

Unit I.Question Bank(Ordinary Diff. Eqⁿs of first order)

Q1. Define an exact differential equation. Give an example

Q2. State the Necessary and sufficient condition for the differential equation $Mdx + Ndy = 0$ to be exact. Write its solution also.

Q3. What do you understand by an Integrating Factor? Give an example.

Q4. What are the various methods to find an Integrating factor.

Q5. Solve $y dx - x dy + \log x dx = 0$

Q6. Solve $(xy^2 + 2x^2y^3) dx + (x^2y - x^3y^2) dy = 0$

Q7. Solve $(x^2y^2 + xy + 1) y dx + (x^2y^2 - xy + 1) x dy = 0$

Q8. Solve $(xy e^{x/y} + y^2) dx - x^2 e^{x/y} dy = 0$

Q9. Solve $p(p+y) = x(x+y)$

Q10. Solve $p^2 + 2py \cot x = y^2$

Q11. Solve $xy p^2 + p(3x^2 - 2y^2) - 6xy = 0$

Q12. Solve $p^2 - 2p \sinh x - 1 = 0$

Q13. Solve $p^3 - 4xyp + 8y^2 = 0$

Q14. Solve $y^2 \log y = xyp + p^2$

Q15. Solve $e^{3x} (p-1) + p^3 e^{2y} = 0$

Q16. Solve $(y+px)^2 = x^2 p$

Q17. Solve $\left(\frac{e^{-25x}}{\sqrt{x}} - \frac{y}{\sqrt{x}} \right) \frac{dx}{dy} = 1$

Q18.

Solve $(1-x^2) \frac{dy}{dx} + 2xy = x\sqrt{1-x^2}$

Q19.

Solve $e^{-y} \sec^2 y \, dy = dx + x \, dy$

Q20.

Solve $x \log x \frac{dy}{dx} + y = 2 \log x$

Q21.

Solve $xy(1+xy^2) \frac{dy}{dx} = 1$

Q22.

Solve $(2x \log x - xy) \, dy = -2y \, dx$

Q23.

Solve $e^y \left(\frac{dy}{dx} + 1 \right) = e^x$

Q24.

Solve $\frac{dy}{dx} + \frac{x}{1-x^2} y = x\sqrt{y}$

Q25.

What do you understand by Leibnitz's linear Equation? How will you write its solution.

Unit II.(Question Bank of Linear Ordinary Diff. Eqn of second and higher order)

Q1. Solve the following differential equations -

$$(i) \frac{d^2x}{dt^2} + \frac{a}{b}(x-c) = 0$$

$$(v) (D^4+1)y = 0$$

$$(ii) \frac{d^4y}{dx^4} + 8\frac{d^2y}{dx^2} + 16y = 0$$

$$(vi) (D^4-1)y = 0$$

$$(iii) (D^4 + D^2 + 1)y = 0$$

$$(iv) \frac{d^4x}{dt^2} = m^4x$$

Q2. solve -

$$(i) \frac{d^2y}{dx^2} + 4y = x \sin mx$$

$$(ii) (D^2 - 6D + 13)y = 8e^{3x} \sin 4x + 2^x$$

$$(iii) (D^2 + 3D + 2)y = e^{e^x}$$

$$(iv) \frac{d^3y}{dx^3} + y = \sin 3x - \cos^2 \frac{x}{2}$$

$$(v) \frac{d^2y}{dx^2} - 4y = x \sinh x$$

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

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

$$(vi) (D^2 - 2D + 2)y = xe^x \sin x$$

$$(vii) \frac{d^4y}{dx^4} - y = \cos x \cosh x$$

$$(viii) (D^2 - 4D + 3)y = \sin 3x \cos 2x$$

Solve the following & by using method of variation of parameter.

