3a $y'' + y' - 2y = 0$

$r^2 + r - 2 = 0$

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

$r_1 = -2, r_2 = 1$

$y = C_1 e^{-2x} + C_2 e^{x}$

3i $y'' - 2y' + 2y = 0$

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

$r_{1,2} = \frac{+2 \pm \sqrt{4 - 2 \cdot 4}}{2} = +1 \pm i$

$y = e^{x}(C_1 \sin x + C_2 \cos x)$

4g) $y'' + 2y' + y = 0$, $y(0) = 1$, $y'(0) = 0$

$r^2 + 2r + 1 = 0$

$(r+1)^2 = 0$, $r_1 = r_2 = -1$

$y = C_1 e^{-x} + C_2 x e^{-x}$

$y' = -C_1 e^{-x} - C_2 x e^{-x} + C_2 e^{-x}$

$y(0) = 1 = C_1$

$y'(0) = -C_1 + C_2 = 0 \Rightarrow C_2 = 1$

$y = -e^{-x} - x e^{-x}$

4i) $y'' + 2y' + 5y = 0$

$y(0) = -1, y'(0) = 1$

$r^2 + 2r + 5 = 0$

$r_{1,2} = \frac{-2 \pm \sqrt{4 - 5 \cdot 4}}{2}$

$= -1 \pm 2i$

$y = C_1 e^{x} \sin 2x + C_2 e^{x} \cos 2x$

$y' = e^{x}[2C_1 \cos 2x - 2C_2 \sin 2x$

$- e^{x}(C_1 \sin 2x + C_2 \cos 2$

$y(0) = C_2 = -1$

$y'(0) = 2C_1 - C_2 = 1 \Rightarrow C_1$

$y = [\sin x - \cos x]e^{-x}$