

Board – CBSE

Class – 12

Topic – Differential Equation

1 Order and degree of a differential equation

LEVEL I

1. Write the order and degree of the following differential equations

(i) $\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^3 + 2y = 0$

2 General and particular solutions of a differential equation

LEVEL I

2. Show that $y = e^{-x} + ax + b$ is the solution of $e^x \frac{d^2y}{dx^2} = 1$

3 Formation of differential equation

LEVEL II

3. Obtain the differential equation by eliminating a, and b from the equation $y = e^x(\text{acosx} + \text{bsinx})$

LEVEL III

4. Find the differential equation of the family of circles $(x - a)^2 + (y - b)^2 = r^2$
5. Obtain the differential equation representing the family of parabola having vertex at the origin and axis along the positive direction of x-axis

4 Solution of differential equation by the method of separation of variables

LEVEL II

6. Solve $\frac{dy}{dx} = 1 + x + y + xy$
7. Solve $\frac{dy}{dx} = e^{-y} \cos x$ given that $y(0) = 0$
8. Solve $(1 + x^2) \frac{dy}{dx} - y = \tan^{-1} x$

5. Homogeneous differential equation of first order and first degree

LEVEL II

9. Solve $(x^2 + xy)dy = (x^2 + y^2)dx$

LEVEL III

10. Show that the given differential equation is homogenous and solve it.

1. $(x - y) \frac{dy}{dx} = x + 2y$

2. $ydx + x \log\left(\frac{y}{x}\right) dy - 2xdy = 0$

11. Solve $xdy - ydx = \sqrt{x^2 - y^2} dx$

12. Solve $x^2ydx - (x^3 + y^3)dy = 0$

13. Solve $xdy - ydx = \sqrt{(x^2 + y^2)} dx$ [CBSE 2011]

14. Solve $(y + 3x^2) \frac{dx}{dy} = x$

15. Solve $xdy + (y - x^3)dx = 0$ [CBSE 2011]

16. Solve $x dy + (y + 2x^2)dx = 0$

6 Linear Differential Equations

LEVEL I

17. Find the integrating factor of the differential $x \frac{dy}{dx} - y = 2x^2$

LEVEL II

18. Solve $\frac{dy}{dx} + 2y \tan x = \sin x$

19. Solve $(1 + x) \frac{dy}{dx} - y = e^{3x}(x + 1)^2$

20. Solve $x \frac{dy}{dx} + y = x \log x$

LEVEL III

21. Solve $\frac{dy}{dx} = \cos(x + y)$

22. Solve $ye^y dx = (y^3 + 2xe^y)dy$

23. Solve $x^2 \frac{dy}{dx} = y(x + y)$

24. Solve $\frac{dy}{dx} + \frac{4x}{x^2+1}y = -\frac{1}{(x^2+1)^3}$

25. Solve the differential $(x + 2y^2) \frac{dy}{dx} = y$: given that when $x = 2, y = 1$