



K24U 4131

Reg. No. :

Name :

**First Semester B.Sc. Honours in Mathematics (C.B.C.S.S. – O.B.E. –
Supplementary/Improvement) Examination, November 2024
(2021 to 2023 Admission)
Core Course
1B01 BMH : CALCULUS – I**

Time : 3 Hours

Max. Marks : 60

PART – A

Answer **any 4** questions out of 5 questions. **Each** question carries **1** mark.

1. What is the domain of the function $y = \sqrt{x-1}$?
2. Write the formula for the local linear approximation of $y = f(x)$ at $x = x_0$.
3. Evaluate $f'(x)$ if $f(x) = \tanh \sqrt{x^2 + x}$.
4. Evaluate $\frac{d}{dx} \int_1^{x^2} \sec t \, dt$.
5. Write the formula for finding the volume by cylindrical shell about Y- axis. **(4×1=4)**

PART – B

Answer **any 6** questions out of 9 questions. **Each** question carries **2** marks.

6. Prove that $\lim_{x \rightarrow -2} 3x + 5 = -1$.
7. Prove that $\cos(\sin^{-1} x) = \sqrt{1-x^2}$.
8. Using Intermediate Value Theorem show that there is a root of the equation $x^4 + x - 3 = 0$ in the interval (1, 2).
9. Evaluate $\lim_{x \rightarrow 0} \frac{\tan x}{x^2}$.
10. Find the average value of the function $f(x) = 1 + x^2$ on $[-1, 2]$.

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11. Find the linear approximation of $f(x) = \sqrt{1-x}$ at $a = 0$ and approximate $\sqrt{0.9}$.
12. Sketch the graph of the function $f(x) = 3 - 2^x$ and determine its domain and range.
13. Evaluate $\int \sin^{-1} x \, dx$.
14. Use the Mid-Point Rule with $n = 5$, to approximate $\int_1^2 \frac{1}{x} \, dx$. **(6×2=12)**

PART – C

Answer **any 8** questions out of 12 questions. **Each** question carries **4** marks.

15. Evaluate $\lim_{x \rightarrow x} (\ln x)^{\frac{1}{x}}$.
16. Sketch the region represented by the definite integral $\int_0^1 (x+1) \, dx$ and hence find its value.
17. Show that $\sinh^{-1} x = \ln(x + \sqrt{x^2 + 1})$.
18. Show that every polynomial functions are continuous on \mathbb{R} .
19. Check the continuity of the function at $x = 3$ if $f(x) = \begin{cases} \frac{2x^2 - 5x - 3}{x - 3}, & \text{if } x \neq 3 \\ 6, & \text{if } x = 3 \end{cases}$.
20. Using Reduction formula evaluate $\int \sin^5 x \cos^2 x \, dx$.
21. Derive the formula for the circumference of the circle of radius r .
22. Find the local extrema of $f(x) = x^4 - 4x^3 + 4x^2$.
23. Find the area of the region bounded by $x = y^2$ and $y = x - 2$.
24. Find the absolute maximum and minimum values of the function $f(x) = 4x^2 - 12x + 10$ on $[1, 2]$.
25. Evaluate $\lim_{x \rightarrow 1} \arcsin\left(\frac{1-\sqrt{x}}{1-x}\right)$.
26. Verify Rolle's theorem for the function $f(x) = x^2 - 6x + 8$ at $[2, 4]$. **(8×4=32)**



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PART – D

Answer **any 2** questions out of 4 questions. **Each** question carries **6** marks.

27. Find the radius and the height of the right circular cylinder of largest volume that can be inscribed in a right circular cone with radius 6 inches and height 10 inches.
28. State and prove Mean Value theorem.
29. Find the area of the surface that is generated by revolving the portion of the curve $y = x^3$ between $x = 0$ and $x = 1$ about the x-axis.
30. The region R enclosed by the curve $y = x$ and $y = x^2$ is rotated about the X-axis. Find the volume of the resulting solid. **(2×6=12)**