[illegible]

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1) $\frac{dy}{dt} + 3y = e^{-2t}$

$t=0,\ y=2.$

$sy(s) - y(0) + 3y(s) = \frac{1}{s+2}.$

$y(s)\{s+3\} - 2 = \frac{1}{s+2}.$

$y(s) = \frac{1 + 2(s+2)}{(s+2)(s+3)}$

$y(s) = \frac{2s+5}{(s+2)(s+3)}.$

$\frac{2s+5}{(s+2)(s+3)} = \frac{A}{(s+2)} + \frac{B}{(s+3)}$

$A(s+3) + B(s+2) = 2s+5.$

$s=-2$

$A=1$

$s=-3$

$B=1$

$L\left\{\frac{1}{(s+2)} + \frac{1}{s+3}\right\} = e^{-2t} + e^{-3t}.$

2) $3\frac{dy}{dt} - 6y = \sin 2t.$

$t=0\ \ y=1$

$3\{sy(s) - y(0)\} - 6y(s) = \frac{2(2)}{s^2+2^2}$

$y(s)\{3s-6\} = \frac{2 + 3(s^2+2^2)}{s^2+2^2}$

$y(s) = \frac{3s^2 + 14}{(s^2+4)(3s-6)}$

$$\frac{3s^2+14}{(3s-6)(s^2+4)} = \frac{A}{3s-6} + \frac{Bs+C}{(s^2+4)}$$

$$3s^2+14 = A(s^2+4) + Bs+C(3s-6)$$

when $s=2$.

$$A = \frac{13}{4}$$

Opening the brackets and comparing coefficients.

$$3s^2 = As^2 + 3Bs^2$$

$$3 = \frac{13}{4} + 3B$$

$$B = \frac{-1}{12}$$

$$14 = 4A - 6c$$

$$\therefore \quad c = -\frac{1}{6}.$$

$$L^{-1}\left\{ \frac{13}{4(3s-6)} + \frac{s(-1/12) - 1/6}{(s^2+4)} \right\}$$

$$= \frac{13}{12}e^{2t} - \frac{1}{12}\cos 2t - \frac{1}{12}\sin 2t.$$

3) $\frac{dy}{dt} - 4y = 8$

$t=0,\ y=2.$

$sy(s) - s(0) - 4y(s) = \frac{8}{s}.$

$y(s)\{s-4\} - 2 = \frac{8}{s}$

$y(s) = \frac{8+2(s)}{s(s-4)}$

$\frac{8+2s}{s(s-4)} = \frac{A}{s} + \frac{B}{s-4}.$

$A(s-4) + B(s) = 8+2s.$

when $s=0$

$A=-2$

when $s=4$

$B=4$

$L\left\{\frac{-2}{s} + \frac{4}{s-4}\right\} = -2 + 4e^{4t}$

4) $\frac{d^2y}{dt^2} - 2\frac{dy}{dt} + 5y = e^{2t}$

$t=0,\ y=2,\ y'=1.$

$s^2y(s) - sy(0) - y'(0) - 2\{sy(s) - y(0)\} + 5y(s) = \frac{1}{s-2}.$

$y(s)\{s^2-2s+5\} - 2s - 1 + 4 = \frac{1}{s-2}$

$y(s) = \frac{1 + 2s(s-2) + 1(s-2) - 4(s-2)}{(s^2-2s+5)(s-2)}$

$y(s) = \frac{2s^2 - 7s + (6+1)}{(s^2-2s+5)(s-2)}$

$$\frac{2s^2-7s+7}{(s-2)(s^2-2s+5)} = \frac{A}{(s-2)} + \frac{Bs+c}{s^2-2s+5}.$$

$$2s^2-7s+7 = A(s^2-2s+5) + Bs+c(s-2).$$

when $s=2$.

$$A = \frac{1}{5}$$

Openny bracket and compary coeffcents.

$$2s^2 = As^2 + Bs^2$$

$$B = \frac{9}{5}$$

$$7 = 5A - 2c$$

$$c = -3.$$

$$L\left\{\frac{\frac{1}{5}}{(s-2)} + \frac{(9/5)s-3}{s^2-2s+5}\right\} = L\left\{\frac{\frac{1}{5}}{s-2} + \frac{(\frac{9}{5})s}{s^2-2s+5} - \frac{3}{s^2-2s+5}\right\}$$

5) $\frac{d^2y}{dt^2} - \frac{6dy}{dt} + 8y = e^{3t}$

$t=0 \quad y=0 \quad y'=2.$

$s^2y(s) - sy(0) - y'(0) - 6\{sy(s) - y(0)\} + 8y(s) = \frac{1}{s-3}.$

$y(s)\{s^2 - 6s + 8\} - 2 = \frac{1}{s-3}$

$y(s) = \frac{1 + 2(s-3)}{(s-3)(s^2-6s+8)}.$

$y(s) = \frac{2s-5}{(s-3)(s-2)(s-4)} = \frac{A}{(s-3)} + \frac{B}{(s-2)} + \frac{C}{s-4}$

$2s-5 = A(s-2)(s-4) + B(s-3)(s-4) + C(s-3)(s-2).$

when $s=2$

$B = \cancel{\frac{2}{4}} -\frac{1}{2}$

when $s=4$

$C = -\cancel{\frac{4}{4}} \frac{3}{2}.$

when $s=3$

$A = -1.$

$L\left\{\frac{-1}{(s-3)} - \frac{\frac{1}{2}}{(s-2)} + \frac{\frac{3}{2}}{s-4}\right\} = -e^{3t} - \frac{1}{2}e^{2t} + \frac{3}{2}e^{4t}$