

MISSION NDA MATHEMATICS

COMPLETE TOPICWISE QUESTIONS

DIFFERENTIATION

- $\frac{d}{dx} [\log (\tan x)]$ is equal to
 (a) $2 \sec 2x$
 (b) $\sec 2x$
 (c) $\operatorname{cosec} 2x$
 (d) $2 \operatorname{cosec} 2x$
- If $y = 2^{\log x}$, then $\frac{dy}{dx}$ is equal to
 (a) $\frac{2^{\log x}}{x}$
 (b) $\frac{2^{\log x}}{\log 2}$
 (c) $2^{\log x} \cdot \log 2$
 (d) $\frac{2^{\log x} \cdot \log 2}{x}$
- If $y = x \log x - x$, then $\frac{dy}{dx}$ is equal to
 (a) $\frac{1}{\log x}$
 (b) $\frac{1}{x \log x}$
 (c) $\log x$
 (d) $\frac{1}{\log x - x}$
- If $y = \tan^{-1} \left(\frac{a \cos x - b \sin x}{b \cos x + a \sin x} \right)$, $\frac{dy}{dx} =$
 (a) $\frac{1}{1+x^2}$
 (b) $\frac{1}{\sqrt{1-x^2}}$
 (c) -1
 (d) none of these
- If $f(x) = \left(\frac{x^a}{x^b} \right)^{a+b} \cdot \left(\frac{x^b}{x^c} \right)^{b+c} \cdot \left(\frac{x^c}{x^a} \right)^{c+a}$ then $f'(x)$ is equal to
 (a) 1
 (b) 0
 (c) x^{a+b+c}
 (d) none of these
- The value of the derivative of $|x - 1| + |x - 3|$ at $x = 2$ is
 (a) -2
 (b) 0
 (c) 2
 (d) not defined
- If $y = \log_e (\log_e x)$, then $e^y \frac{dy}{dx}$ is equal to
 (a) e^y
 (b) $\frac{1}{x}$
 (c) $\frac{1}{\log x}$
 (d) $\frac{1}{x \log x}$
- If

$$y = \frac{1}{1 + x^{\beta-\alpha} + x^{\gamma-\alpha}} + \frac{1}{1 + x^{\alpha-\beta} + x^{\gamma-\beta}} + \frac{1}{1 + x^{\alpha-\gamma} + x^{\beta-\gamma}}$$



then $\frac{dy}{dx}$ is equal to

- (a) 0 (b) 1
(c) $(\alpha + \beta + \gamma)x^{\alpha+\beta+\gamma-1}$ (d) none of these

9. If $y = ce^{\frac{x}{x-a}}$, then $\frac{dy}{dx}$ equals

- (a) $a^2(x-a)^2$ (b) $a(x-a)^2$
(c) $-\frac{ay}{(x-a)^2}$ (d) none of these

10. If $y = \tan^{-1}(\operatorname{cosec} x + \cot x)$, then $\frac{dy}{dx}$ equals

- (a) $-\frac{1}{2}$ (b) -1
(c) 0 (d) 2

11. If $y = 1 + \frac{x}{|1|} + \frac{x^2}{|2|} + \frac{x^3}{|3|} + \dots$, $\frac{dy}{dx}$ is equal to

- (a) 0 (b) 1
(c) x (d) y

12. If $y = 1 - x + \frac{x^2}{|2|} - \frac{x^3}{|3|} + \frac{x^4}{|4|} - \dots$, then $\frac{d^2y}{dx^2}$ is equal to

- (a) $-x$ (b) $-y$
(c) x (d) y

13. If $y = x^{x^{x^{\dots}}}$, then $\frac{dy}{dx}$ is equal to

- (a) yx^{y-1} (b) $\frac{y^2}{x(1-y\log x)}$
(c) $\frac{y}{x(1+y\log x)}$ (d) none of these

14. If $f(a) = 2, f'(a) = 1, g(a) = 1, g'(a) = 2$, then $\lim_{x \rightarrow a} \frac{g(x)f(a) - g(a)f(x)}{x-a}$ is equal to

