ABHINAV ACADEMY

UDUPI

CET25M9 DIFFERENTIAL EQUATIONS

Class 12 - Mathematics

Time Allowed: 1 hour and 30 minutes **Maximum Marks: 75**

1. The general solution of the differential equation e^x dy + (y e^x + 2x) dx = 0 is **[1]**

   a) x e^y + x^2 = C

   b) y e^x + x^2 = C

   c) x e^y + y^2 = C

   d) y e^y + x^2 = C

2. Consider a differential equation of order m and degree n. Which one of the following pairs is not feasible? **[1]**

   a) (2, $\frac{3}{2}$)

   b) (2, 4)

   c) (3, 2)

   d) (2, 2)

3. Degree of the differential equation sin x + cos$\left(\frac{dy}{dx}\right)$ = y^2 is **[1]**

   a) 2

   b) not defined

   c) 0

   d) 1

4. Find a solution of cos$\left(\frac{dy}{dx}\right) = a\ (a\ \in\ R)$ which satisfy the condition y = 1 when x = 0. **[1]**

   a) $cos\frac{y-10}{x} = a$

   b) $cos\frac{y-1}{x} = a$

   c) $cos\frac{y-4}{x} = a$

   d) $cos\frac{y-3}{x} = a$

5. The solution of the differential equation $\frac{dy}{dx} + \frac{2xy}{1+x^2} = \frac{1}{(1+x^2)^2}$ is: **[1]**

   a) $\frac{y}{1+x^2}$ = c + $\tan^{-1}$ x

   b) y (1 + x^2) = c + $\sin^{-1}$ x

   c) y(1 + x^2) = c + $\tan^{-1}$ x

   d) y log (1 + x^2) = c + $\tan^{-1}$ x

6. What is the degree of the differential equation y = $x\frac{dy}{dx} + \left(\frac{dy}{dx}\right)^{-1}$? **[1]**

   a) -1

   b) 1

   c) Does not exist

   d) 2

7. For the differential equation $xy\frac{dy}{dx} = (x+2)\,(y+2)$ find the solution curve passing through the point (1, –1). **[1]**

   a) $y + x + 2 = log\left(x^2(y+2)^2\right)$

   b) $y - x - 2 = log\left(x^2(y-2)^2\right)$

   c) $y - x + 2 = log\left(x^2(y+2)^2\right)$

   d) $y - x - 2 = log\left(x^2(y+2)^2\right)$

8. The solution of the differential equation $\frac{dy}{dx} = \frac{y}{x} + \frac{\phi\left(\frac{y}{x}\right)}{\phi'\left(\frac{y}{x}\right)}$ is **[1]**

   a) $\phi\left(\frac{y}{x}\right) = ky$

   b) $x\phi\left(\frac{y}{x}\right) = k$

   c) $y\phi\left(\frac{y}{x}\right) = k$

   d) $\phi\left(\frac{y}{x}\right) = kx$

[1]

9. A solution of the differential equation $\left(\frac{dy}{dx}\right)^2 - x\frac{dy}{dx} + y = 0$ is

a) $y = 2x^2 - 4$ b) $y = 2x$

c) $y = 2$ d) $y = 2x - 4$

10. The order and degree of the differential equation $\left[1 + \left(\frac{dy}{dx}\right)^2\right] = \frac{d^2y}{dx^2}$ respectively, are **[1]**

a) 4, 2 b) 2, 2

c) 1, 2 d) 2, 1

11. The integrating factor of the differential equation $(3x^2 + y)\ \frac{dx}{dy} = x$ is **[1]**

a) $\frac{2}{x}$ b) $-\frac{1}{x}$

c) $\frac{1}{x}$ d) $\frac{1}{x^2}$

12. A homogeneous equation of the form $\frac{dy}{dx} = h\left(\frac{x}{y}\right)$ can be solved by making the substitution **[1]**

a) $y = \nu x$ b) $x = \nu y$

c) $\nu = yx$ d) $x = \nu$

13. The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^2 = x\sin\left(\frac{dy}{dx}\right)$ is **[1]**

a) not defined b) 1

c) 2 d) 3

14. Consider the following statements in respect of the differential equation $\frac{d^2y}{dx^2} + \cos\left(\frac{dy}{dx}\right) = 0$ **[1]**

i. The degree of the differential equation is not defined.

ii. The order of the differential equation is 2.

