

Reg No:.....
Name :.....

K24FY 1473 (B)

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First Semester FYUGP Mathematics Examination
NOVEMBER 2024 (2024 Admission onwards)
KU1DSCMAT112 (CALCULUS AND MATRIX ALGEBRA)
(DATE OF EXAM: 4-12-2024)

Time : 120 min

Maximum Marks : 70

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

1. Find $\frac{d}{dx}(e^x \sin x)$. 3
2. Find the derivative of $\ln 3x$ w.r.t. x . 3
3. Find $\frac{d}{dx}(3^{-x})$. 3
4. Determine $\int \frac{1}{2x} dx$. 3
5. Determine the integral $\int x^2 e^{x^3} dx$. 3
6. Reduce the matrix $\begin{bmatrix} 5 & \sqrt{3} \\ 0 & 0 \end{bmatrix}$ to its normal form, and hence find the rank. 3
7. Find the inverse of the 2×2 matrix $\begin{bmatrix} \cos 2\theta & \sin 2\theta \\ -\sin 2\theta & \cos 2\theta \end{bmatrix}$. 3
8. Find the characteristic equation of the matrix $A = \begin{bmatrix} -2 & 1 \\ 1 & 2 \end{bmatrix}$. 3

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

9. Find an equation for a line that is tangent to the graph of $y = e^x$ and goes through the origin. 6
10. Evaluate $\lim_{x \rightarrow \pi/2} \cos \left(2x + \sin \left(\frac{3\pi}{2} + x \right) \right)$. 6
11. Use implicit differentiation to find $\frac{d^2y}{dx^2}$ if $5x^3 - 7y^2 = 10$. 6
12. Find the inverse of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 0 & -1 & 2 \\ 2 & 4 & -1 \end{bmatrix}$. 6
13. Find the eigen vectors of the matrix $\begin{bmatrix} a & b \\ 0 & c \end{bmatrix}$. 6

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14. Find the eigen vectors of the matrix $\begin{bmatrix} 4 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & -1 \end{bmatrix}$. 6

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

15. (a) Find the inverse of the function $y = x^2 + 1$, $x \geq 0$, expressed as a function of x .
(b) State Algebraic properties of the Natural Logarithm.
(c) Simplify $3 \ln \sqrt[3]{t^2 - 1} - \ln(t + 1)$. 14
16. (a) Find the domain and range for the function $g(t) = \cos(e^{-t})$.
(b) Prove that $\cosh^2 x - \sinh^2 x = 1$.
(c) Compute $\lim_{x \rightarrow 1} \frac{x^2 + x - 2}{x^2 - x}$. 14
17. (a) Evaluate $\int_0^1 \frac{x^5}{1+x^{12}} dx$.
(b) Evaluate $\int \cos^3 x dx$. 14