

MISSION NDA MATHEMATICS

COMPLETE TOPICWISE QUESTIONS

DIFFERENTIAL EQUATION

- The differential equation of the family of curves $y = e^x(A\cos x + B\sin x)$, where A and B are arbitrary constants, is
 - $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = 0$
 - $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 2y = 0$
 - $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 + y = 0$
 - $\frac{d^2y}{dx^2} - 7\frac{dy}{dx} + 2y = 0$
- The solution of the differential equation $\frac{dy}{dx} + \frac{1+\cos 2x}{1-\cos 2x} = 0$ is
 - $\tan y + \cot x = c$
 - $\tan y \cot x = c$
 - $\tan y - \cot x = c$
 - none of these
- The solution of the differential equation $(6x + 2y - 10)\frac{dy}{dx} = 2x + 9y - 20$ is
 - $(y + 2x)^2 = c(x - 2y + 5)$
 - $(y + 2x)^3 = c(x + 2y - 5)$
 - $(y - 2x)^2 = c(x + 2y - 5)$
 - none of these
- The curve whose subtangents are proportional to the abscissae of the points of tangency (k being the constant of proportionality) is
 - $y^k = cx^2$
 - $y^k = cx^3$
 - $y^k = cx$
 - none of these
- The solution of the differential equation $\frac{dy}{dx} = \sin(x + y) + \cos(x + y)$ is
 - $\log [1 + \tan(x + y)] = x + c$
 - $\log [1 - \tan(x + y)] = x + c$
 - $\log \left[1 + \tan \frac{1}{2}(x + y)\right] = x + c$
 - $\log \left[1 - \tan \frac{1}{2}(x + y)\right] = x + c$
- The solution of $\frac{dy}{dx} = \frac{2x-6y+7}{x-3y+4}$ is
 - $2x - y + \frac{1}{5} \log(5x - 15y + 17) = c$
 - $2x - 6y + \frac{1}{5} \log(5x - 15y + 17) = c$
 - $2x + y + \frac{1}{5} \log(5x - 15y + 17) = c$
 - none of these
- The curves which satisfy $(1 - x^2)\frac{dy}{dx} + xy = ax$ are
 - straight lines and ellipses
 - circles and ellipses
 - parabolas and ellipses
 - ellipses and hyperbolas
- The solution of the differential equation $(x^2 - yx^2)dy + (y^2 + x^2y^2)dx = 0$ is
 - $\frac{1}{x} + y + \log y = c$
 - $\frac{1}{x} + y + \frac{1}{y^2} = c$
 - $\frac{1}{y} + \frac{1}{x} + \log y - x = c$
 - none of these
- The solution of the differential equation $\sqrt{a+x}\frac{dy}{dx} + xy = 0$ is
 - $y = Ae^{2/3(2a-x)\sqrt{x+a}}$
 - $y = Ae^{-2/3(a-x)\sqrt{x+a}}$
 - $y = Ae^{2/3(a+x)\sqrt{x+a}}$
 - $y = Ae^{-2/3(2a-x)\sqrt{x+a}}$



