

$$1. \quad y = \tan 4x^2 \quad y = \tan u, u = 4x^2$$

$$y' = 8x \sec^2 4x^2$$

$$2. \quad y = \sin 3x \cos 2x \quad y' = \sin 3x \left(\frac{d}{dx} \cos 2x \right) + \frac{d}{dx} (\sin 3x) \cos 2x$$

$$= -2 \sin 2x \sin 3x + 3 \cos 3x \cos 2x$$

$$3. \quad y = e^{x^2-5x+1} \quad y = e^u \quad u = x^2-5x+1$$

$$y' = (2x-5)e^{x^2-5x+1}$$

$$4. \quad y = 2^{\cos x} \quad y = 2^u \quad u = \cos x$$

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

$$5. \quad y = \ln(3x^2+1) \quad y = \ln u \quad u = 3x^2+1$$

$$y' = \frac{6x}{3x^2+1}$$

$$6. \quad y = \log_2 \sin x \quad y = \log_a u \quad u = \sin x$$

$$y' = \frac{\cos x}{\ln 2 \sin x} = \frac{\cot x}{\ln 2}$$

$$7. y = \sin^{-1}(x^3) \quad y = \sin^{-1} u \quad u = x^3$$

$$y' = \frac{3x^2}{\sqrt{1-(x^3)^2}} = \boxed{\frac{3x^2}{\sqrt{1-x^6}}}$$

$$8. y = \sin^3(x^2) \quad y = u^3 \quad u = \sin(x^2)$$

$$\rightarrow u = \sin v \\ v = x^2$$

$$y' = 3 \sin^2 x^2 \cos x^2 (2x) = \boxed{6x \sin^2(x^2) \cos(x^2)}$$

$$9. y = (3x^2+3)^7 \quad y = u^7 \quad u = 3x^2+3$$

$$y' = 7(3x^2+3)^6 (6x) = \boxed{42x(3x^2+3)^6}$$

$$10. y = x^2 \tan^2(x^2) \quad y' = x^2 \frac{d}{dx}(\tan^2 x^2) + \tan^2(x^2) \frac{d}{dx}(x^2)$$

$$= x^2 (2 \tan(x^2) (\sec^2 x^2) (2x)) + 2x \tan^2(x^2)$$

$$= \boxed{4x^3 \tan(x^2) \sec^2 x^2 + 2x \tan^2(x^2)}$$

$$11. y = \frac{\ln(x^3-1)}{x} \quad y' = \frac{x \left(\frac{3x^2}{x^3-1} \right) - \ln(x^3-1)}{x^2}$$

$$= \boxed{\frac{\frac{3x^3}{x^3-1} - \ln(x^3-1)}{x^2}}$$

$$12. \quad y = e^{\sin(x^2)} \quad y = e^u \quad u = \sin x^2$$

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

$$13. \quad y = \tan^{-1} x^4 \quad y = \tan^{-1} u \quad u = x^4$$

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

$$14. \quad y = [\cos^{-1}(x+5)]^2 \quad y = u^2 \quad u = \cos^{-1}(x+5)$$

$$y' = 2(\cos^{-1}(x+5)) \cdot \left[-\frac{1}{\sqrt{1-(x+5)^2}} \right]$$

$$= -\frac{2\cos^{-1}(x+5)}{\sqrt{-x^2-10x-24}}$$

$$15. \quad y = (x^3 - \sec x)^3 \quad y = u^3 \quad u = x^3 - \sec x$$

$$y' = 3(x^3 - \sec x)^2 [3x^2 - \sec x \tan x]$$

$$16. \quad y = \sec^{-1}(\sin x) \quad y = \sec^{-1} u \quad u = \sin x$$

$$y' = \frac{\cos x}{|\sin x| \sqrt{\sin^2 x - 1}}$$

$$17. \quad y = 3^{x - \sin 2x} \quad y = 3^u \quad u = x - \sin 2x$$

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

$$18. \quad y = (e^x)^2 = e^{2x} \quad y = e^u \quad u = 2x$$

$$y' = 2e^{2x}$$

$$19. \quad y = \log_2(\ln x) \quad y = \log_2 u \quad u = \ln x$$

$$y' = \frac{1}{\ln 2 \ln x} \cdot \frac{d}{dx}(\ln x) = \frac{1}{x \ln 2 \ln x}$$

$$20. \quad y = e^{4x - 8 \ln x} \quad y = e^u \quad u = 4x - 8 \ln x$$

$$y' = e^{4x - 8 \ln x} \left(4 - \frac{8}{x} \right)$$