- (a) $-\frac{1}{3}$ (b) $\frac{1}{3}$
(c) -3 (d) 3

15. The derivative of $\log_{10} x$ with respect to x^2 is

- (a) $\frac{1}{2x^2} \log_e 10$ (b) $\frac{2}{x^2} \log_{10} e$
(c) $\frac{1}{2x^2} \log_{10} e$ (d) none of these

16. If $\tan^{-1} \frac{\sqrt{1+x} - \sqrt{1-x}}{\sqrt{1+x} + \sqrt{1-x}}$, then $\frac{dy}{dx} =$

- (a) $\frac{1}{\sqrt{1-x^2}}$ (b) $\frac{1}{2\sqrt{1-x^2}}$
(c) $\frac{x}{\sqrt{1-x^2}}$ (d) none of these

17. If $f(x) = |x|^{\sec x}$, then $f'(-\frac{\pi}{3})$ is

- (a) $\frac{2\pi}{3} - \frac{\pi^2}{3\sqrt{3}} \log \frac{\pi}{3}$ (b) $\frac{\pi}{3} - \frac{\pi^2\sqrt{3}}{2} \log \frac{\pi}{3}$
(c) $-\frac{2\pi}{3} + \frac{2\pi^2}{3\sqrt{3}} \log \frac{\pi}{3}$ (d) none of these



18. If $f(x) = \begin{vmatrix} \sec \theta & \tan^2 \theta & 1 \\ \theta \sec x & \tan x & x \\ 1 & \tan x - \tan \theta & 0 \end{vmatrix}$, then $f'(\theta)$ is
 (a) 0 (b) -1
 (c) independent of θ (d) none of these
19. If $e^x = \frac{\sqrt{1+t}-\sqrt{1-t}}{\sqrt{1+t}+\sqrt{1-t}}$ and $\tan \frac{y}{2} = \sqrt{\frac{1-t}{1+t}}$, then $\frac{dy}{dx}$ at $t = \frac{1}{2}$ is
 (a) $\frac{1}{2}$ (b) $-\frac{1}{2}$
 (c) 0 (d) none of these
20. If $f(x) = (\log_{\cot x} \tan x)(\log_{\tan x} \cot x)^{-1} + \tan^{-1} \left(\frac{x}{\sqrt{4-x^2}} \right)$, then $f(x)$ at $x = 0$ is
 (a) $7/2$ (b) $1/4$
 (c) $1/3$ (d) none of these
21. If $f(x) = \sqrt{x^2 + 9}$, then $\lim_{x \rightarrow 4} \frac{f(x) - f(4)}{x - 4}$ has the value
 (a) $5/4$ (b) $-4/5$
 (c) $4/5$ (d) none of these
22. The derivative of $\tan^{-1} \left(\frac{1+x}{1-x} \right)$ is
 (a) $\frac{2}{1+x^2}$ (b) $\frac{1}{1+x^2}$
 (c) $\frac{1+x^2}{1-x^2}$ (d) none of these
23. If $y = \log_a x + \log_x a + \log_x x + \log_a a$, then $\frac{dy}{dx}$ is equal to
 (a) $\frac{1}{x} + x \log a$ (b) $\frac{\log a}{x} + \frac{x}{\log a}$
 (c) $\frac{1}{x \log a} + x \log a$ (d) $\frac{1}{x \log a} - \frac{\log a}{x(\log x)^2}$
24. If $f(x) = x^n$, then the value of $f(1) + \frac{f'(1)}{1!} + \frac{f''(1)}{2!} + \frac{f'''(1)}{3!} + \dots + \frac{f^{(n)}(1)}{n!}$ is
 (a) n (b) 2^n
 (c) 2^{n-1} (d) $\frac{n(n+1)}{2}$
25. If $y = \sin^{-1} 2x \cdot \sqrt{1-x^2} + \sec^{-1} \frac{1}{\sqrt{1-x^2}}$, then $\frac{dy}{dx} =$
 (a) $\frac{1}{\sqrt{1-x^2}}$ (b) $\frac{2}{\sqrt{1-x^2}}$
 (c) $\frac{3}{\sqrt{1-x^2}}$ (d) none of these
26. Derivative of the function $f(x) = \log_5 (\log_7 x)$, $x > 7$ is
 (a) $\frac{1}{x(\log 5)(\log 7)(\log_7 x)}$ (b) $\frac{1}{x(\log 5)(\log 7)}$
 (c) $\frac{1}{x(\log x)}$ (d) none of these
27. $\frac{d}{dx} \left(\sin^2 \cot^{-1} \frac{1}{\sqrt{\frac{1+x}{1-x}}} \right) =$
 (a) 0 (b) $-\frac{1}{2}$
 (c) $\frac{1}{2}$ (d) -1



