Example Sheet 0: Ordinary linear differential equations in time

1. Solve, for the general solution,

$$\frac{dx}{dt} + x = 1$$

$$\frac{dx}{dt} + x = e^{2t}$$

$$\frac{dx}{dt} + x = \sin t$$

$$\frac{dx}{dt} + x = e^{-t}$$

2. Solve, for the general solution,

$$\frac{d^2x}{dt^2} - x = 1$$

$$\frac{d^2x}{dt^2} - x = e^{2t}$$

$$\frac{d^2x}{dt^2} - x = \sin t$$

$$\frac{d^2x}{dt^2} - x = e^{-t}$$

3. Solve, for the general solution,

$$\frac{d^2x}{dt^2} + \frac{dx}{dt} = 1$$

$$\frac{d^2x}{dt^2} + \frac{dx}{dt} = e^{2t}$$

$$\frac{d^2x}{dt^2} + \frac{dx}{dt} = \sin t$$

$$\frac{d^2x}{dt^2} + \frac{dx}{dt} = e^{-t}$$

4. Solve, for the general solution,

$$\frac{d^2x}{dt^2} + x = 1$$

$$\frac{d^2x}{dt^2} + x = e^{2t}$$

$$\frac{d^2x}{dt^2} + x = \sin t$$

$$\frac{d^2x}{dt^2} + x = e^{-t}$$

5. Solve, for the general solution,

$$\frac{d^2x}{dt^2} + 2\nu\frac{dx}{dt} + (\nu^2 + 1)x = 1$$

$$\frac{d^2x}{dt^2} + 2\nu\frac{dx}{dt} + (\nu^2 + 1)x = e^{2t}$$

$$\frac{d^2x}{dt^2} + 2\nu\frac{dx}{dt} + (\nu^2 + 1)x = \sin t$$

$$\frac{d^2x}{dt^2} + 2\nu\frac{dx}{dt} + (\nu^2 + 1)x = e^{-t}$$