# *Ordinary Differential Equations – 1 (ODE-1)*

## *Exercise 12*

**Question 1** Find general solutions for the following DEs by means of the method of coefficients' variation.

a. $\dot{y} = \begin{pmatrix} 4 & -2 \\ 8 & -4 \end{pmatrix} y + \begin{pmatrix} t^{-3} \\ -t^2 \end{pmatrix}$,

b. $\ddot{y} + \dot{y} = \dfrac{1}{\sin t}$ for $0 < t < \pi$.

**Question 2** Solve the following DEs.

a. $t^2\ddot{y} + 3t\dot{y} - 3y = 0$,

b. $t^2\ddot{y} + 3t\dot{y} + 5y = 0$,

c. $t^2\ddot{y} - 4t\dot{y} + 6y = t^{-2} + \sin(\ln t) + t^3 e^t$ for $t > 0$. Remark: it is impossible to calculate the integral $\int \dfrac{e^x}{x} dx$ in elementary functions, leave it as it is.

**Question 3** Find the general solutions for the following systems of DEs.

a. Solve the DE $t\ddot{y} + 2\dot{y} + ty = 0,\ t \neq 0$, given its particular solution $\dfrac{\sin t}{t}$.

b. Solve the system of DEs $t\dot{y} = \begin{pmatrix} 3 & -2 \\ 4 & -3 \end{pmatrix} y,\ t \neq 0$, given its particular solution $\begin{pmatrix} t \\ t \end{pmatrix}$.