1.

$$y' = -t + ty$$

$$y' - ty = -t$$

$$\sigma y' - \sigma t y = -t\sigma$$

$$d\{\sigma y\} = \sigma y' + \sigma' y$$

$$\therefore\ d\{e^{-t^2/2} y\} = -t e^{-t^2/2}$$

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

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

$$\sigma' = -\sigma t$$

$$\frac{d\sigma}{-\sigma} = t\,dt$$

$$\ln \sigma = -\frac{t^3}{2}$$

$$\sigma = e^{-t^2/2}$$

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

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

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

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

$$\frac{V_0^2}{2} = \frac{k}{R+x_0} + C$$

$\ddot{y} + 2\dot{y} + y = 4e^{-t}$

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

$\lambda = -1$ ∴ repeated roots

$y_h = c_1 e^{-t} + c_2 t e^{-t}$

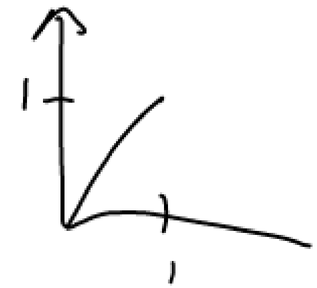
$y_p = At^2 e^{-t}$

$y_p' = 2Ate^{-t} - At^2 e^{-t}$

$y_p'' = 2Ae^{-t} - 2Ate^{-t} - 2Ate^{-t} + At^2 e^{-t}$

$\frac{1}{(s+1)^2} + \frac{1}{(s^2+4s+40)}e^{-s} = te^{-t} + \sin$

$\frac{1}{6}\frac{6}{((s+2)^2+6^2)} = \frac{1}{6}e^{-2t}\sin 6t$



$f_T(t) = t$

$= t - t\,u(t-1)$

$= t - (t-1+1)u(t-1)$

$= t - (t-1)u(t-1) - u(t-1)$

$F_T(t) = \frac{1}{s^2} - \frac{1}{s^2}e^{-s} - \frac{1}{s}e^{-s}$

$= \frac{1}{1-e^{-s}}\left(\frac{1}{s^2} - \frac{1}{s^2}e^{-s} - \frac{1}{s}e^{-s}\right)$