ODE IFoS Maths PYQ 2020

1. 5a

Solve the initial value problem :

$$(2x^2 + y)\, dx + (x^2y - x)\, dy = 0, \quad y(1) = 2.$$ 8

2. 5b

Solve the differential equation

$$\frac{d^2y}{dx^2} - 3\frac{dy}{dx} - 4y = 16x - 12e^{2x}.$$ 8

3. 6a

Find one solution of the differential equation

$$(x^2 + 1)\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2y = 0$$

by inspection and using that solution determine the other linearly independent solution of the given equation. Obtain the general solution of the given differential equation. 10

4. 7b

Solve the differential equation

$$x^2\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} + y = \frac{1}{(1-x)^2}.$$ 15

5. 8b

Reduce the differential equation

$$xp^2 - 2yp + x + 2y = 0, \quad \left(p = \frac{dy}{dx}\right),$$

to Clairaut's form and obtain its complete primitive. Also, determine a singular solution of the given differential equation. 15

2019

6. 5a

Solve the differential equation $(D^2+1)y = x^2 \sin 2x$; $D \equiv \frac{d}{dx}$. 8

7. 5b

Solve the differential equation $(px-y)(py+x) = h^2 p$, where $p = y'$. 8

8. 6a

Solve by the method of variation of parameters the differential equation

$$x''(t) - \frac{2x(t)}{t^2} = t, \quad \text{where } 0 < t < \infty$$ 15

9. 7a

Find the general solution of the differential equation

$$\ddot{x} + 4x = \sin^2 2t$$

Hence find the particular solution satisfying the conditions

$$x\left(\frac{\pi}{8}\right) = 0 \quad \text{and} \quad \dot{x}\left(\frac{\pi}{8}\right) = 0$$ 15

10. 8a

Find the general solution of the differential equation

$$(x-2)y'' - (4x-7)y' + (4x-6)y = 0$$ 10

2018

11. 5a

Find the complementary function and particular integral for the equation

$$\frac{d^2y}{dx^2} - y = xe^x + \cos^2 x$$

and hence the general solution of the equation. *8*

12. 5b

Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x \log x \;\; (x > 0)$ by the method of variation of parameters. *8*

13. 6a

Solve the differential equation $(y^2 + 2x^2y)\,dx + (2x^3 - xy)\,dy = 0$. *10*

14. 7b

Solve : *10*

$$\frac{dy}{dx} = \frac{4x + 6y + 5}{3y + 2x + 4}$$

15. 8b

A snowball of radius r(t) melts at a uniform rate. If half of the mass of the snowball melts in one hour, how much time will it take for the entire mass of the snowball to melt, correct to two decimal places ? Conditions remain unchanged for the entire process. *15*

2017

16. 5a

Solve

$$(2D^3 - 7D^2 + 7D - 2)\, y = e^{-8x} \text{ where } D = \frac{d}{dx}. \qquad 8$$

17. 5b

Solve the differential equation

$$x^2 \frac{d^2y}{dx^2} - 2x\frac{dy}{dx} - 4y = x^4. \qquad 8$$

18. 6a

Solve the differential equation

$$\left(\frac{dy}{dx}\right)^2 + 2\cdot\frac{dy}{dx}\cdot y \cot x = y^2. \qquad 15$$

19. 7a

Solve the differential equation

$$e^{3x}\left(\frac{dy}{dx} - 1\right) + \left(\frac{dy}{dx}\right)^3 e^{2y} = 0. \qquad 10$$

20. 8a

Solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$ by using the method of variation of parameter. *10*

2016

21. 5a

Obtain the curve which passes through (1, 2) and has a slope = $\frac{-2xy}{x^2+1}$. Obtain one asymptote to the curve. 8

22. 5b

Solve the dE to get the particular integral of $\frac{d^4y}{dx^4} + 2\frac{d^2y}{dx^2} + y = x^2 \cos x$. 8

23. 6b

Using the method of variation of parameters, solve

$$x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} - y = x^2 e^x.$$ 10

24. 7c

Obtain the singular solution of the differential equation

$$y^2 - 2pxy + p^2(x^2 - 1) = m^2, \quad p = \frac{dy}{dx}.$$ 10

25. 8b

Solve the differential equation

$$\frac{dy}{dx} - y = y^2(\sin x + \cos x).$$ 10

2015

26. 5a

Reduce the differential equation $x^2p^2 + yp(2x+y) + y^2 = 0$, $p = \frac{dy}{dx}$ to Clairaut's form. Hence, find the singular solution of the equation. 8

