Kulkarni Science Academy

Exam Name :-Int derivative CN mat det FL2

Date :-31/08/2025

Time :-90 Minutes

Mark :- 100

MATHEMATICS

1. $\int_2^5 2[x]dx =$ { where $[x]$ denotes the greatest integer function $\le x$}[MHT-CET 2021]
   (a) 16 (b) 12
   (c) 24 (d) 18

2. If $y = \dfrac{1-\tan x}{1+\tan x}$, then $\dfrac{dy}{dx} =$
   (a) $\dfrac{2}{1-\sin 2x}$ (b) $\dfrac{-2}{1+\sin 2x}$
   (c) $\dfrac{2}{1+\sin 2x}$ (d) $\dfrac{-2}{1-\sin 2x}$

3. If ω is a complex cube root of unity, then $225+(3\omega+8\omega^2)^2+(3\omega^2+8\omega)^2$ is equal to
   (a) 72 (b) 192
   (c) 200 (d) 248

4. $\int_0^{\pi} \dfrac{x \tan x}{\sec x \operatorname{cosec} x} dx =$
   (a) $\dfrac{\pi^2}{2}$ (b) $\dfrac{\pi^2}{4}$
   (c) $\dfrac{\pi}{2}$ (d) $\dfrac{\pi}{4}$

5. $\int_{-\pi/4}^{\pi/4} \sin^2 x\,dx =$
   (a) $\dfrac{\pi}{2}-\dfrac{1}{2}$ (b) $\dfrac{\pi}{4}-\dfrac{1}{4}$
   (c) $\dfrac{\pi}{2}-\dfrac{1}{4}$ (d) $\dfrac{\pi}{4}-\dfrac{1}{2}$

6. The area of the region enclosed by the curves $y=\sin x$ and $y=\cos x$ and Y-axis is
   (a) $1-\sqrt{2}$ sq. units (b) $2-\sqrt{2}$ sq. units
   (c) $-1+\sqrt{2}$ sq. units (d) $-2+\sqrt{2}$ sq. units

7. The second order derivative of $\frac{e^x+1}{e^x}$ is [MHT-CET 2004]
   (a) e^x (b) $\frac{1}{e^x}$
   (c) $\frac{e^x-1}{e^x}$ (d) $e^x+\frac{1}{e^x}$

8. If $\int \frac{x+1}{x^2+5x+6}dx$ $= P\log(x+2)+Q\log(x+3)+c$, then $P+Q=$ ……. [MHT-CET 2019]
   (a) -1 (b) 3
   (c) 1 (d) -3

9. $\int e^x\left(\frac{1+\sin x}{1+\cos x}\right)dx =$[MHT-CET 2021]

(a) $e^x \cos\frac{x}{2} + c$
(b) $e^x \cot\frac{x}{2} + c$
(c) $e^x \tan\frac{x}{2} + c$
(d) $e^x \sin\frac{x}{2} + c$

10. If $I = \int e^{\sin\theta}(\log\sin\theta + \operatorname{cosec}^2\theta)\cos\theta d\theta$, then I is equal to (where c is a constant of integration)[MHT-CET 2024]

(a) $e^{\sin\theta}(\log\sin\theta + \operatorname{cosec}^2\theta) + c$
(b) $e^{\sin\theta}(\log\sin\theta - \operatorname{cosec}^2\theta) + c$
(c) $e^{\sin\theta}(\log\sin\theta - \operatorname{cosec}\theta) + c$
(d) $e^{\sin\theta}(\log\sin\theta + \operatorname{cosec}\theta) + c$

11. $\int_{-\pi/2}^{\pi/2} \log\left(\frac{3-\tan x}{3+\tan x}\right) dx = \ldots\ldots$ [MHT-CET 2019]

(a) -1
(b) 0
(c) 1
(d) 6

12. If $AB = A$ and $BA = B$, then $B^2 =$

(a) A
(b) B
(c) I
(d) 0

13. $\int \frac{x^2 \tan^{-1}(x^3)}{1 + x^6} dx =$

(a) $\frac{1}{6}(\tan^{-1}(x^3))^2 + c$
(b) $\frac{1}{6}\tan^{-1}(x^3) + c$
(c) $\frac{1}{6}\tan^{-1}(1 + x^6)^2 + c$
(d) $\tan^{-1}\left(\frac{x^3}{6}\right) + c$

14. The distance in seconds, described by a particle in t seconds is given by $s = ae^t + \frac{b}{a^t}$. The acceleration of the particle at time is

