Sec 3.7 page 226 day 1 (1-13)

(1) because $\frac{d}{dx} \log_a x = \frac{1}{x \ln a}$ and $\ln e = 1$ so it becomes $\frac{1}{x}$.

(2) $f(x) = x \ln x - x$

$\ln x + 1 - 1 = \boxed{\ln x}$

(3) $f(x) = \sin(\ln x)$

$\boxed{f'(x) = \frac{\cos(\ln x)}{x}}$

(4) $f(x) = \ln(\sin^2 x)$

$f'(x) = \frac{2 \sin x \cos x}{\sin^2 x} = \frac{2 \cos x}{\sin x} = \boxed{2 \cot x}$

(5) $f(x) = \log_2(1-3x)$

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

(6) $f(x) = \log_5(xe^x)$

$f'(x) = \frac{e^x + xe^x}{xe^x \ln 5} = \boxed{\frac{1+x}{x \ln 5}}$

(7) $f(x) = \sqrt[5]{\ln x} = (\ln x)^{1/5}$

$f'(x) = \frac{1}{5\sqrt[5]{(\ln x)^4}} \left(\frac{1}{x}\right) = \boxed{\frac{1}{5x \sqrt[5]{(\ln x)^4}}}$

(8) $f(x) = \ln \sqrt[5]{x} = \ln x^{1/5} = \frac{1}{5}\ln x$

$$\boxed{f'(x) = \frac{1}{5x}}$$

(9) $f(x) = \sin x \ln(5x)$ $\qquad \ln ax = \frac{\cancel{a}}{\cancel{a}x} = \frac{1}{x}$

$$\boxed{f'(x) = \cos x \ln 5x + \frac{\sin x}{x}}$$

(10) $f(t) = \dfrac{1+\ln t}{1-\ln t}$

$$f'(t) = \frac{\frac{1-\ln t}{t} + \frac{1+\ln t}{t}}{(1-\ln t)^2} = \boxed{\frac{2}{t(1-\ln t)^2}}$$

(11) $F(t) = \ln \dfrac{(2t+1)^3}{(3t-1)^4} = 3\ln(2t+1) - 4\ln(3t-1)$

$$\boxed{F'(t) = \frac{6}{2t+1} - \frac{12}{3t-1} \quad \text{or} \quad \frac{-6(t+3)}{(2t+1)(3t-1)}}$$

(12) $h(x) = \ln(x + \sqrt{x^2-1})$

$$h'(x) = \frac{1 + \frac{x}{\sqrt{x^2-1}}}{x+\sqrt{x^2-1}} = \frac{\sqrt{x^2-1}+x}{(\sqrt{x^2-1})(x+\sqrt{x^2-1})} = \boxed{\frac{1}{\sqrt{x^2-1}}}$$

(13) $g(x) = \ln(x\sqrt{x^2-1}) = \ln x + \frac{1}{2}\ln(x^2-1)$

$$\boxed{g'(x) = \frac{1}{x} + \frac{x}{x^2-1} \quad \text{or} \quad \frac{2x^2-1}{x(x^2-1)}}$$