Which of the above statement(s) is/are correct?

a) Both (i) and (ii) b) Only (ii)

c) Only (i) d) Neither (i) nor (ii)

15. If $\frac{d}{dx}[f(x)] = ax + b$ and $f(0) = 0$, then $f(x)$ is equal to **[1]**

a) $\frac{ax^2}{2} + bx + c$ b) a + b

c) b d) $\frac{ax^2}{2} + bx$

16. The solution of the differential equation $\left(x^2 + 1\right)\frac{dy}{dx} + \left(y^2 + 1\right) = 0$, is **[1]**

a) $y = \frac{1-x}{1+x}$ b) $y = \frac{1+x}{1-x}$

c) $y = 2 + x^2$ d) Y x(x - 1)

17. The general solution of the differential equation $(x^2 + x + 1)\ dy + (y^2 + y + 1)\ dx = 0$ is $(x + y + 1) = A(1 + Bx + Cy + Dxy)$, where B, C and D are constants and A is parameter. What is C equal to? **[1]**

a) -1 b) 2

c) -2 d) 1

18. The solution of the DE $\frac{dy}{dx} = 1 - x + y - xy$ is **[1]**

a) $e^y = x - \frac{x^2}{2} + C$ b) $\log(1 + y) = x - \frac{x^2}{2} + C$

c) $e^y = x + \frac{x^2}{4} + C$ d) $e^{(1+y)} = x - \frac{x^2}{2} + C$

19. The solution of the DE x cos y dy = (xe^x log x + e^x)dx is **[1]**

a) sin y = e^x + 2 log x + C b) sin y - e^x + log x = C

c) sin y = e^x + log x + C d) sin y = e^x (log x) + C

20. The degree and order respectively of the differential equation $\frac{dy}{dx} = \frac{1}{x+y+1}$ are **[1]**

a) 1, 2 b) 1, 1

c) 2, 1 d) 2, 2

21. The number of arbitrary constants in the particular solution of a differential equation of third order are: **[1]**

a) 1 b) 3

c) 2 d) 0

22. The general solution of the differential equation (x^2 + x + 1) dy + (y^2 + y + 1) dx = 0 is (x + y + 1) = A(1 + Bx + Cy + Dxy), where B, C and D are constants and A is parameter. What is B equal to? **[1]**

a) 2 b) -1

c) 1 d) -2

23. Family y = Ax + A^3 of curves is represented by the differential equation of degree: **[1]**

a) 2 b) 1

c) 3 d) 4

24. The solution of the DE $\frac{dy}{dx} = \frac{1-\cos x}{1+\cos x}$ is **[1]**

a) y = tan x + x + C b) $y = \tan\frac{x}{2} - 2x + C$

c) $y = 2\tan\frac{x}{2} - x + C$ d) y = tan x - x + C

25. The solution of the DE $\frac{dy}{dx} = \frac{(1+y^2)}{(1+x^2)}$ is **[1]**

a) y = (1 - x)C b) y = (1 + x)C

c) (y - x) = C(1 + yx) d) (y + x) = C(1 - yx)

26. Which of the following is not a homogeneous function of x and y. **[1]**

a) $\cos^2\left(\frac{y}{x}\right) + \frac{y}{x}$ b) x^2 + 2xy

c) 2x - y d) sin x - cos y

27. The general solution of the differential equation (e^x + 1) ydy = (y + 1) e^x dx is: **[1]**

a) y + 1 = e^x + 1 + k b) (y + 1) = k (e^x + 1)

c) $y = \log\left\{\frac{e^x+1}{y+1}\right\} + k$ d) y = log {k (y + 1) (e^x + 1)}

