$$\log(ab) = \log a + \log b$$

$$\log\left(\frac{a}{b}\right) = \log a - \log b$$

$$c \log a = \log a^c$$

$y = \ln x \qquad y' = \frac{1}{x}$

$y = \ln(u) \qquad y' = \frac{1}{u} \cdot u'$

$y = \ln(4x+1) \qquad y' = \frac{1}{4x+1} \cdot 4 = \frac{4}{4x+1}$

$y = \ln(3x^2+5) \qquad y' = \frac{1}{3x^2+5} \cdot 6x = \frac{6x}{3x^2+5}$

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

p326 ex3c

$y = x \ln x$

$y' = 1 \ln x + \frac{1}{x} \cdot x$

$= \ln x + 1$

ex3d

$y = (\ln x)^3$

$y' = 3(\ln x)^2 \cdot \frac{1}{x} = \frac{3(\ln x)^2}{x}$

$\ln x^2 = \ln(x^2)$

p330 #54

$$h(t) = \frac{\ln t}{t}$$

$$h'(t) = \frac{\frac{1}{\cancel{t}} \cdot \cancel{t} - 1 \ln t}{t^2} = \frac{1 - \ln t}{t^2}$$

#56 $y = \ln(\ln x)$

$$y' = \frac{1}{\ln x} \cdot \frac{1}{x} = \frac{1}{x \ln x}$$

p326 ex 4 $\quad f(x) = \ln\sqrt{x+1} = \ln(x+1)^{1/2}$

$$f'(x) = \frac{1}{(x+1)^{1/2}} \cdot \frac{1}{2}(x+1)^{-1/2}$$

$$= \frac{1}{(x+1)^{1/2}} \cdot \frac{1}{2(x+1)^{1/2}} = \frac{1}{2(x+1)}$$

OR $\quad f(x) = \ln(x+1)^{1/2} = \frac{1}{2}\ln(x+1)$

$$f'(x) = \frac{1}{2} \cdot \frac{1}{x+1} = \frac{1}{2(x+1)}$$

$$f(x) = \ln(2x+1)^5 = 5\ln(2x+1)$$

$$f'(x) = 5 \cdot \frac{1 \cdot 2}{2x+1} = \frac{10}{2x+1}$$

OR

$$f'(x) = \frac{1}{\cancel{(2x+1)^5}} \cdot 5\cancel{(2x+1)^4} \cdot 2$$

$$= \frac{10}{2x+1}$$

p330 #52

$$f(x) = \ln\left(\frac{2x}{x+3}\right) = \ln 2x - \ln(x+3)$$

$$f'(x) = \frac{1\cdot 2}{2x} - \frac{1}{x+3} = \frac{1}{x}\cdot\frac{(x+3)}{(x+3)} - \frac{1}{(x+3)}\cdot\frac{x}{x}$$

$$\frac{x+3-x}{x(x+3)} = \frac{3}{x(x+3)}$$

OR

$$f'(x) = \frac{1}{\frac{2x}{x+3}} \cdot \frac{2(x+3) - 1(2x)}{(x+3)^2}$$

$$= \frac{\frac{1}{1}}{\frac{2x}{\cancel{x+3}}\cdot\frac{(\cancel{x+3})}{1}}, \qquad \cancel{2}x + 6 - \cancel{2x}$$

$$= \frac{\cancel{x+3}}{2x} \cdot \frac{6}{(x+3)^{\cancel{2}}} = \frac{\cancel{6}^{\,3}}{\cancel{2}x(x+3)}$$

$$= \frac{3}{x(x+3)}$$

$$y = \ln\left[(x^2+5)^4(3x-7)^3\right]$$

$$= \ln(x^2+5)^4 + \ln(3x-7)^3$$

$$= 4\ln(x^2+5) + 3\ln(3x-7)$$

$$y' = 4\cdot\frac{1}{x^2+5}\cdot 2x + 3\cdot\frac{1}{3x-7}\cdot 3$$

$$= \frac{8x}{x^2+5} + \frac{9}{3x-7}$$

$$y = \ln(e^x + 5)$$

$$y' = \frac{1 \cdot e^x}{e^x + 5} = \frac{e^x}{e^x + 5}$$

p357 #46

$y = \ln e^x$ $\quad y' = \cancel{\frac{1}{e^x} \cdot e^x} = 1$

OR $y = x \ln e = x(1) = x$

$$y' = 1$$

$$y = \ln(e^x + x^2)$$

$$y' = \frac{1}{e^x + x^2}(e^x + 2x)$$

$$= \frac{e^x + 2x}{e^x + x^2}$$

p357 #42

$$y = \ln\left(\frac{1+e^x}{1-e^x}\right) = \ln(1+e^x) - \ln(1-e^x)$$

$$y' = \frac{1e^x}{1+e^x} - \frac{-1e^x}{1-e^x} = \frac{e^x}{1+e^x} + \frac{e^x}{1-e^x}$$

p 330 # 71

$f(x) = 3x^2 - \ln x$ $\quad (1,3)$

$f'(x) = 6x - \frac{1}{x}$

$m = 6(1) - \frac{1}{1} = 5$ $\quad y - 3 = 5(x-1)$

---

a) $y = e^x \ln x^2$ $\quad (1, e)$ $\quad \frac{1}{x^2} \cdot 2x = \frac{2}{x}$

$= e^x \cdot 2 \ln x$

$y' = e^x 2 \ln x + \frac{2}{x} e^x$ $\quad y - e = 2e(x-1)$

$m = e^1 2 \ln 1 + \frac{2}{1} e^1 = 2e$

p330 #70

$$g(x) = \int_1^{\ln x} t^2 + 3\,dt \qquad \text{find } g'(x)$$

$$g'(x) = \left((\ln x)^2 + 3\right)\frac{1}{x} - \cancel{(1^2+3)0}$$

$$= \frac{(\ln x)^2 + 3}{x}$$

p357 #48

$$F(x) = \int_0^{e^{2x}} \ln(t+1)\,dt$$

$$F'(x) = \ln(e^{2x}+1)2e^{2x} - \cancel{\ln(0+1)0}$$

$$= \ln(e^{2x}+1)2e^{2x} = 2e^{2x}\ln(e^{2x}+1)$$

p 330

47, 51, 53, 55, 75

p 357

41, 51, 55