

1. 500L max 100L current SO/SO @ 2L/m in  
out SO/SO @ 1L/m result SO/SO @ 1.4/m in  
100LW + 200LW + 200LP  $\Rightarrow$  40% Pollutant

2.  $y'' - y' - 6y = 0$   $\lambda^2 - \lambda - 6 = 0$   $(\lambda - 3)(\lambda + 2) = 0$   
 $\lambda = -2, 3$   $y(x) = C_1 e^{-2x} + C_2 e^{3x}$   
 Ansatz:  $e^{\lambda x}$

3.  $y'' + 8y' + 16y = 0$   $\lambda^2 + 8\lambda + 16 = 0$   $\lambda = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$   $(\lambda + 4)^2 = 0$   
 $\lambda = -4$  mult. 2 Ansatz:  $e^{\lambda x}$   $y(x) = C_1 e^{-4x} + C_2 x e^{-4x}$

4.  $y'' - 4y' - 5y = 0$   $y(0) = 0$   $y'(0) = 2$  Ansatz:  $e^{\lambda x}$   $\lambda^2 - 4\lambda - 5 = 0$   
 $(\lambda - 5)(\lambda + 1) = 0$   $\lambda = -1, 5$   $y(x) = C_1 e^{-x} + C_2 e^{5x}$   $C_1 = -C_2$   
 $0 = C_1 e^0 + C_2 e^0$   $0 = C_1 + C_2$   $2 = 0 e^0 + C_2 e^0$   $C_2 = 2$   
 $2 = -C_1 + C_2$   $C_2 - C_1 = 2$   $C_1 = 0$   $C_2 = 2$   
 $y(x) = 2e^{5x}$

5.  $y'' + 7y = 0$  Ansatz:  $e^{\lambda x}$   $\lambda^2 + 7 = 0$   $\lambda = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$   
 $\lambda = \pm \sqrt{7}i$   $\alpha = 0$   $\beta = \sqrt{7}$   $y(x) = C_1 e^{-7ix} + C_2 e^{7ix}$   
 $y = e^{\alpha x} (C_1 \cos \beta x + C_2 \sin \beta x) = C_1 \cos(7x) + C_2 \sin(7x) = y(x)$

6.  $y'' + 2y' + 5y = 0$  Ansatz:  $e^{\lambda x}$   $\lambda^2 + 2\lambda + 5 = 0$   $\lambda = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$   
 $\lambda = \frac{-2 \pm \sqrt{4 - 20}}{2} = \frac{-2 \pm \sqrt{-16}}{2} = \frac{-2 \pm 4i}{2} = -1 \pm 2i$   $\alpha = -1$   $\beta = 2$   
 $y(x) = C_1 e^{(-1-2i)x} + C_2 e^{(-1+2i)x}$   $y(x) = e^{-x} (C_1 \cos(2x) + C_2 \sin(2x))$

7.  $y'' + 4y' + 20y = 0$   $y(0) = 2$   $y'(0) = 1$   $\lambda^2 + 4\lambda + 20 = 0$   
 $\lambda = \frac{-4 \pm \sqrt{16 - 80}}{2} = \frac{-4 \pm \sqrt{-64}}{2} = \frac{-4 \pm 8i}{2} = -2 \pm 4i$   $\alpha = -2$   $\beta = 4$   
 $1 = C_1 + C_2$   
 $y(x) = e^{-2x} (C_1 \cos(4x) + C_2 \sin(4x))$   $1 = 1(C_1(1) + C_2(1))$