

First Semester FYUGP Mathematics Examination
November 2024 (2024 Admission onwards)
KU1DSCMAT113 (FUNCTIONS, CALCULUS AND
MATRICES)

(EXAM DATE : 06-12-2024)

Time : 120 min

Maximum Marks : 70

Part A (Answer any 6 questions. Each carries 3 marks)

1. Define the logarithm function with base a , where $a > 0$, $a \neq 1$ 3
2. Use the laws of exponents to simplify the following expressions:
 (a) $9^{\frac{1}{3}} \cdot 9^{\frac{1}{6}}$
 (b) $(25^{\frac{1}{8}})^4$. 3
3. Calculate $\lim_{x \rightarrow 5} \frac{x - 5}{x^2 - 25}$. 3
4. If $g(t) = \frac{1}{t^2}$, find $g'(t)$ at $t = -1$. 3
5. Apply Chain rule to differentiate $y = e^{\cos x}$. 3
6. Evaluate $\int a^{2x} dx$. 3
7. Evaluate $\int \sqrt{x^{-3}} dx$. 3
8. Obtain the integral $\int \cot x dx$. 3

Part B (Answer any 4 questions. Each carries 6 marks)

9. Express the following logarithms in terms of $\ln 5$ and $\ln 7$
 (a) $\ln(1/125)$ (b) $\ln(9.8)$ (c) $\ln(7\sqrt{7})$. 6
10. Calculate the value of the limit $\lim_{v \rightarrow 2} \frac{v^2 - 4}{v^4 - 16}$. 6
11. Simplify: $\ln(\cosh x + \sinh x) + \ln(\cosh x - \sinh x)$. 6
12. Evaluate $\int_0^1 \frac{x^4}{1 + x^2} dx$. 6
13. Calculate $\int_0^{\pi/4} \frac{\tan^2 x \sec^2 x}{1 + \tan^6 x} dx$. 6

14. Integrate $\frac{1}{e^x + e^{-x}}$ with respect to x . 6

Part C (Answer any 2 question(s). Each carries 14 marks)

15. If $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & -2 & 1 \\ 4 & 2 & 1 \end{bmatrix}$, compute $\text{adj}A$ and A^{-1} . 14

16. If $A = \frac{1}{3} \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -2 \\ -2 & 2 & -1 \end{bmatrix}$, prove that $A^{-1} = A'$, where A' is the transpose of A . 14

17. (a) Find the derivative of $y = \frac{\tan x}{1 + \tan x}$ w.r.t. x
(b) Calculate the derivative $\frac{d}{dx}(\sin^{-1} x^2)$.

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