10. The curve for which the normal at any point (x, y) and the line joining the origin to that point form an isosceles triangle with the x -axis as base is
 (a) an ellipse (b) a rectangular hyperbola
 (c) a circle (d) none of these
11. The solution of the differential equation $x \frac{dy}{dx} + y = x^2 3x + 2$ is
 (a) $xy = \frac{x^3}{3} + \frac{3}{2}x^2 + 2x + c$ (b) $xy = \frac{x^4}{4} + x^3 + x^2 + c$
 (c) $xy = \frac{x^4}{4} + \frac{x^3}{3} + x^2 + c$ (d) $xy = \frac{x^4}{4} + x^3 + x^2 + cx$
12. The general solution of $\frac{dy}{dx} = 2xe^{x^2-y}$ is
 (a) $e^{x^2-y} = c$ (b) $e^{-y} + e^{x^2} = c$
 (c) $e^y = e^{x^2} + c$ (d) none of these
13. The integral curve satisfying $\frac{dy}{dx} = \frac{x^2+y^2}{x^2-y^2}$, $y(1) = 1$ has the slope at the point $(1,0)$ of the curve, is equal to
 (a) -1 (b) 1
 (c) $-5/3$ (d) $5/3$
14. If $\frac{dy}{dx} = \frac{xy+y}{xy+x}$, then the solution of this equation is
 (a) $y = xe^x + c$ (b) $y = e^x + c$
 (c) $y = cxe^{x-y}$ (d) $y = x + c$
15. If $x = A \cos 4t + B \sin 4t$, then $\frac{d^2x}{dt^2}$ is equal to
 (a) $-16x$ (b) $16x$
 (c) x (d) $-x$
16. The degree and order of the differential equation $y = px + \sqrt[3]{a^2p^2 + b^2}$, where $p = \frac{dy}{dx}$, are respectively
 (a) 3,1 (b) 1,3
 (c) 1,1 (d) 3,3
17. The solution of the differential equation $\frac{dy}{dx} = 2xy$ is
 (a) $y = ce^{x^2}$ (b) $y^2 = 2x^2 + c$
 (c) $y = ce^{-x^2} + c$ (d) $y = x^2 + c$
18. The differential equation of $y = \sec(\tan^{-1} x)$ is
 (a) $(1+x^2) \frac{dy}{dx} = y + x$ (b) $(1+x^2) \frac{dy}{dx} = y - x$
 (c) $(1+x^2) \frac{dy}{dx} = xy$ (d) $(1+x^2) \frac{dy}{dx} = \frac{x}{y}$
19. The order and degree of the differential equation $\left(1 + \left(\frac{dy}{dx}\right)^2\right)^{3/4} = \left(\frac{d^2y}{dx^2}\right)^{1/3}$ are respectively
 (a) 2,4 (b) 2, 3
 (c) 6,4 (d) 6,9



20. The solution of the differential equation $\frac{dy}{dx} = \frac{x(2\log x + 1)}{\sin y + y \cos y}$ is
 (a) $y \sin y = x^2 \log x + \frac{x^2}{2} + c$ (b) $y \cos y = x^2 (\log x + 1) + c$
 (c) $y \cos y = x^2 \log x + \frac{x^2}{2} + c$ (d) $y \sin y = x^2 \log x + c$
21. The differential equation of all the straight lines passing through the origin is
 (a) $y = \sqrt{x} \frac{dy}{dx}$ (b) $\frac{dy}{dx} = y + x$
 (c) $\frac{dy}{dx} = y - x$ (d) none of these
22. The order of the differential equation $\frac{d^2y}{dx^2} = \sqrt{1 + \left(\frac{dy}{dx}\right)^2}$ is
 (a) 3 (b) 2
 (c) 1 (d) 4
23. The solution of the differential equation $x + y \frac{dy}{dx} = 2y$ is
 (a) $\log(y - x) = c + \frac{y-x}{x}$ (b) $\log(y - x) = c + \frac{x}{y-x}$
 (c) $y - x = c + \log \frac{x}{y-x}$ (d) $y + x = c + \log \frac{x}{y-x}$
24. The solution of the differential equation $\frac{dx}{x} + \frac{dy}{y} = 0$ is
 (a) $xy = c$ (b) $x + y = c$
 (c) $\log x \log y = c$ (d) $x^2 + y^2 = c$
25. The order of the differential equation of all the tangent lines to the parabola $y = x^2$ is
 (a) 1 (b) 2
 (c) 3 (d) 4
26. A curve is such that the mid-point of the portion of the tangent intercepted between the point where the tangent is drawn and the point, where the tangent meets the y-axis, lies on the line $y = x$. If the curve passes through (1,0), then the curve is
 (a) $2y = x^2 - x$ (b) $y = x^2 - x$
 (c) $y = x - x^2$ (d) $y = 2(x - x^2)$
27. The solution of $\frac{dy}{dx} = 2^{y-x}$ is
 (a) $2^x + 2^y = c$ (b) $2^x - 2^y = c$
 (c) $\frac{1}{2^x} - \frac{1}{2^y} = c$ (d) $\frac{1}{2^x} + \frac{1}{2^y} = c$
28. The solution of the differential equation $x = 1 + xy \frac{dy}{dx} + \frac{x^2 y^2}{2!} \left(\frac{dy}{dx}\right)^2 + \frac{x^3 y^3}{3!} \left(\frac{dy}{dx}\right)^3 + \dots$ is
 (a) $y = \ln(x) + c$ (b) $y^2 = (\ln x^2) + c$
 (c) $y = \log x + xy$ (d) $xy = x^y + c$
29. The solution of the differential equation $x \frac{dy}{dx} = y(\log y - \log x + 1)$ is
 (a) $\log \frac{x}{y} = cy$ (b) $\log \frac{y}{x} = cy$
 (c) $\log \frac{x}{y} = cx$ (d) $\log \frac{y}{x} = cx$
30. The differential equation $\cot y dx = x dy$ has a solution of the form
 (a) $y = \cos x$ (b) $x = \operatorname{cosec} y$
 (c) $x = \sin y$ (d) $y = \sin x$



