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

Apply $\frac{d}{dx}$

$$\frac{1}{1+(x^2y)^2}\frac{d[x^2 \cdot y]}{dx} = 1 + \frac{dx}{dx}\cdot y^2 + x \cdot \frac{d}{dx}y^2$$

$$\frac{1}{1+x^4y^2}\cdot\left[2x\cdot y + x^2\cdot y'\right] = 1 + y^2 + \underline{x \cdot 2 y y'}$$

$$\frac{2xy}{1+x^4y^2} + \left[\frac{x^2}{1+x^4y^2} - 2xy\right]y' = 1 + y^2$$

$$\frac{dy}{dx} = \frac{1 + y^2 - \frac{2xy}{1+x^4y^2}}{\left[\frac{x^2}{1+x^4y^2} - 2xy\right]}$$

$$y = \frac{e^{-2x} \cdot \sin^3(x+1)}{x^4 \cdot (5x-1)^{1/2}}$$

Apply ln:

$$\ln y = \left[\ln e^{-2x} + \ln \sin^3(x+1)\right] - \left[\ln x^4 + \ln(5x-1)^{1/2}\right]$$

$$\ln y = -2x + 3\ln \sin(x+1 - 4\ln x - \frac{1}{2}\ln(5x-1)$$

$\frac{d}{dx}$:

$$\frac{1}{y} \cdot y' = -2 + 3 \cdot \frac{1}{\sin(x+1)} \cdot \cos(x+1) \cdot 1 - 4 \cdot \frac{1}{x} - \frac{1}{2} \cdot \frac{1}{5x-1} \cdot 5$$

$$\frac{dy}{dx} = \left[-2 + 3\cot(x+1) - \frac{4}{x} - \frac{5}{2} \cdot \frac{1}{5x-1}\right] \frac{e^{-2x} \cdot \sin^3(x+1)}{x^4 \cdot (5x-1)^{1/2}}$$

$$(\ln|x|)' = \frac{1}{x}$$

$$f(x) = (x+1)^{(\sin x + \cos x)}$$

Apply ln: $\underline{\ln f(x)} = \ln (x+1)^{(\sin x + \cos x)} = \underline{(\sin x + \cos x) \ln (x+1)}$

Apply $\frac{d}{dx}$:

$$\frac{1}{f(x)} \cdot f'(x) = (\cos x - \sin x) \ln(x+1) + (\sin x + \cos x) \cdot \frac{1}{x+1}$$

$$\therefore f'(x) = \left[(\cos x - \sin x) \ln(x+1) + \frac{\sin x + \cos x}{x+1} \right] (x+1)^{(\sin x + \cos x)} \checkmark$$

$$f'(0) = [\, 0 + 1 \,] = 1$$