28. If $y = \cot^{-1} \left[\frac{\sqrt{1+\sin x} + \sqrt{1+\sin x}}{\sqrt{1+\sin x} - \sqrt{1+\sin x}} \right]$, then $\frac{dy}{dx} =$
- (a) $\frac{1}{2}$ (b) $\frac{2}{3}$
 (c) 3 (d) 1
29. The derivative of $\cos^{-1} \frac{1-x^2}{1+x^2}$ w.r.t. $\cot^{-1} \frac{1-3x^2}{3x+x^3}$ is
- (a) $\frac{1}{2}$ (b) $\frac{2}{3}$
 (c) 1 (d) $\frac{3}{2}$
30. If $y^{1/m} = [x + \sqrt{1+x^2}]$, then $(1+x^2)y_2 + xy_1$ is equal to
- (a) m^2y (b) my^2
 (c) m^2y^2 (d) none of these
31. If $y = (1+x)^{1/x}$, then $\frac{dy}{dx} =$
- (a) $\frac{x}{1+x} (1+x)^{1/x} - \log(1+x)$ (b) $(1+x)^{1/x} \frac{\left[\frac{x}{1+x} - \log(1+x) \right]}{x^2}$
 (c) $(1+x)^{1/x} \cdot x \log(1+x)$ (d) none of these
32. If $f(x) = \log_{x^2}(\log x)$, then $f'(x)$ at $x = e$ is
- (a) 0 (b) 1
 (c) $\frac{1}{e}$ (d) $\frac{1}{2e}$
33. If $y = \frac{2}{\sqrt{a^2-b^2}} \tan^{-1} \left(\sqrt{\frac{a-b}{a+b}} \tan \frac{x}{2} \right)$, $a > b > 0$, then
- (a) $\frac{dy}{dx} = \frac{1}{a+b\cos x}$ (b) $\frac{d^2y}{dx^2} = \frac{b\sin x}{(a+b\cos x)^2}$
 (c) $\frac{dy}{dx} = \frac{1}{a-b\cos x}$ (d) $\frac{d^2y}{dx^2} = \frac{-b\sin x}{(a-b\cos x)^2}$
34. If $y = \cos^{-1} \sqrt{\frac{\sqrt{1+x^2}+1}{2\sqrt{1+x^2}}}$ w.r.t. x , then $\frac{dy}{dx} \left(\cot^{-1} \frac{1-3x^2}{3x-x^3} \right)$ is
- (a) $\frac{1}{2(1+x^2)}$ (b) $\frac{1}{1+x^2}$
 (c) $-\frac{1}{2(1+x^2)}$ (d) none of these
35. If $f(x) = |x-2|$ and $g(x) = f[f(x)]$, then for $x > 20$, $g'(x)$ is equal to
- (a) -1 (b) 0
 (c) 1 (d) 2
36. If $y = (\log x)^x + x^{\log x}$, then $\frac{dy}{dx} =$
- (a) $(\log x)^x \left[\log(\log x) + \frac{1}{\log x} \right] + x^{\log x} \cdot \left(\frac{2\log x}{x} \right)$
 (b) $(\log x)^x \left[\log(\log x) - \frac{1}{\log x} \right] - x^{\log x} \cdot \left(\frac{2\log x}{x} \right)$
 (c) $(\log x)^x \left[\log(\log x) + \frac{1}{\log x} \right] - x^{\log x} \cdot \left(\frac{2\log x}{x} \right)$
 (d) none of these
37. If $f(x) = \cot^{-1} \left(\frac{x^x - x^{-x}}{2} \right)$, then $f'(1)$ is equal to
- (a) -1 (b) 1
 (c) $\log 2$ (d) $-\log 2$



