1. $\mathcal{L}[3 - e^{-3t} + 5\sin 2t] = F(s)$

$F(s) = 3/s - 1/s+3 + 5(2)/s+2^2$

$\boxed{F(s) = 3/s - 1/s+3 + 10/s+4}$

1. $\mathcal{L}^-\left[\dfrac{8-3s+s^2}{s^3}\right] = f(t)$

$f(t) = 8/s^3 - 3s/s^3 + s^2/s^3$

$f(t) = 4t^2 - 3/s^2 + 1/s$

$\boxed{f(t) = 4t^2 - 3t + 1}$

1. $F(s) = \dfrac{1}{s(s^2+2s+2)}$

$\left[\dfrac{1}{s(s^2+2s+2)} = \dfrac{A}{s} + \dfrac{Bs+C}{s^2+2s+2}\right] s(s^2+2s+2)$

$1 = A(s^2+2s+2) + s(Bs+C)$

if $s=0$

$1 = A(0^2+2(0)+2)$; $\underline{A = 1/2}$

substituting A:

$1 = 1/2(s^2+2s+2) + Bs^2 + Cs$

$1 = (s^2+2s+2+2Bs^2+2Cs)/2$

$1 = s^2(1+2B) + s(2C+2) + 2$

$\underline{B = -1/2}$ $\quad$ $\underline{C = -1}$

$f(t) = \dfrac{1}{2}/s - \dfrac{\frac{1}{2}s+1}{s^2+2s+2}$

$1/2 - \mathcal{L}^-\left[\dfrac{\frac{1}{2}s+1}{s^2+2s+2}\right]$

$1/2 - \mathcal{L}^-\left[\dfrac{1}{2}\left(\dfrac{s+2}{s^2+2s+2}\right)\right]$

$\rightarrow \dfrac{(s+1)+1}{s^2+2s+2} = \dfrac{(s+1)+1}{(s+1)^2+1}$

$\boxed{f(t) = 1/2 - 1/2e^{-t}(\cos t + \sin t)}$