(4)   1. Find the general solution to the homogenous differential equation $y'' - 3y' + 2y = 0$.

(3)   2. Find a particular solution to the inhomogenous differential equation $y'' - 3y' + 2y = 4t$.

(3)   3. Find the solution to $y'' - 3y' + 2y = 4t$ which satisfies $y(0) = 8$ and $y'(0) = -7$.

1. $y'' - 3y' + 2y = 0$

$r^2 - 3r + 2 = 0$

$(r-1)(r-2) = 0$

$r = 1$ or 2

$$\boxed{y = c_1 e^t + c_2 e^{2t}}$$

2. $y'' - 3y' + 2y = 4t$

$y = At + B$

$y' = A$

$y'' = 0$

$0 - 3A + 2(At + B) = 4t$

$2At + (2B - 3A) = 4t$

$2A = 4 \qquad A = 2$

$2B = 3A = 6 \qquad B = 3$

$$\boxed{y_p = 2t + 3}$$

3. $y = 2t + 3 + c_1 e^t + c_2 e^{2t}$

$8 = y(0) = 3 + c_1 + c_2$

$-7 = y'(0) = 2 + c_1 + 2c_2$

$c_1 + c_2 = 5$

$c_1 + 2c_2 = -9$

$c_2 = -14$

$c_1 = 5 - c_2 = 19$

$$\boxed{y = 2t + 3 + 19e^t - 14e^{2t}}$$