28. A first order linear differential equation, Is a differential equation of the form **[1]**

a) $\frac{dy}{dx} = Q$ b) $\frac{dy}{dx} + Py = Q$

c) $\frac{dy}{dx} + Py = 0$ d) $\frac{dy}{dx} + Px = Q$

29. Integrating factor of the differential equation $x\frac{dy}{dx}$ - 2y = $4x^2$ is: **[1]**

a) $\frac{1}{x^2}$

b) $-x^2$

c) $-\frac{1}{x^2}$

d) x^2

30. General solution of$cos^2 x\frac{dy}{dx} + y = \tan x\ \left(0 \leqslant x < \frac{\pi}{2}\right)$ is **[1]**

a) $y = (\tan x - 1) + Ce^{-\tan x}$

b) $y = (\tan x + 1) + Ce^{-\tan x}$

c) $y = (\tan x + 1) - Ce^{-\tan x}$

d) $y = (\tan x - 1) - Ce^{-\tan x}$

31. Which of the following is a homogeneous differential equation? **[1]**

a) $y^2dx + \left(x^2 - xy - y^2\right)dy = 0$

b) $(xy)\ dx - \left(x^3 + y^3\right)dy = 0$

c) $\left(x^3 + 2y^2\right)dx + 2xy\,dy = 0$

d) $(4x + 6y + 5)\ dy - (3y + 2x + 4)\ dx = 0$

32. The general solution of the differential equation $\log\left(\frac{dy}{dx}\right)$ + x = 0 is **[1]**

a) $y = -e^x + C$

b) $y = e^{-x} + C$

c) $y = -e^{-x} + C$

d) $y = e^x + C$

33. The general solution of $\frac{dy}{dx} = 2xe^{x^2-y}$ is: **[1]**

a) $e^{x^2+y} = c$

b) $e^y = e^{x^2} + c$

c) $e^{-y} + e^{x^2} + c$

d) $e^{x^2-y} = c$

34. The degree of the differential equation $\left(1 + \frac{dy}{dx}\right)^3 = \left(\frac{d^2y}{dx^2}\right)^2$ is **[1]**

a) 2

b) 1

c) 3

d) 4

35. Variable separation method can be used to solve First Order, First Degree Differential Equations in which y' is of the form. **[1]**

a) $y^2 = cos\ (g(y))$

b) $y^2 = sin\ (h(x))$

c) y' = h(x)g(y)

d) $y^3 = g(y)$

36. General solution of $x\frac{dy}{dx} + y - x + xycot\ x = 0\ (x \neq 0)$ is **[1]**

a) $y = \frac{1}{x} + \cot x + \frac{C}{x\sin x}$

b) $y = \frac{1}{x} - \cot x + \frac{C}{x\sin x}$

c) $y = \frac{1}{x} - \cot x - \frac{C}{x\sin x}$

d) $y = \frac{1}{x} + \cot x - \frac{C}{x\sin x}$

37. Solution of differential equation xdy - ydx = 0 represents: **[1]**

a) a circle whose centre is at origin

b) straight line passing through origin

c) a rectangular hyperbola

d) parabola whose vertex is at origin

38. The solution of $\frac{dy}{dx} = \sqrt{1 - x^2 - y^2 + x^2y^2}$ is, where, C is an arbitrary constant. **[1]**

a) $2\sin^{-1} y = x\sqrt{1 - x^2} + \cos^{-1} x + C$

b) $2\sin^{-1} y = \sqrt{1 - x^2} + \sin^{-1} x + C$

c) $2\sin^{-1} y = x\sqrt{1 - x^2} + \sin^{-1} x + C$

d) $\sin^{-1} y = \sin^{-1}x + C$

39. The differential equation $x\frac{dy}{dx} - y = x^2$, has the general solution **[1]**

a) $y + x^2 = 2cx$

b) $y - x^3 = 2cx$

c) $2y + x^2 = 2cx$

d) $2y - x^3 = cx$

40. What are the order and degree respectively of the differential equation whose solution is y = cx + c^2 - $3c^{3/2}$ + 2, where c is a parameter? **[1]**

a) 1, 3 b) 1, 4

c) 2, 2 d) 1, 2

41. The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + \sin\left(\frac{dy}{dx}\right) + 1 = 0$ is **[1]**

a) Not defined b) 3

c) 1 d) 2

42. The degree of the differential equation $\frac{d^2y}{dx^2} + 3\left(\frac{dy}{dx}\right)^2 = x^2 \log\left(\frac{d^2y}{dx^2}\right)$ is **[1]**

a) 3 b) 2

c) 1 d) not defined

43. To solve the homogeneous differential equation of the form $\frac{dy}{dx} = f\left(\frac{y}{x}\right)$, we put: **[1]**

a) y = vx b) y = v

c) x = vy d) x = v

44. y = 2 cos x + 3 sin x satisfies which of the following differential equations? **[1]**

i. $\frac{d^2y}{dx^2}$ + y = 0

ii. $\left(\frac{dy}{dx}\right)^2 + \frac{dy}{dx}$ = 0

Select the correct answer using the codes given below.

a) Only (ii) b) Neither (i) nor (ii)

c) Only (i) d) Both (i) and (ii)