(a) Proportional to t
(b) Proportional to s
(c) s
(d) Constant

15. The approximate value of $x^4 + 2x^2 + 3$, when $x = 2.01$ is

(a) 27.02
(b) 27.20
(c) 27.04
(d) 27.40

16. If $A = \begin{bmatrix} 1 & \tan x \\ -\tan x & 1 \end{bmatrix}$, then $A^T \cdot A^{-1}$ =[MHT-CET 2023]

(a) $\begin{bmatrix} \cos 2x & \sin 2x \\ -\sin 2x & \cos 2x \end{bmatrix}$
(b) $\begin{bmatrix} \cos 2x & -\sin 2x \\ -\sin 2x & \cos 2x \end{bmatrix}$
(c) $\begin{bmatrix} \cos 2x & -\sin 2x \\ \sin 2x & \cos 2x \end{bmatrix}$
(d) $\begin{bmatrix} -\cos 2x & \sin 2x \\ -\sin 2x & \cos 2x \end{bmatrix}$

17. $\int_0^1 \frac{dx}{\sqrt{x^2 - x + 1}} =$

(a) $-3\log 3$
(b) $3\log 3$
(c) $-\log 3$
(d) $\log 3$

18. The value of $\int_0^\pi \left|\sin x - \frac{2x}{\pi}\right| dx$ is[MHT-CET 2023]

(a) $\frac{\pi}{2}$
(b) π
(c) $\frac{\pi}{4}$
(d) 2π

19. Area bounded by the curve $y^2 = 16x$, and line $y = mx$ is $\frac{2}{3}$,then m is equal to

(a) 3
(b) 4
(c) 1
(d) 2

20. If $x = \sin\theta, y = \sin^3\theta$, then $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{2}$ is[MHT-CET 2019]

(a) $\frac{1}{6}$ (b) 3

(c) 6 (d) $\frac{1}{3}$

21. $\int \frac{\cos x}{\sqrt{5+4\sin x-\sin^2 x}}\,dx =$

(a) $\frac{1}{3}\sin^{-1}\left(\frac{\sin x-2}{3}\right)+c$ (b) $\frac{1}{3}\cos^{-1}\left(\frac{\sin x-2}{3}\right)+c$

(c) $\sin^{-1}\left(\frac{\sin x-2}{3}\right)+c$ (d) $\cos^{-1}\left(\frac{\sin x-2}{3}\right)+c$

22. The slope of normal to the curve $x=\sqrt{t}$ and $y=t-\frac{1}{\sqrt{t}}$ at $t=4$ is

(a) $\frac{17}{4}$ (b) $\frac{-17}{4}$

(c) $\frac{4}{17}$ (d) $\frac{-4}{17}$

23. $\int_0^{\pi}\frac{dx}{4+3\cos x}$ =[MHT-CET 2023]

(a) $\frac{2\pi}{7}$ (b) $\frac{\pi}{2\sqrt{7}}$

(c) $\frac{\pi}{\sqrt{7}}$ (d) $\frac{\pi}{7}$

24. If Matrix $A=\begin{bmatrix}1 & 2\\ 4 & 3\end{bmatrix}$, such that, $AX=1$, then $X=$ _____[MHT-CET 2016]

(a) $\frac{1}{5}\begin{bmatrix}1 & 3\\ 2 & -1\end{bmatrix}$ (b) $\frac{1}{5}\begin{bmatrix}4 & 2\\ 4 & -1\end{bmatrix}$

(c) $\frac{1}{5}\begin{bmatrix}-3 & 2\\ 4 & -1\end{bmatrix}$ (d) $\frac{1}{5}\begin{bmatrix}-1 & 2\\ -1 & 4\end{bmatrix}$

25. The value of c of Lagrange's mean value theorem for $f(x)=\sqrt{25-x^2}$ on [1,5] is[MHT-CET 2023]

(a) $\sqrt{10}$ (b) $\sqrt{15}$

(c) 1 (d) 5

26. If $A=\begin{bmatrix}1 & 0 & 1\\ 0 & 2 & 3\\ 1 & 2 & 1\end{bmatrix}, B=\begin{bmatrix}1 & 2 & 3\\ 1 & 1 & 5\\ 2 & 4 & 7\end{bmatrix}$ and $XA=B$, then $X=$

(a) $\frac{1}{3}\begin{bmatrix}4 & 4 & 2\\ 11 & 8 & -5\\ 10 & 10 & 2\end{bmatrix}$ (b) $\frac{1}{2}\begin{bmatrix}4 & 4 & 2\\ 11 & 8 & -5\\ 10 & 10 & 2\end{bmatrix}$

