$$y' - ty = -t$$

$$\sigma y' - ty\sigma = -t\sigma \qquad \therefore \sigma' = -t\sigma$$

$$d\{\sigma y\} = \sigma y' + \sigma' y \qquad \frac{d\sigma}{\sigma} = -t\,dt$$

$$d\{e^{-t^2/2} y\} = -te^{-t^2/2} \qquad \ln\sigma = -\frac{t^2}{2} + C$$

$$e^{-t^2/2} y = -\int te^{-t^2/2} dt \qquad \sigma = e^{-t^2/2}$$

$$y = e^{t^2/2}\left(e^{-t^2/2} + C\right)$$

b) $v\,dv = \frac{-k}{(R+x)^2} dx$

$$\frac{v^2}{2} = k\frac{1}{(R+x)} + C$$

$$\frac{v_0^2}{2} = k\frac{1}{(R+x_0)} + C$$

2.a) $y^2 - 4\zeta y + 4 = 0$

$$C_1 e^{-\omega t} + C_2 e^{-\omega t}$$

$$C_1 e^{-\omega t} + C_2 t e^{-\omega t}$$

$$C_1 \cos 2t + C_2 \sin 2t$$

b) $\lambda^2+2\lambda+1=0$

$(\lambda+1)^2=0$

$\lambda=-1$

$\therefore y_h = C_1e^{-t}+C_2te^{-t}$

$y_p = At^2e^{-t}$

b)

c) $e^{-t}\frac{1}{6} + e^{-(t-1)}\frac{\sin 6(t-1)}{6}u(t-1)$

$\frac{1}{6}\quad \frac{6}{(s+2)^2+6^2}$