45. The solution of the differential equation $\frac{dy}{dx} + 1 = e^{x+y}$ is **[1]**

a) (x + C)$e^{x + y}$ = 0 b) $(x + y)e^{x+y} = 0$

c) (x - C) e^{x+y} + 1 = 0 d) $(x - C)e^{x+y} = 1$

46. The number of solutions of the differential equation $\frac{dy}{dx} = \frac{y+1}{x-1}$, when y(1) = 2, is: **[1]**

a) two b) infinite

c) one d) zero

47. The general solution of the DE $\log\left(\frac{dy}{dx}\right) = (ax + by)$ is **[1]**

a) $\frac{-e^{-by}}{b} = \frac{e^{ax}}{a} + C$ b) be^{ax} - ae^{by} = C

c) e^{ax} - e^{-by} = C d) be^{ax} + ae^{by} = C

48. Consider the following statements **[1]**

i. The general solution of $\frac{dy}{dx}$ = f(x) + x is of the dx form y = g(x) + C, where C is an arbitrary constant.

ii. The degree of $\left(\frac{dy}{dx}\right)^2$ = f(x) is 2.

Which of the above statement(s) is/are correct?

a) Only (ii) b) Only (i)

c) Both (i) and (ii)

d) Neither (i) nor (ii)

49. Find the equation of a curve passing through the point (0, –2) given that at any point (x, y) on the curve, the product of the slope of its tangent and y coordinate of the point is equal to the x coordinate of the point. **[1]**

a) $y^3 - x^2 = 4$

b) $y^3 - x^3 = 4$

c) $y^2 - x^3 = 4$

d) $y^2 - x^2 = 4$

50. The degree of the differential equation $x^2 \frac{d^2y}{dx^2} = \left(x\frac{dy}{dx} - y\right)^3$ is: **[1]**

a) 6

b) 2

c) 3

d) 1

51. The solution of the differential equation $y_1 y_3 = y_2^2$ is **[1]**

a) $2x = C_1 e^{C_2 y} + C_3$

b) $x = C_1 e^{C_2 y} + C_3$

c) $y = C_1 e^{C_2 x} + C_3$

d) $2y = C_1 e^{C_2 x} + C_3$

52. The order and degree (if defined) of the differential equation, $\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^3 = x \sin\left(\frac{dy}{dx}\right)$ respectively are: **[1]**

a) 2, 3

b) 1, 3

c) 2, 2

d) 2, degree not defined

53. The solution of $\frac{dy}{dx} + y = e^{-x}$, y(0) = 0 **[1]**

a) $y = xe^{-x} + 1$

b) $y = xe^{-x}$

c) $y = e^x (x - 1)$

d) $y = xe^x$

54. The solution of differential equation x dy - y dx = 0 represents **[1]**

a) a circle whose centre is at origin

b) straight line passing through origin

c) a rectangular hyperbola

d) parabola whose vertex is at origin

55. The equation of the curve whose slope is given by $\frac{dy}{dx} = \frac{2y}{x}$; 0 and which passes through the point (1, 1) is **[1]**

a) $x^2 = y$

b) $y^2 = 2x$

c) $x^2 = 2y$

d) $y^2 = x$

56. The solution of the differential equation $\frac{dy}{dx} = \frac{x^2+xy+y^2}{x^2}$, is **[1]**

a) $\tan^{-1}\left(\frac{y}{x}\right) = \log y + C$

b) $\tan^{-1}\left(\frac{x}{y}\right) = \log x + c$

c) $\tan^{-1}\left(\frac{y}{x}\right) = \log x + C$

d) $\tan^{-1}\left(\frac{x}{y}\right) = \log y + C$

57. What is the order of the differential equation $\left(\frac{dy}{dx}\right)^2 + \frac{dy}{dx} - \sin^2 y = 0$? **[1]**

a) undefined

b) 3

c) 2

d) 1

58. The order and degree of the differential equation $\left(\frac{d^3y}{dx^3}\right)^2 - 3\frac{d^2y}{dx^2} + 2\left(\frac{dy}{dx}\right)^4 = y^4$ are: **[1]**

a) 1, 4

b) 3, 4

c) 2, 4

d) 3, 2

59. Find the equation of a curve passing through the point (0, 0) and whose differential equation is $y' = e^x \sin x$. **[1]**