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

$$(ii) \frac{d^2y}{dx^2} + 4y = \tan 2x$$

$$(iii) \frac{d^2y}{dx^2} + 4y = 4 \sec^2 2x$$

$$(iv) y'' - 2y' + 2y = e^x \tan x$$

Q4. Solve:-

$$(i) x^3 \frac{d^3y}{dx^3} + 2x^2 \frac{d^2y}{dx^2} + 2y = 10 \left(x + \frac{1}{x} \right)$$

$$(ii) x^2 \frac{d^2y}{dx^2} + 3x \frac{dy}{dx} + y = \frac{1}{(1-x)^2}$$

$$(iii) x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + 2y = x \log x$$

$$(iv) x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + y = \log x \cdot \frac{\sin(\log x) + 1}{x}$$

Q5 Solve:-

$$(i) (1+x)^2 \frac{d^2y}{dx^2} + (1+x) \frac{dy}{dx} + y = 4 \cos \log(1+x)$$

$$(ii) (2x+3)^2 \frac{d^2y}{dx^2} - 2(2x+3) \frac{dy}{dx} - 12y = 6x$$

$$(iii) (1+2x)^2 \frac{d^2y}{dx^2} - 6(1+2x) \frac{dy}{dx} + 16y = 8(1+2x)^2$$

Q6. What is the solution of differential Equation if roots of A.E. are

- (i) Real and distinct
- (ii) Imaginary and repeating

Q7. Explain method of variation of Parameters

Q8. Define Cauchy's homogeneous linear differential Equation and give one example.

Q9. Define Legendre's linear Equation and give one example.

Q10. Solve $\frac{d^4y}{dx^4} + 2\frac{d^2y}{dx^2} + y = 0$

Additional Questions

- ① Solve the differential equation $x^4 \frac{dy}{dx} + xy^3 = -\sec(x)$
- ② Solve the equation $\frac{dy}{dx} = \frac{y}{x} + x \sin \frac{y}{x}$
- ③ Solve $(x+2y)(dx-dy) = dx+dy$
- ④ Solve $(x^3-x) \frac{dy}{dx} - (3x^2-1)y = x^5 - 2x^3 + x$
- ⑤ Solve $\sin x \frac{dy}{dx} + 2y = \tan^3 \left(\frac{x}{2}\right)$
- ⑥ Solve $x \frac{dy}{dx} + y \log y = xy e^x$
- ⑦ Solve $y \log y dx + (x - \log y) dy = 0$
- ⑧ Solve $[1 + \log(xy)] dx + [1 + \frac{x}{y}] dy = 0$
- ⑨ Solve $(2x \log x - xy) dy + 2y dx = 0$
- ⑩ Solve $y(xy + 2x^2y^2) dx + x(xy - x^2y^2) dy = 0$
- ⑪ Solve $y = (x-a)p - p^2$
- ⑫ Solve $y = 2px + yp^2$
- ⑬ Solve $p = \log(px-y)$
- ⑭ Solve $\frac{d^2y}{dx^2} + 4 \frac{dy}{dx} + 5y = 0$
- ⑮ Solve $\frac{d^2y}{dx^2} + 6 \frac{dy}{dx} + 9y = 5e^{3x}$
- ⑯ Solve $\frac{d^3y}{dx^3} - 3 \frac{d^2y}{dx^2} + 4 \frac{dy}{dx} - 2y = e^x + \cos x$
- ⑰ Solve $(D^2 + 6D + 9)y = \frac{e^{-3x}}{x^3}$
- ⑱ Solve $\frac{d^2y}{dx^2} + ay = \sec 3x$
- ⑲ Solve $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = \sin(\log x^2)$
- ⑳ Solve $(1+x)^2 \frac{d^2y}{dx^2} + (1+x) \frac{dy}{dx} + y = \sin 2 \{ \log(1+x) \}$
- ㉑ Solve $\frac{d^2y}{dx^2} + y = \operatorname{Cosec} x$
- ㉒ Solve $\frac{d^2y}{dx^2} - y = \frac{2}{1+e^x}$
- ㉓ Solve $3a^3 \frac{d^3y}{dx^3} + 3x \frac{d^2y}{dx^2} + \frac{dy}{dx} = x^2 \log x$
- ㉔ Solve $(D^2 + 5D + 6)y = e^{-2x} \sec^2 x (1 + 2 \tan x)$
- ㉕ Solve $(D^3 + 1)y = \cos^2 \left(\frac{x}{2}\right) + e^{-x}$

Q
1 Write the order and degree of the differential Equation

$$\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}} = \frac{d^2y}{dx^2}$$

- ② Write a small note on the equations reducible to linear form.
- ③ Define exact differential Equations & write the method of solving exact differential equation.
- ④ Write and derive Clairaut's equation.
- ⑤ Consider a linear differential equation and write its complete solution.
- ⑥ Write the method of parameter to find General Solution.