

D 32374

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Name.....

Reg. No.....

**FIRST SEMESTER (CBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2022**

Mathematics

MTS 1C 01—MATHEMATICS—I

(2019—2022 Admissions)

Time : Two Hours

Maximum : 60 Marks

Section A*Answer any number of questions.**Each question carries 2 marks.**Maximum 20 marks.*

1. Calculate the slope of the tangent line to the graph of $y = x^2$ at $x = 1$.
2. Find $\lim_{x \rightarrow -5} \frac{x^2 + 3x - 10}{x + 5}$.
3. If f has a derivative at $x = c$, then prove that f is continuous at $x = c$.
4. Find the derivative of $y = \frac{2x + 5}{3x - 2}$.
5. Find the linearization of $f(x) = x^4$ when $x = 1$.
6. Find $\frac{d}{dx} [\tan(x^2 + 1)]$.
7. Find $\lim_{x \rightarrow 0} \frac{(1+x)^n - 1}{x}$.
8. Find points of inflection on the curve $y = 3x^4 - 4x^3 + 1$.
9. Find the intervals on which the function $g(t) = -t^2 - 3t + 3$ is increasing and decreasing.

Turn over

10. Evaluate $\sum_{k=1}^7 -2k$.
11. Using limits of Riemann sums, establish the equation $\int_a^b c \, dx = c(b-a)$, where c is a constant.
12. Find $\int_1^2 \frac{x^2 + 2x + 2}{x^4} \, dx$.

Section B

Answer any number of questions.

Each question carries 5 marks.

Maximum 30 marks.

13. If $\lim_{x \rightarrow 4} \frac{f(x) - 5}{x - 2} = 1$, find $\lim_{x \rightarrow 4} f(x)$.
14. Show that the line $y = mx + b$ is its own tangent at any point $(x, mx + b)$ on the line.
15. An oil slick has area $y = 30x^3 + 100x$ square meters x minutes after a tanker explosion. Find the average rate of change in area with respect to time during the period from $x = 2$ to $x = 3$ and from $x = 2$ to $x = 2.1$. What is the instantaneous rate of change of area with respect to time at $x = 2$?
16. State and prove power rule for positive integers.
17. Find the maximum and minimum points and values for the function $f(x) = (x^2 - 8x + 12)^4$ on the interval $[-10, 10]$.
18. Evaluate $\lim_{x \rightarrow 0} \left(\frac{1}{\sin x} - \frac{1}{x} \right)$.
19. Find the area of the region in the first quadrant bounded by the line $y = x$, the line $x = 2$, the curve $y = 1/x^2$, and the axis.

Section C

Answer any **one** question.
Each question carries 10 marks.
Maximum 10 marks.

20. (a) Find the area of the region enclosed by the parabola $y = 2 - x^2$ and the line $y = -x$.

(b) Evaluate $\frac{d}{dx} \int_0^{\sqrt{x}} \cos t \, dt$.

21. (a) Find the absolute maximum and minimum values of $f(x) = x^2$ on $[-2, 1]$.

(b) Evaluate $\lim_{x \rightarrow \frac{\pi}{2}} (\sin x)^{\tan x}$.

(c) State and prove the product rule of differentiation.