Ex. 4, p. 6

(a) $y = a^x$,

$\because$ a is a constant $\Rightarrow$ $a = e^{\ln a}$

$\therefore$ $y = (e^{\ln a})^x$

$= e^{(\ln a)(x)}$ [exponential property : $(b^n)^m = b^{n \cdot m}$]

$\frac{dy}{dx} = \frac{d}{dx}[e^{(\ln a)(x)}] = \frac{d}{dx} e^u$ where $u = (\ln a)(x)$

$= e^u \frac{du}{dx}$ (5.3 ②, p. 4)

$= e^{(\ln a)(x)} \cdot \ln a$ ($u = (\ln a) \cdot x$ = constant $\cdot x \Rightarrow u' =$ constant $= \ln a$)

$= (e^{\ln a})^x \cdot \ln a$

$= a^x \ln a$ ($\because e^{\ln a} = a$)

(d) $y = \alpha \cdot 10^{-x} + \beta 10^{-x^2}$

$y = u + v$

$y' = u' + v'$

$= \alpha \frac{d 10^{-x}}{dx} + \beta \frac{d 10^{-x^2}}{dx}$

$\because$ 10 is a constant $\Rightarrow$ substitute $10 = e^{\ln 10}$

$\therefore$ $y' = \alpha \frac{d}{dx}[e^{(\ln 10)(-x)}] + \beta \frac{d}{dx}[e^{(\ln 10)(-x^2)}]$

$= \alpha \frac{d}{dx}[e^a] + \beta \frac{d}{dx}[e^b]$ where $a = (\ln 10)(-x)$
$b = (\ln 10)(-x^2)$

$= \alpha e^a \frac{da}{dx} + \beta e^b \frac{db}{dx}$

$= \alpha (e^{\ln 10})^{-x} (-\ln 10) + \beta (e^{\ln 10})^{-x^2} (-2 \ln 10)(x)$

$= -\ln 10 [\alpha 10^{-x} + 2\beta x 10^{-x^2}]$ remember $e^{\ln 10} = 10$