27. 5e

Solve the differential equation $x^2\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} + y = \frac{1}{(1-x)^2}$. 8

28. 6a

Solve $x\frac{d^2y}{dx^2} - \frac{dy}{dx} - 4x^3y = 8x^3 \sin x^2$ by changing the independent variable. 10

29. 6c

Solve $(D^4 + D^2 + 1)y = e^{-x/2}\cos\left(\frac{x\sqrt{3}}{2}\right)$, where $D \equiv \frac{d}{dx}$. 10

2014

30. 5a

Solve the differential equation :

$$y = 2px + p^2 y,\ p = \frac{dy}{dx}$$

and obtain the non-singular solution. 8

31. 5b

Solve :

$$\frac{d^4y}{dx^4} - 16y = x^4 + \sin x.$$ 8

32. 6a

Solve the following differential equation :

$$\frac{dy}{dx} = \frac{2y}{x} + \frac{x^3}{y} + x \tan \frac{y}{x^2}.$$ 10

33. 6c

Solve by the method of variation of parameters :

$y'' + 3y' + 2y = x + \cos x.$ 10

34. 7c

Solve the D.E. :

$$\frac{d^3y}{dx^3} - 3\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 2y = e^x + \cos x.$$ 10

2013

35. 5a

Solve :

$$\frac{dy}{dx} + x \sin 2y = x^3 \cos^2 y.$$ 8

36. 6a

Solve the differential equation

$$\frac{d^2y}{dx^2} - 4x\frac{dy}{dx} + (4x^2 - 1)y = -3e^{x^2} \sin 2x$$

by changing the dependent variable. 13

37. 7a

Solve

$$(D^3 + 1)\, y = e^{\frac{x}{2}} \sin\left(\frac{\sqrt{3}}{2}x\right)$$

where $D = \frac{d}{dx}$. 13

38. 8a

Apply the method of variation of parameters to solve

$$\frac{d^2y}{dx^2} - y = 2(1 + e^x)^{-1}.$$ 13

2012

39. 5a

Solve $\frac{dy}{dx} - \frac{\tan y}{1+x} = (1+x)e^x \sec y$. 8

40. 5b

Solve and find the singular solution of $x^3p^2 + x^2py + a^3 = 0$. 8

41. 6a

Solve :

$x^2 y \frac{d^2y}{dx^2} + \left(x\frac{dy}{dx} - y\right)^2 = 0$. 10

42. 6d

Solve $\frac{d^4y}{dx^4} + 2\frac{d^2y}{dx^2} + y = x^2 \cos x$. 10

43. 8a

Solve $x = y\frac{dy}{dx} - \left(\frac{dy}{dx}\right)^2$. 10

44. 8d

Solve $x^2 \frac{d^2y}{dx^2} + 3x\frac{dy}{dx} + y = (1-x)^{-2}$. 10

2011

45. 5a

Find the family of curves whose tangents form an angle $\pi/4$ with hyperbolas $xy = c$. 10

46. 5b

Solve :

$$\frac{d^2y}{dx^2} - 2\tan x \frac{dy}{dx} + 5y = \sec x \cdot e^x.$$ 10

47. 6a

Solve :

$$p^2 + 2py\cot x = y^2,$$

where $p = \frac{dy}{dx}$. 10

48. 6b

Solve :

$$(x^4D^4 + 6x^3D^3 + 9x^2D^2 + 3xD + 1)y = (1 + \log x)^2,$$

where $D \equiv \frac{d}{dx}$. 15

49. 6c

Solve :

$$(D^4 + D^2 + 1)y = ax^2 + be^{-x}\sin 2x,$$

where $D \equiv \frac{d}{dx}$. 15

2010

50. 5a

Show that $\cos(x+y)$ is an integrating factor of

$$y\,dx + [y + \tan(x+y)]\,dy = 0.$$

Hence solve it. 8

51. 5b

Solve

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x \sin x$$ 8

52. 6a

Solve the following differential equation

$$\frac{dy}{dx} = \sin^2(x - y + 6)$$ 8

53. 6b

Find the general solution of

$$\frac{d^2y}{dx^2} + 2x\frac{dy}{dx} + (x^2 + 1)y = 0$$ 12

54. 6c

Solve

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

55. 6d

Solve by the method of variation of parameters the following equation

$$(x^2 - 1)\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2y = (x^2 - 1)^2 \qquad 10$$