

Ex Find the general solution of a homog. lin. ODE if you are told that the char. eq. has form

$$(\underline{r^2 + 2r + 10})^2 = 0$$

$$\text{roots for } r^2 + 2r + 10 = 0 \longrightarrow r = \frac{-2 \pm \sqrt{4 - 40}}{2} = -1 \pm 3i$$

conjugate pair

so the "full set of roots" of char eq. are

$-1 \pm 3i, -1 \pm 3i$ (root pair has multiplicity 2)

If pair had multiplicity 1, our gen solution is

$$y = Ae^{-x} \cos(3x) + Be^{-x} \sin(3x)$$

Since pair has mult. 2, our gen sol is

$$\begin{aligned} y &= (A + Bx)e^{-x} \cos(3x) + (C + Dx)e^{-x} \sin(3x) \\ &= c_1 e^{-x} \cos(3x) + c_2 x e^{-x} \cos(3x) + c_3 e^{-x} \sin(3x) \\ &\quad + c_4 x e^{-x} \sin(3x) \end{aligned}$$