig

$y' = -3\sin(5x)(5) + 3\cos(x^9)(9x^8)$

$\boxed{y' = -3(5\sin(5x) - 9x^8\cos(x^9))}$

22) $y = x^2 \tan\left(\frac{1}{x}\right)$ product/trig

$y' = x^2 \sec^2\left(\frac{1}{x}\right)(-x^{-2}) + \tan\left(\frac{1}{x}\right)(2x)$

$\boxed{y' = -\sec^2\left(\frac{1}{x}\right) + 2x\tan\left(\frac{1}{x}\right)}$

24) $g(x) = e^{3x}\cos(2x)$ product/e^u/trig

$g'(x) = e^{3x}(-\sin(2x)2) + \cos(2x)(e^{3x})(3)$

$\boxed{g'(x) = e^{3x}(-2\sin(2x) + 3\cos(2x))}$

26) $y = \tan(6x^2 - 1)$ trig/chain

$y' = \sec^2(6x^2-1)(12x)$

$\boxed{y' = 12x\sec^2(6x^2-1)}$

28) $y = \frac{\sec^2 x - \tan^2 x}{x^3} = \frac{1}{x^3} = x^{-3}$ trig identity/power

$y' = -3x^{-4}$

$\boxed{y' = -3/x^4}$

30) $y = \sin(\sin(4x)) + \frac{1}{e}$ trig/chain/e

$y' = \cos[(\sin 4x)(\cos(4x))(4)] - e^{-\frac{1}{2}}$

$\boxed{y' = \cos[4\sin(4x)\cos(4x)] - \frac{1}{e^2}}$

32) $y = x^3\sin\left(\frac{1}{x}\right)$ product/trig

$y' = x^3\cos\left(\frac{1}{x}\right)(-x^{-2}) + \sin\left(\frac{1}{x}\right)(3x^2)$

$y' = -x\cos\left(\frac{1}{x}\right) + 3x^2\sin\left(\frac{1}{x}\right)$

$\boxed{y' = -x\left(\cos\left(\frac{1}{x}\right) - 3x\sin\left(\frac{1}{x}\right)\right)}$

34) $y = \frac{\tan x}{2x-1}$ quotient/trig

$y' = \frac{(2x-1)(\sec^2 x) - \tan x(2)}{(2x-1)^2}$

$\boxed{y' = (2x-1)(\sec^2 x - 2\tan x) / (2x-1)^2}$

36) $y = (\sin x)e^{3x} + \pi^2$ product/trig/e^u

$y' = (\sin x)e^{3x}(3) + e^{3x}(\cos x) + 0$

$\boxed{y' = e^{3x}(3\sin x + \cos x)}$

38) $y = \frac{1}{7}\sin x - \frac{1}{6}\cos x$ trig

$\boxed{y' = \frac{1}{7}\cos x + \frac{1}{6}\sin x}$

40) $y = \frac{\cos(9x)}{\sin(9x)}$ quotient/trig/chain

$y' = \sin(9x)(-\sin(9x)(9)) - (\cos(9x)(\cos(9x)(9)) / [\sin(9x)]^2$

$y' = -9\sin^2(9x) - 9\cos^2(9x) / \sin^2(9x)$

$y' = -9(\sin^2(9x) + \cos^2(9x)) / \sin^2(9x)$

$\boxed{y' = -9 / \sin^2(9x)}$

42) $y = 4x^5 \tan(-\frac{1}{x})$ product/trig/chain

$y' = 4x^5 \sec^2(-\frac{1}{x})(x^{-2}) + \tan(-\frac{1}{x})(20x^4)$

$\boxed{y' = 4x^3(\sec^2(-\frac{1}{x}) + 5x\tan(-\frac{1}{x}))}$