

$$y'' + y = 2 \cdot \sin x$$

General homogeneous
equation:

$$y'' + y = 0$$

$$r^2 + 1 = 0 \rightarrow r \cdot \text{d.i.}$$

$$r^2 = -1 \rightarrow r = \sqrt{-1} \rightarrow r_1 = +i \quad r_2 = -i$$

$$p+q \cdot i = 0+i$$

because $p+q \cdot i = 0+i$ just $\sqrt{r \cdot \text{d.i.}}$

$$y_p = x \cdot e^{0 \cdot x} \cdot [A \cos x + B \sin x]$$

$$y_p = x \cdot t[A \cos x + B \sin x] = x \cdot A \cos x + x \cdot B \sin x$$

$$y'_p = t \cos x + x \cdot (-\sin x) + B \sin x + x \cdot B \cos x$$

$$y'_p = A \cos x - x \cdot t \sin x + B \sin x + B \cdot x \cos x$$

$$y''_p = -A \sin x - A \sin x - A \cdot x \cos x - B \cos x + B \cos x - B \cdot x \sin x$$

$$\underline{-A \sin x} - \underline{A \sin x} - \underline{A \cdot x \cos x} - \underline{B \cos x} + \underline{B \cos x} - \underline{B \cdot x \sin x} + \underline{A \cdot x \cos x} + \underline{B \cdot x \sin x} = 2 \cdot \underline{\sin x}$$

$$\begin{array}{l|l} \sin x & -A - A = 2 \Rightarrow -2 \cdot A = 2 \Rightarrow A = -1 \\ \cos x & -B + B = 0 \\ x \cdot \sin x & -B + B = 0 \\ x \cdot \cos x & -A + A = 0 \end{array}$$

$$y_p = -x \cdot \cos x$$

General
inhomogeneous
equation

$$y = \underbrace{C_1 \cos x + C_2 \sin x}_{\text{General homogeneous equation}} - \underbrace{x \cdot \cos x}_{\text{Specific inhomogeneous equation}}$$