31. The form of the differential equation of all family of lines $y = mx + \frac{4}{m}$ by eliminating the arbitrary constant m is
- (a) $\frac{d^2y}{dx^2} = 0$ (b) $x \left(\frac{dy}{dx}\right)^2 - y \frac{dy}{dx} + 4 = 0$
 (c) $x \left(\frac{dy}{dx}\right)^2 + y \frac{dy}{dx} + 4 = 0$ (d) $\frac{dy}{dx} = 0$
32. The family of curves represented by $\frac{dy}{dx} = \frac{x^2+x+1}{y^2+y+1}$ and the family of curves represented by $\frac{dy}{dx} + \frac{y^2+y+1}{x^2+x+1} = 0$
- (a) touch each other (b) are orthogonal
 (c) are one and the same (d) none of these
33. The general solution of $\frac{dy}{dx} = \frac{2x-y}{x+2y}$ is
- (a) $x^2 - xy + y^2 = c$ (b) $x^2 - xy - y^2 = c$
 (c) $x^2 + xy - y^2 = c$ (d) $x^2 + xy^2 = c$
34. $y = cx - c^2$ is the general solution of the differential equation
- (a) $(y')^2 - xy' + y = 0$ (b) $y'' = 0$
 (c) $y' = c$ (d) $(y')^2 + xy' + y = 0$
35. The solution of the differential equation $\frac{dy}{dx} = \frac{xy}{x^2+y^2}$ is
- (a) $cy^2 = e^{\frac{x^2}{y^2}}$ (b) $cy = e^{\frac{x}{y}}$
 (c) $y = e^{x^2} + y + c$ (d) $y = e^x + e^y + c$
36. An object falling from rest in air is subject not only to the gravitational force but also to air resistance. Assume that the air resistance is proportional to the velocity with constant of proportionality as $k > 0$ and acts in a direction opposite to motion ($g = 9.8 \text{ m/s}^2$). Then the velocity cannot exceed
- (a) 9.8/km/s (b) 98/km/s
 (c) $k/9.8 \text{ m/s}$ (d) none of these
37. The equation of the curve which is such that the portion of the x -axis cut off between the origin and the tangent at any point is proportional to the ordinate of that point is
- (a) $x = y(a - b \log y)$ (b) $\log x = by^2 + a$
 (c) $x^2 = y(a - b \log y)$ (d) none of these
38. If a is an arbitrary constant, then the solution of the differential equation $\frac{dy}{dx} + \sqrt{\frac{1-y^2}{1-x^2}} = 0$ is
- (a) $x\sqrt{1-y^2} + y\sqrt{1-x^2} = a$ (b) $y\sqrt{1-y^2} + x\sqrt{1-x^2} = a$
 (c) $x\sqrt{1-y^2} - y\sqrt{1-x^2} = a$ (d) $y\sqrt{1-y^2} - x\sqrt{1-x^2} = a$
39. The differential equation representing the family of curves $y = xe^{cx}$ (c is a constant) is
- (a) $\frac{dy}{dx} = \frac{y}{x} \left(1 - \log \frac{y}{x}\right)$ (b) $\frac{dy}{dx} = \frac{y}{x} \log \left(\frac{y}{x}\right) + 1$
 (c) $\frac{dy}{dx} = \frac{y}{x} \left(1 + \log \frac{y}{x}\right)$ (d) $\frac{dy}{dx} + 1 = \frac{y}{x} \log \left(\frac{y}{x}\right)$
40. If $\phi(x)$ is a differentiable function, then the solution of the differential equation $dy + [y\phi'(x) - \phi(x)\phi'(x)]dx = 0$ is
- (a) $y = [\phi(x) - 1] + ce^{-\phi(x)}$ (b) $y\phi(x) = [\phi(x)^2] + c$
 (c) $ye^{\phi(x)} = \phi(x)e^{\phi(x)} + c$ (d) $y - \phi(x) = \phi(x)e^{-\phi(x)}$



