

First Semester FYUGP Degree Supplementary Examination

January 2025

KU1DSCMAT101 - CALCULUS I

2024 Admission onwards

Time : 2 hours

Maximum Marks : 70

Section A

Answer any 6 questions. Each carry 3 marks.

1. Using horizontal line test, show that $y = x^3$ is one-to-one.
2. Use the laws of exponents to simplify the following expressions:
(a) $9^{\frac{1}{3}} \cdot 9^{\frac{1}{6}}$
(b) $(25^{\frac{1}{5}})^4$.
3. If $f(x) = 3x - x^3$, evaluate $f'(0)$.
4. Show that the slope of every line tangent to the curve $y = \frac{1}{(1-2x)^3}$ is positive.
5. Verify the relation $\frac{d}{dx}(\cosh x) = \sinh x$.
6. Find the integral $\int e^{9x} dx$.
7. Write the formula for integration by parts.
8. Evaluate $\int_0^{\pi/4} \sec^2 x dx$.

Section B

Answer any 4 questions. Each carry 6 marks.

9. Find the first and second derivatives of $y = 3x^{-2} - \frac{1}{x}$.
10. Using logarithmic differentiation, find $\frac{dy}{dx}$ where $y = (\sin x)^{\cos x} > 0$.
11. Find $\frac{d^2y}{dx^2}$ by implicit differentiation if $y + \sin y = x$.
12. Find the integral $\int \sec^2(5t+1)5 dt$.
13. Compute $\int_0^{3/2} \frac{1}{\sqrt{9-x^2}} dx$.

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14. Express the $\frac{1}{1-x^2}$ as a sum of partial fractions and hence evaluate the integral $\int \frac{1}{1-x^2} dx$.

Section C

Answer any 2 questions. Each carry 14 marks.

15. (a) Evaluate $\int_0^{\sqrt{\pi^2}} \sqrt{\theta} \cos^2(\theta^{3/2}) d\theta$
(b) Find the arc length of the curve $y = \frac{x^3}{12} + \frac{1}{x}$, $1 \leq x \leq 4$.
16. (a) Find $\int_0^{\pi/4} (1 + e^{\tan \theta}) \sec^2 \theta d\theta$
(b) Find the area of the region enclosed by the parabola $y = 2 - x^2$ and the line $y = -x$.
17. (a) Find the inverse of the function $y = x^2$, $x \geq 0$, expressed as a function of x .
(b) State Algebraic properties of the Natural Logarithm.
(c) Simplify $3 \ln \sqrt[3]{t^2 - 1} - \ln(t + 1)$.