(c) $\frac{1}{6}\begin{bmatrix}4 & 4 & 2\\ 11 & 8 & -5\\ 10 & 10 & 2\end{bmatrix}$ (d) $\frac{1}{3}\begin{bmatrix}2 & 2 & 1\\ 11 & 8 & -5\\ 10 & 10 & 2\end{bmatrix}$

27. $\int \sin^4 x\cos^3 x\,dx=$

(a) $\frac{\sin^5 x}{5}+\frac{\sin 7x}{7}+c$ (b) $\frac{\sin^5 x}{5}-\frac{\sin^7 x}{7}+c$

(c) $\frac{\sin^7 x}{7}-\frac{\sin^5 x}{5}+c$ (d) $\frac{-\sin^7 x}{7}-\frac{\sin^5 x}{5}+c$

28. The area of the region bounded by the curve $y=\sin x$, the X-axis and the lines $x=\frac{-\pi}{2}, x=\frac{\pi}{2}$ is

(a) 0 sq. units (b) 1 sq. units

(c) 3 sq. units (d) 2 Sq. units

29. The angle between the tangents to the curves $y = 2x^2$ and $x = 2y^2$ at $(1,1)$ is

(a) $\tan^{-1}\left(\frac{15}{8}\right)$ **(b)** $\tan^{-1}\left(\frac{1}{4}\right)$

(c) $\tan^{-1}\left(\frac{7}{8}\right)$ **(d)** $\tan^{-1}\left(\frac{3}{4}\right)$

30. $\int_0^{\pi} \frac{x}{a^2\cos^2 x + b^2\sin^2 x}\,dx =$

(a) $\frac{\pi}{ab}$ **(b)** $\frac{\pi}{2ab}$

(c) $\frac{\pi^2}{ab}$ **(d)** $\frac{\pi^2}{2ab}$

31. In inverse of the matrix $\begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$ is

(a) $\begin{bmatrix} 3 & -1 & 1 \\ 5 & -2 & 2 \\ -15 & 6 & -5 \end{bmatrix}$ **(b)** $\begin{bmatrix} -3 & 1 & -1 \\ -5 & 2 & -2 \\ 15 & -6 & 3 \end{bmatrix}$

(c) $\begin{bmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{bmatrix}$ **(d)** $\begin{bmatrix} -3 & 1 & -1 \\ 15 & -6 & 5 \\ -5 & 2 & -2 \end{bmatrix}$

32. Let α and β be the roots of the equation $x^2 + x + 1 = 0$. The equation whose roots are α^{19}, β^7 is

(a) $x^2 - x - 1 = 0$ **(b)** $x^2 - x + 1 = 0$

(c) $x^2 + x - 1 = 0$ **(d)** $x^2 + x + 1 = 0$

33. The inverse of $\begin{bmatrix} 1 & \sin\alpha \\ -\sin\alpha & -1 \end{bmatrix}$ is :

(a) $\begin{bmatrix} 1 & -\sin\alpha \\ -\sin\alpha & -1 \end{bmatrix}$ **(b)** $-\sec^2\alpha\begin{bmatrix} 1 & -\sin\alpha \\ \sin\alpha & -1 \end{bmatrix}$

(c) $\sec^2\alpha\begin{bmatrix} 1 & -\sin\alpha \\ -\sin\alpha & -1 \end{bmatrix}$ **(d)** $-\cos^2\alpha\begin{bmatrix} 1 & \sin\alpha \\ -\sin\alpha & -1 \end{bmatrix}$

34. If $y = \frac{(2x+1)(3x-1)}{4x-1}$, then $\frac{dy}{dx} =$

(a) $\frac{3(8x^2-4x+1)}{(4x-1)^2}$ **(b)** $\frac{3(8x^2+4x+1)}{(4x-1)^2}$

(c) $\frac{3(8x^2-4x-1)}{(4x-1)^2}$ **(d)** $\frac{3(8x^2+4x-1)}{(4x-1)^2}$

35. If $y = \sqrt{\sin x + y}$, then $\frac{dy}{dx}$ equals :

(a) $\frac{\cos x}{2y-1}$ **(b)** $\frac{\cos x}{1-2y}$

(c) $\frac{\sin x}{1-2y}$ **(d)** $\frac{\sin x}{2y-1}$

36. If $\frac{d}{dx}(f(x)) = g(x)$, then $\int f(x)\,g(x)\,dx$ is equal to

(a) $f(x) + c$ **(b)** $\frac{[f(x)]^2}{2} + c$

(c) $g(x) + c$

(d) $\frac{[g(x)]^2}{2} + c$

37. The area bounded between the curve $x^2 = y$ and the line $y = 4x$ is[MHT-CET 2021]

(a) $\frac{32}{3}$ sq. units

(b) $\frac{1}{3}$ sq. units

(c) $\frac{8}{3}$ sq. units

(d) $\frac{16}{3}$ sq. units

38. If $y = \sin^2\left(\cot^{-1}\sqrt{\frac{1+x}{1-x}}\right)$, then $\frac{dy}{dx}$ has the value, when $x = 1$[MHT-CET 2024]