41. The equation of a curve that passes through the point (1,2) and satisfies the differential equation $\frac{dy}{dx} = \frac{2xy}{x^2+1}$ is
- (a) $y(x^2 + 1) = 1$ (b) $y(x^2 - 1) = 1$
 (c) $y(x^2 + 1) = 4$ (d) none of these
42. Let $f(x)$ be differentiable on the interval $(0, \infty)$ such that $f(1) = 1$ and $\lim_{t \rightarrow x} \frac{t^2 f(x) - x^2 f(t)}{t - x} = 1$ for each $x > 0$. Then $f(x)$ is
- (a) $\frac{1}{3x} + \frac{2}{3}x^2$ (b) $-\frac{1}{3x} + \frac{4}{3}x^2$
 (c) $-\frac{1}{x} + \frac{2}{x^2}$ (d) $\frac{1}{x}$
43. The solution of $(y + x + 5)dy = (y - x + 1)dx$ is
- (a) $\log [(y + 3)^2 + (x + 2)^2] + \tan^{-1} \frac{y+3}{x+2} = c$
 (b) $\log [(y + 3)^2 + (x - 2)^2] + \tan^{-1} \frac{y-3}{x-2} = c$
 (c) $\log [(y + 3)^2 + (x + 2)^2] + 2\tan^{-1} \frac{y+3}{x+2} = c$
 (d) $\log [(y + 3)^2 + (x + 2)^2] - 2\tan^{-1} \frac{y+3}{x+2} = c$
44. The solution of the differential equation $\log_e \left(\frac{dx}{dy} \right) = 3x - 5y$ is
- (a) $5e^{5y} = 3e^{3x} + c$ (b) $3e^{5y} - 5e^{3x} = c$
 (c) $5e^{5y} = -3e^{-3x} + c$ (d) $3e^{5y} - 5e^{-3x} = c$
45. The differential equation $\frac{dy}{dx} = \frac{\sqrt{1-y^2}}{y}$ determines a family of circles with
- (a) variable radii and a fixed centre at (0,1)
 (b) variable radii and a fixed centre at (0, -1)
 (c) a fixed radius 1 and variable centre along the x -axis
 (d) a fixed radius 1 and variable centre along the axis (0, -1)
46. The solution of the differential equation $\frac{d^2y}{dx^2} + \frac{1}{x^2} = 0$ is
- (a) $(\log_e x)^2$ (b) $\log_e x^2$
 (c) $\log_e x$ (d) $2\log_e x$
47. The solution of the equation $ydx + xdy = xy(dy - dx)$ is
- (a) $x - y - \log(xy) = c$ (b) $x - y + \log xy = c$
 (c) $x - y\log(x/y) = c$ (d) $x + \log xy = c$
48. The differential equation of all 'Simple Harmonic Motions' of the given period $\frac{2\pi}{n}$ is
- (a) $\frac{d^2x}{dt^2} = nx = 0$ (b) $\frac{d^2x}{dt^2} + n^2x = 0$
 (c) $\frac{d^2x}{dt^2} - n^2x = 0$ (d) $\frac{d^2x}{dt^2} + \frac{1}{n^2}x = 0$
49. The solution of the given differential equation $\frac{dy}{dx} + 2xy = y$ is
- (a) $y = ce^{x-x^2}$ (b) $y = ce^{x^2-x}$
 (c) $y = ce^x$ (d) $y = ce^{-x^2}$
50. The solution of the equation $\frac{dy}{dx} + \sin \frac{x+y}{2} = \sin \frac{x-y}{2}$ is
- (a) $\log \left| \tan \frac{y}{2} \right| + 2\sin \frac{x}{2} = c$ (b) $\log \left| \tan \frac{y}{4} \right| + 2\sin \frac{x}{2} = c$
 (c) $\log \left| \tan \frac{y}{4} \right| - 2\sin \frac{x}{2} = c$ (d) none of these



