

**MA102 Mathematics-II (2023-24)**  
**Tutorial sheet-3**  
**Higher order ODEs with constant coefficients**

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1. Solve the following differential equations:

(a)  $(D^4 + 2D^3 - 3D^2 - 4D + 4)y = 0$

(b)  $(D^3 + 6D^2 + 11D + 6)y = 0$

(c)  $(D^2 + D + 1)^2(D - 2)y = 0$ .

2. Solve the linear differential equation  $l \frac{d^2\theta}{dt^2} + g\theta = 0$  given that  $\theta = \theta_0$  and  $\frac{d\theta}{dt} = 0$  when  $t = 0$ .

3. Solve:

(a)  $\frac{d^2y}{dx^2} + a^2y = \sec ax$

(b)  $\frac{d^2y}{dx^2} + y = \sec^2 x$ .

4. Solve  $(D^2 + 4D + 4)y = 2 \sinh 2x$ .

5. Find the general solutions of the following differential equations:

(a)  $(D^3 - 5D^2 + 7D - 3)y = e^{2x} \cosh x$

(b)  $(D^2 - 6D + 8)y = (e^{2x} + 1)^2$ .

6. Solve:

(a)  $(D^2 + 2D + 1)y = \cos^2 x$

(b)  $(D^3 + a^2D)y = \sin ax$

(c)  $(D - 1)^2(D^2 + 1)^2y = \sin x$ .

7. Find the solution of  $d^2y/dx^2 + 4y = 8 \cos 2x$ , given that  $y = 0$  and  $dy/dx = 0$ , when  $x = 0$ .

8. Solve:

(a)  $(D^4 + 4D^2)y = x^2 + 1$

(b)  $(D^3 + 3D^2 + 2D)y = x^2$ .

9. Solve the equation  $(d^2y/dx^2) = a + bx + cx^2$  given that  $dy/dx = 0$  when  $x = 0$  and  $y = d$ , when  $x = 0$ .

10. Solve:

(a)  $(D - 1)^2y = e^x \sec^2 x \tan x$

(b)  $(D^2 + 3D + 2)y = e^{2x} \sin x$

(c)  $(D^2 + 1)y = x^2 \sin 2x$ .

11. Solve:

(a)  $(D^2 + 9)y = x \cos x$

(b)  $(D^2 - 1)y = x \sin x + (1 + x^2)e^x$ .

12. Solve  $(D^2 + 3D + 2)y = e^{e^x}$ .