

$$6. f(x) = \ln \sqrt[5]{x} = \ln x^{1/5} = \frac{1}{5} \ln x \Rightarrow f'(x) = \frac{1}{5} \cdot \frac{1}{x} = \frac{1}{5x}$$

$$10. f(t) = \frac{1 + \ln t}{1 - \ln t} \Rightarrow f'(t) = \frac{(1 - \ln t)(1/t) - (1 + \ln t)(-1/t)}{(1 - \ln t)^2} = \frac{(1/t)[(1 - \ln t) + (1 + \ln t)]}{(1 - \ln t)^2} = \frac{2}{t(1 - \ln t)^2}$$

$$20. \text{ By the Quotient Rule, } y = \frac{e^x}{1+x} \Rightarrow y' = \frac{(1+x)e^x - e^x(1)}{(1+x)^2} = \frac{e^x + xe^x - e^x}{(x+1)^2} = \frac{xe^x}{(x+1)^2}.$$

$$30. y = \frac{e^u - e^{-u}}{e^u + e^{-u}} \Rightarrow$$

$$\begin{aligned} y' &= \frac{(e^u + e^{-u})(e^u - (-e^{-u})) - (e^u - e^{-u})(e^u + (-e^{-u}))}{(e^u + e^{-u})^2} \\ &= \frac{e^{2u} + e^0 + e^0 + e^{-2u} - (e^{2u} - e^0 - e^0 + e^{-2u})}{(e^u + e^{-u})^2} = \frac{4e^0}{(e^u + e^{-u})^2} = \frac{4}{(e^u + e^{-u})^2} \end{aligned}$$

$$40. y = \ln(\sec x + \tan x) \Rightarrow y' = \frac{\sec x \tan x + \sec^2 x}{\sec x + \tan x} = \sec x \Rightarrow y'' = \sec x \tan x$$

$$\begin{aligned} 58. x^y = y^x &\Rightarrow y \ln x = x \ln y \Rightarrow y \cdot \frac{1}{x} + (\ln x) \cdot y' = x \cdot \frac{1}{y} \cdot y' + \ln y \Rightarrow y' \ln x - \frac{x}{y} y' = \ln y - \frac{y}{x} \Rightarrow \\ y' &= \frac{\ln y - y/x}{\ln x - x/y} \end{aligned}$$

$$\begin{aligned} 65. f(x) = \ln(x-1) &\Rightarrow f'(x) = 1/(x-1) = (x-1)^{-1} \Rightarrow f''(x) = -(x-1)^{-2} \Rightarrow f'''(x) = 2(x-1)^{-3} \Rightarrow \\ f^{(4)}(x) &= -2 \cdot 3(x-1)^{-4} \Rightarrow \dots \Rightarrow f^{(n)}(x) = (-1)^{n-1} \cdot 2 \cdot 3 \cdot 4 \cdot \dots \cdot (n-1)(x-1)^{-n} = (-1)^{n-1} \frac{(n-1)!}{(x-1)^n} \end{aligned}$$