38. If $u = f(x^3), v = g(x^2), f'(x) = \cos x$ and $g'(x) = \sin x$, then $\frac{du}{dv}$ is
 (a) $\frac{3}{2}x \cdot \cos x^3 \cdot \operatorname{cosec} x^2$ (b) $\frac{2}{3} \sin x^3 \cdot \sec x^2$
 (c) $\tan x$ (d) none of these
39. $\frac{d}{dx} \left(\cos^{-1} \frac{x-x^{-1}}{x+x^{-1}} \right) =$
 (a) $\frac{1}{1+x^2}$ (b) $\frac{-2}{1+x^2}$
 (c) $\frac{2}{1-x^2}$ (d) none of these
40. The differential coefficient of the function $|x-1| + |x-3|$ at the point $x=2$ is
 (a) -2 (b) 0
 (c) 2 (d) undefined
41. If $y = \frac{ax^2}{(x-a)(x-b)(x-c)} + \frac{bx}{(x-b)(x-c)} + \frac{c}{x-c} + 1$, then $\frac{y'}{y} =$
 (a) $\frac{1}{x} \left(\frac{a}{a-x} + \frac{b}{b-x} + \frac{c}{c-x} \right)$ (b) $\frac{a}{a-x} + \frac{b}{b-x} + \frac{c}{c-x}$
 (c) $\frac{1}{x} \left(\frac{a}{x-a} + \frac{b}{x-b} + \frac{c}{x-c} \right)$ (d) none of these
42. Let $f(x) = x^n$, n being a non-negative integer. The value of n for which the equality $f'(x+y) = f'(x) + f'(y)$ is valid for all $x, y > 0$ is
 (a) 0,1 (b) 1, 2
 (c) 2,4 (d) none of these
43. If $f(x) = x + \tan x$ and f is inverse of g , then $g'(x)$ is equal to
 (a) $\frac{1}{1+[g(x)-x]^2}$ (b) $\frac{1}{2-[g(x)-x]^2}$
 (c) $\frac{1}{2+[g(x)-x]^2}$ (d) none of these
44. If S_n denotes the sum of mn terms of a G.P. whose common ratio is r , then $(r-1) \frac{dS_n}{dr}$ is equal to
 (a) $(n-1)S_n + nS_{n-1}$ (b) $(n-1)S_n - nS_{n-1}$
 (c) $(n-1)S_n$ (d) none of these
45. If $xe^{xy} = y + \sin^2 x$, then at $x=0$, $\frac{dy}{dx}$ is equal to
 (a) -1 (b) 1
 (c) 0 (d) none of these
46. If $\sqrt{1-x^6} + \sqrt{1-y^6} = a^3(x^3 - y^3)$, then $\frac{dy}{dx}$ is equal to
 (a) $\frac{x^2}{y^2} \sqrt{\frac{1-y^6}{1-x^6}}$ (b) $\frac{y^2}{x^2} \sqrt{\frac{1-y^6}{1-x^6}}$
 (c) $\frac{x^2}{y^2} \sqrt{\frac{1-x^6}{1-y^6}}$ (d) none of these
47. If g is inverse of f and $f'(x) = \frac{1}{1+x^n}$, then $g'(x)$ equals
 (a) $1+x^n$ (b) $1+[f(x)]^n$
 (c) $1+[g(x)]^n$ (d) none of these