a) $2y + 1 = e^x (sin2\ x - cos\ x)$

b) $2y - 1 = (\sin x - \cos x)\, e^x$

c) $3y - 1 = e^x (sin\ x - cos2x)$

d) $4y - 1 = e^x (sin\ x - cos\ 2x)$

60. The order and degree of the differential equation $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^{\frac{1}{4}} + x^{\frac{1}{5}} = 0$, respectively, are **[1]**

a) 2 and 4

b) 2 and 2

c) 2 and 3

d) 3 and 3

61. The solution of the differential equation $x\frac{dy}{dx} + 2y = x^2$ is **[1]**

a) $y = \frac{x^4+c}{x^2}$

b) $y = \frac{x^4+c}{4x^2}$

c) $y = \frac{x^2+c}{4x^2}$

d) $y = \frac{x^2}{4} + c$

62. What is the degree of the differential equation $\left(\frac{d^3y}{dx^3}\right)^{3/2} = \left(\frac{d^2y}{dx^2}\right)^2$? **[1]**

a) 3

b) 2

c) 1

d) 4

63. The integrating factor of differential equation $\cos x\frac{dy}{dx}$ + y sin x = 1 is **[1]**

a) sin x

b) sec x

c) tan x

d) cos x

64. The order and the degree of the differential equation $\left(1 + 3\frac{\mathrm{dy}}{\mathrm{d}x}\right)^2 = 4\frac{\mathrm{d}^3y}{\mathrm{d}x^3}$ respectively are: **[1]**

a) 3, 3

b) 3, 1

c) 1, 2

d) $1, \frac{2}{3}$

65. The general solution of the DE $\frac{dy}{dx} = \frac{y^2-x^2}{2xy}$ is **[1]**

a) $x^2 + y^2 = C_1x$

b) $x^2 + y^2 = C_1y$

c) $x^2 - y^2 = C_1x$

d) $x^2 - y^2 = C_1x$

66. Solution of the differential equation $\frac{dy}{dx} + \frac{y}{x}$ = sin x is: **[1]**

a) x (y + cos x) = cos x + c

b) x (y + cos x) = sin x + c

c) x (y - cos x) = sin x + c

d) xy cos x = sin x + c

67. The order of the differential equation $2x^2\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + y = 0$ is **[1]**

a) Not defined

b) 1

c) 2

d) 0

68. Integrating factor of the differential equation $\frac{dy}{dx}$ + y tan x - sec x = 0 is: **[1]**

a) sec x

b) $e^{\cos x}$

c) $e^{\sec x}$

d) cos x

69. The solution of the differential equation $\frac{dy}{dx}$ - ky = 0, y (0) = 1 approaches to zero when $x \to \infty$, if **[1]**

a) $k \neq 0$

b) k = 0

c) $k > 0$ d) $k < 0$

70. The number of arbitrary constants in the particular solution of a differential equation of second order is (are): **[1]**

a) 1 b) 3

c) 0 d) 2

71. $\tan^{-1} x + \tan^{-1} y = c$ is the general solution of the differential equation: **[1]**

a) $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$ b) $\frac{dy}{dx} = \frac{1+x^2}{1+y^2}$

c) $(1 + x^2) dy + (1 + y^2) dx = 0$ d) $(1 + x^2) dx + (1 + y^2) dy = 0$

72. The solution of the differential equation = $x\,dx + y\,dy = x^2y\,dy - y^2x\,dx$ is **[1]**

a) $x^3 + 1 = C(1 - y^3)$ b) $x^3 - 1 = C(1 + y^3)$

c) $x^2 + 1 = C(1 - y^2)$ d) $x^2 - 1 = C\left(1 + y^2\right)$

73. The integrating factor for solving the differential equation $x\frac{dy}{dx} - y = 2x^2$ is: **[1]**

a) e^{-x} b) x

c) e^{-y} d) $\frac{1}{x}$

74. What is the product of the order and degree of the differential equation $\frac{d^2y}{dx^2}\sin y + \left(\frac{dy}{dx}\right)^3 \cos y = \sqrt{y}$? **[1]**

a) 6 b) not defined

c) 2 d) 3

75. General solution of $\frac{dy}{dx} = sin^{-1}x$ is **[1]**

a) $y = xsin^{-1}x + \sqrt[2]{1 - x^2} + C$ b) $y = xsin^{-1}x + \sqrt[3]{1 - x^2} + C$

c) $y = xsin^{-1}x + \sqrt[2]{1 - x^4} + C$ d) $y = xsin^{-1}x + \sqrt[2]{1 - x^3} + C$