51. The equation of a curve passing through $(2, 7/2)$ and having gradient $1 - \frac{1}{x^2}$ at (x, y) is
 (a) $y = x^2 + x + 1$ (b) $xy = x^2 + x + 1$
 (c) $xy = x + 1$ (d) none of these
52. The solution of the differential equation $(1 + y^2)dx + (1 + x^2)dy = 0$ is
 (a) $1 - xy = k$ (b) $\frac{x+y}{1-xy} = k$
 (c) $\frac{x+y}{xy} = k$ (d) $\frac{1}{x} + \frac{1}{y} = k$
53. The solution of the equation $\frac{dy}{dx} = 1 + xy + x + y$ is
 (a) $(1 + y)(1 + x) = c$ (b) $\log_e (1 + y) = 1 + x + c$
 (c) $\log |1 + y| = x + \frac{x^2}{2} + c$ (d) $\log |1 + y| + x + \frac{x^2}{2} = c$
54. A particle moves in a straight line with a velocity given by $\frac{dx}{dt} = x + 1$ (x is the distance described). The time taken by the particle to traverse a distance of 99 m is
 (a) $\log_{10} e$ (b) $2\log_e 10$
 (c) $2\log_{10} e$ (d) $\frac{1}{2}\log_{10} e$
55. The differential equation for the family of curves $x^2 + y^2 - 2ay = 0$, where a is an arbitrary constant, is
 (a) $(x^2 - y^2)y' = 2xy$ (b) $2(x^2 + y^2)y' = xy$
 (c) $2(x^2 - y^2)y' = xy$ (d) $(x^2 + y^2)y' = 2xy$
56. If $\frac{dy}{dx} = \frac{x+y}{x}$, then
 (a) $y = x\log |x| + cx$ (b) $y = x\log |x| + c$
 (c) $y = \log |x| + cx$ (d) $xy = \log |x| + cx$
57. $y = 2e^{2x} - e^{-x}$ is a solution of the differential equation
 (a) $y_2 + y_1 + 2y = 0$ (b) $y_2 - y_1 + 2y = 0$
 (c) $y_2 + y_1 = 0$ (d) $y_2 - y_1 - 2y = 0$
58. The solution of the differential equation $\tan y \sec^2 x dx + \tan x \sec^2 y dy = 0$ is
 (a) $\frac{\tan x}{\tan y} = c$ (b) $\tan x \tan y = c$
 (c) $\tan x + \tan y = c$ (d) $\tan x - \tan y = c$
59. The solution of $x^4 \frac{dy}{dx} + x^3 y + \operatorname{cosec} xy = 0$ is
 (a) $2x^2 \cos xy + cx^2 + 1 = 0$ (b) $2x^2 \cos xy = cx^2$
 (c) $2x^2 \cos xy = cx^2 + 1$ (d) $x^2 \cos xy + cx^2 = 1$
60. The differential equation of the family of straight lines whose slope is equal to the y-intercept is
 (a) $(x + 1) \frac{dy}{dx} - y = 0$ (b) $(x + 1) \frac{dy}{dx} + y = 0$
 (c) $\frac{dy}{dx} = \frac{x-1}{y-1}$ (d) $\frac{dy}{dx} = \frac{x+1}{y+1}$



ANSWER KEY

1. (a)	2. (c)	3. (c)	4. (c)	5. (c)	6. (a)	7. (d)	8. (c)	9. (a)	10. (b)
11. (a)	12. (c)	13. (b)	14. (c)	15. (a)	16. (a)	17. (a)	18. (c)	19. (a)	20. (d)
21. (d)	22. (b)	23. (b)	24. (a)	25. (a)	26. (c)	27. (c)	28. (b)	29. (d)	30. (b)
31. (b)	32. (b)	33. (b)	34. (a)	35. (a)	36. (a)	37. (a)	38. (a)	39. (c)	40. (a)
41. (d)	42. (a)	43. (c)	44. (b)	45. (c)	46. (c)	47. (b)	48. (b)	49. (a)	50. (b)
51. (b)	52. (b)	53. (c)	54. (b)	55. (a)	56. (c)	57. (d)	58. (b)	59. (c)	60. (a)