48. If $f'(1) = 2$ and $g'(\sqrt{2}) = 4$, then the derivative of $f(\tan x)$ w.r.t. $g(\sec x)$ at $x = \frac{\pi}{4}$ is
 (a) 1 (b) $\sqrt{2}$
 (c) $\sqrt{2}/2$ (d) 2
49. If $y = f(x) = \left(\frac{\tan^m x}{\tan^n x}\right)^{m+n} \left(\frac{\tan^n x}{\tan^p x}\right)^{n+p} \left(\frac{\tan^p x}{\tan^m x}\right)^{p+m}$, then $\frac{dy}{dx} =$
 (a) 0 (b) 1
 (c) $\tan^{m+n+p} x$ (d) none of these
50. The value of $\frac{d}{dx}(|x-1| + |x-5|)$ at $x = 3$ is
 (a) -2 (b) 0
 (c) 2 (d) 4
51. Let $f\left(\frac{x+y}{2}\right) = \frac{f(x)+f(y)}{2}$ for all real x and y for $f'(0) = -1, f(0) = 1$, then $f'(2) =$
 (a) $\frac{1}{2}$ (b) 1
 (c) -1 (d) $-\frac{1}{2}$
52. If $y = (1+x)(1+x^2)(1+x^4) \cdots (1+x^{2^n})$, then $\frac{dy}{dx}$ at $x = 0$ is
 (a) 1 (b) -1
 (c) 0 (d) none of these
53. If $y = \sin px$ and y_n is the n th derivative of y , then $\begin{vmatrix} y & y_1 & y_2 \\ y_3 & y_4 & y_5 \\ y_6 & y_7 & y_8 \end{vmatrix}$ is equal to
 (a) 1 (b) 0
 (c) -1 (d) none of these
54. If $y = \sin^{-1} \frac{\sqrt{1+x} + \sqrt{1-x}}{2}$, then $\frac{dy}{dx} =$
 (a) $\frac{1}{\sqrt{1-x^2}}$ (b) $-\frac{1}{\sqrt{1-x^2}}$
 (c) $-\frac{1}{2\sqrt{1-x^2}}$ (d) none of these
55. If $f(x) = \cos x \cdot \cos 2x \cdot \cos 4x \cdot \cos 8x \cdot \cos 16x$, then the value of $f'\left(\frac{\pi}{4}\right)$ is
 (a) 1 (b) $\sqrt{2}$
 (c) $\frac{1}{\sqrt{2}}$ (d) 0
56. If $f(x) = x \tan^{-1} x$, then $f'(1)$ equals
 (a) $\frac{1}{2} + \frac{\pi}{4}$ (b) $-\frac{1}{2} + \frac{\pi}{4}$
 (c) $-\frac{1}{2} - \frac{\pi}{4}$ (d) $\frac{1}{2} - \frac{\pi}{4}$
57. If $f(x) = \frac{x^2-x}{x^2+2x}$, then $\frac{df^{-1}(x)}{dx}$ is equal to
 (a) $-\frac{3}{(1-x)^2}$ (b) $\frac{3}{(1-x)^2}$
 (c) $\frac{1}{(1-x)^2}$ (d) none of these
58. If $2x^3 - 3x^2y^2 + 4x - y + 7 = 0$ and $y(1) = 1$, then the value of $y''(1)$ is equal to
 (a) $-\frac{343}{474}$ (b) $-\frac{474}{343}$
 (c) $\frac{474}{343}$ (d) $\frac{343}{474}$