(a) $\frac{-1}{2}$

(b) -1

(c) 1

(d) $\frac{1}{2}$

39. Let $\frac{d}{dx}[f(x)] = \frac{e^{\sin x}}{x}$, where x > 0. If $\int_1^4 \frac{3}{x}.e^{\sin x^3}\,dx = f(k) - f(1)$, then one of the possible value of k is

(a) 15

(b) 16

(c) 63

(d) 64

40. The area between the parabola $y = x^2$ and the line $y = x$ is

(a) $\frac{1}{6}$ sq. units

(b) $\frac{1}{3}$ sq. units

(c) $\frac{1}{2}$ sq. units

(d) None of these

41. $\int \frac{dx}{x + x^{-n}} =$

(a) $\frac{1}{n-1}\log(x^{n-1} + 1) + c$

(b) $\frac{1}{n+1}\log(x^{n+1} + 1) + c$

(c) $\frac{1}{n-1}\log(x^{n+1} - 1) + c$

(d) $\frac{1}{n+1}\log(x^{n-1} - 1) + c$

42. The equation of normal to the curve $y = 3x^2 - x + 1$ at (1, 3) is

(a) $x + 5y + 16 = 0$

(b) $x + 5y - 16 = 0$

(c) $x - 5y + 16 = 0$

(d) $x - 5y - 16 = 0$

43. If $y = x\tan y$, then $\frac{dy}{dx}$ =[MHT-CET 2021]

(a) $\frac{\tan x}{x - x^2 - y^2}$

(b) $\frac{\tan x}{x - y^2}$

(c) $\frac{y}{x - x^2 - y^2}$

(d) $\frac{\tan y}{y - x}$

44. $\int \frac{dx}{\sqrt{4 - 2x - x^2}} =$

(a) $\sin^{-1}\left(\frac{x+1}{\sqrt{5}}\right) + c$

(b) $\sin^{-1}\left(\frac{x-1}{\sqrt{5}}\right) + c$

(c) $\frac{1}{\sqrt{5}}\sin^{-1}\left(\frac{x+1}{\sqrt{5}}\right) + c$

(d) $\frac{1}{\sqrt{5}}\sin^{-1}\left(\frac{x-1}{\sqrt{5}}\right) + c$

45. $\int x^3 e^x\,dx =$

(a) $e^x(x^3 + 3x^2 + 6x + 6) + c$

(b) $e^x(x^3 - 3x^2 - 6x + 6) + c$

(c) $e^x(x^3 - 3x^2 + 6x - 6) + c$

(d) $e^x(x^3 + 3x^2 - 6x - 6) + c$

46. If ω is a complex cube root of unity and $A = \begin{bmatrix} \omega & 0 \\ 0 & \omega \end{bmatrix}$, then $A^{-1} =$ [MHT-CET 2020]

(a) $-A$
(b) $2A$
(c) A^2
(d) A

47. The area bounded by the parabola $y = 2x - x^2$, X-axis is

(a) $\frac{2}{3}$ sq. units
(b) $\frac{3}{2}$ sq. units
(c) $\frac{4}{3}$ sq. units
(d) $\frac{4}{2}$ sq. units

48. The approximate value of $(4.01)^5$ is

(a) 1036.08
(b) 1036.06
(c) 1036.80
(d) 1036.60

49. $\int_0^{\pi/2} \frac{x + \sin x}{1 + \cos x} dx =$

(a) log2
(b) -log2
(c) $\frac{\pi}{2}$
(d) 0

50. $\int \left(1 + x - \frac{1}{x}\right) e^{x+\frac{1}{x}} dx$ is equal to (where c is a constant of integration.)[MHT-CET 2024]

(a) $xe^{x+\frac{1}{x}} + c$
(b) $(x - 1)e^{x+\frac{1}{x}} + c$
(c) $(x + 1)e^{x+\frac{1}{x}} + c$
(d) $-xe^{x+\frac{1}{x}} + c$