59. If $\frac{\cos^4 \alpha}{x} + \frac{\sin^4 \alpha}{y} = \frac{1}{x+y}$, then $\frac{dy}{dx} =$
- (a) $\sqrt{\left(\frac{1-y^2}{1-x^2}\right)}$ (b) $\sqrt{\left(\frac{1-x^2}{1-y^2}\right)}$
 (c) $\sqrt{(1-x^2)(1-y^2)}$ (d) none of these
60. If $y = \sqrt{\sin x + \sqrt{\sin x + \sqrt{\sin x + \dots + \infty}}}$, then $\frac{dy}{dx}$ is equal to
- (a) $\frac{\cos x}{2y-1}$ (b) $\tan^2 \alpha$
 (c) 0 (d) $(x^2 + y^2)\sec^2 \alpha$
61. If $y = ax^{n+1} + bx^{-n}$, then $x^2 \frac{d^2y}{dx^2} =$
- (a) $n(n-1)y$ (b) $n(n+1)y$
 (c) ny (d) n^2y
62. If $x^2 + y^2 = 1$, then
- (a) $yy'' - 2(y')^2 + 1 = 0$ (b) $yy'' + (y')^2 + 1 = 0$
 (c) $yy'' + (y')^2 - 1 = 0$ (d) $yy'' + 2(y')^2 + 1 = 0$
63. If $x = \operatorname{cosec} \theta - \sin \theta$, $y = \operatorname{cosec}^n \theta - \sin^n \theta$, then $(x^2 + 4) \left(\frac{dy}{dx}\right)^2 - n^2 y^2 =$
- (a) n^2 (b) $2n^2$
 (c) $3n^2$ (d) $4n^2$
64. If $\sin^{-1} [\sqrt{x-ax} - \sqrt{a-ax}]$, then $\frac{dy}{dx} =$
- (a) $\frac{1}{\sin \sqrt{a-ax}}$ (b) $\sin \sqrt{x} \sin \sqrt{a}$
 (c) $\frac{1}{2\sqrt{x}\sqrt{1-x}}$ (d) 0
65. If variables x and y are related by the equation $x = \int_0^y \frac{1}{\sqrt{1+9u^2}} du$, then $\frac{d^2y}{dx^2}$ is equal to
- (a) $\sqrt{1+9y^2}$ (b) $\frac{1}{1+9y^2}$
 (c) $9y$ (d) $\frac{1}{9}y$
66. If $f(0) = 0 = g(0)$ and $f'(0) = 6 = g'(0)$, then $\lim_{x \rightarrow 0} \frac{f(x)}{g(x)}$ is given by
- (a) 1 (b) 0
 (c) 12 (d) -1
67. The derivative of $f(\tan x)$ with respect to $g(\sec x)$ at $x = \frac{\pi}{4}$, where $f'(1) = 2$ and $g'(\sqrt{2}) = 4$, is
- (a) $\frac{1}{\sqrt{2}}$ (b) $\sqrt{2}$
 (c) 1 (d) 0
68. If $y = x^2 + \frac{1}{x^2 + \frac{1}{x^2 + \frac{1}{x^2 + \dots + \infty}}}$, then $\frac{dy}{dx} =$
- (a) $\frac{2x}{2y-x^2}$ (b) $\frac{xy}{y+x^2}$
 (c) $\frac{xy}{y-x^2}$ (d) $\frac{2xy}{2+(x^2/y)}$



69. If $y = \sum_{n=1}^x \tan^{-1} \left(\frac{1}{1+n+n^2} \right)$, then $\frac{dy}{dx} =$

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

(b) $\frac{1}{1+(1+x)^2}$

(c) 0

(d) none of these

70. $\frac{d^2}{dx^2} (2\cos x \cos 3x)$ is equal to

(a) $2^2(\cos 2x + 2^2 \cos 4x)$

(b) $2^2(\cos 2x - 2^2 \cos 4x)$

(c) $2^2(-\cos 2x + 2^2 \cos 4x)$

(d) $-2^2(\cos 2x + 2^2 \cos 4x)$

71. If $f(x) = e^x g(x)$, $g(0) = 2$, $g'(0) = 1$, then $f'(0) =$

(a) 1

(b) 3

(c) 2

(d) 0

ANSWER KEY

- | | | | | | | | |
|-------------|---------|---------|---------|---------|---------|---------|---------|
| 1. (d) | 2. (d) | 3. (c) | 4. (c) | 5. (b) | 6. (b) | 7. (b) | 8. (a) |
| 9. (c) | 10. (a) | 11. (d) | 12. (d) | 13. (b) | 14. (d) | 15. (b) | 16. (b) |
| 17. (c) | 18. (b) | 19. (b) | 20. (d) | 21. (c) | 22. (b) | 23. (d) | 24. (b) |
| 25. (c) | 26. (a) | 27. (c) | 28. (a) | 29. (b) | 30. (a) | 31. (b) | 32. (d) |
| 33. (a) (b) | 34. (a) | 35. (c) | 36. (a) | 37. (a) | 38. (a) | 39. (b) | 40. (b) |
| 41. (a) | 42. (d) | 43. (c) | 44. (b) | 45. (b) | 46. (a) | 47. (c) | 48. (c) |
| 49. (a) | 50. (b) | 51. (c) | 52. (a) | 53. (b) | 54. (c) | 55. (b) | 56. (a) |
| 57. (b) | 58. (b) | 59. (b) | 60. (a) | 61. (b) | 62. (b) | 63. (d) | 64. (c) |
| 65. (c) | 66. (a) | 67. (a) | 68. (a) | 69. (b) | 70. (d) | 71. (b) | |



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