

D 53678

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Name.....

Reg. No.....

**FIRST SEMESTER (CBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2023**

Mathematics

MTS 1C 01—Mathematics—I

(2019—2023 Admissions)

Time : Two Hours

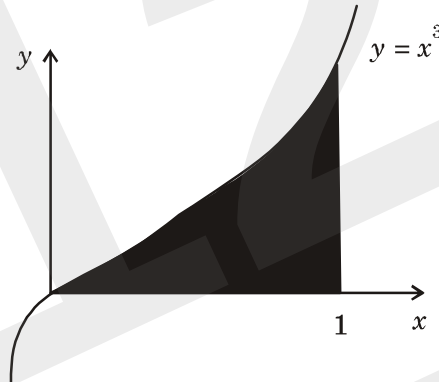
Maximum : 60 Marks

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

1. Find the tangent line to the parabola $y = x^2 - 3x + 1$ when $x_0 = 2$. Sketch.
2. Find limit if exists, $\lim_{x \rightarrow 3} \sqrt{|x - 3|}$.
3. Calculate an approximate value for $\sqrt{10}$ using a linear approximation around $x_0 = 9$.
4. Calculate the second derivative of $\frac{1+x}{\sqrt{x}}$.
5. Find the critical points of the function $f(x) = 3x^4 - 8x^3 + 6x^2 - 1$.
6. Find the intervals on which the function $f(x) = \frac{x}{x-1}$ is concave upward and those which they are concave downward,
7. A shoe repair shop can produce $2x - x^2 - 3$ dollars of revenue every hour when x workers are employed. Find the marginal productivity when 5 workers are employed.
8. Find $\lim_{x \rightarrow 0^+} x \log x$.
9. Find the rate of increase of are of circle with radius r .

Turn over

10. Compute the area of the region shown in Fig.



11. Using the fundamental theorem of calculus, compute $\int_a^b x^2 dx$.
12. Verify the formula $\frac{d}{dx} \int_a^x f(s) ds = f(x)$ or $f(x) = x$.

Section B

Answer any number of questions.

Each question carries 5 marks.

Maximum Marks 30.

13. (a) Find $\lim_{x \rightarrow 2} \frac{3x}{x^2 - 4x + 4}$; (b) Find $\lim_{x \rightarrow 0} \frac{3x + 2}{x}$.
14. Calculate the linear approximation to the area of a square whose side is 2.01. Draw a geometric figure, obtained from a square of side 2, whose area is exactly that given by the linear approximation.
15. A race car travels mile in 6 seconds, its distance from the start in feet after t seconds being $f(t) = \frac{44}{3} t^2 + 132 t$. (a) Find its velocity and acceleration as it crosses the finish line ; and (b) How fast was it going halfway down the track ?
16. If $y = f(x)$ and $x^2 + y^2 = 1$ express $\frac{dy}{dx}$ in terms of x and y .

17. State Mean Value Theorem .Verify Mean Value Theorem for the function $f(x) = x^3 - 5x^2 - 3x$ in $[1, 3]$.
18. Find the volume of a ball' of radius r .
19. (a) Find the average value of $f(x) = x^2$ on $[0, 2]$.
- (b) Find the volume of the solid obtained by revolving the region under the graph of $3x + 1$ on $[0, 2]$ about the x axis.

Section C

*Answer any **one** question.*

Each question carries 10 marks.

Maximum Marks 10.

20. (a) Prove the power rule $\int x^n dx = \frac{x^{n+1}}{n+1} + c, n \neq -1$.
- (b) The velocity of a particle moving along a line is $2t + 3$, at a time t . At time 2 the particle is at position 6, where is it at time 15 ?
21. (a) Show that a good approximation to $\frac{1}{1+x}$ when x is small is $1 - x$.
- (b) Find the equation of the tangent line to the curve to $x^6 + y^4 = 9xy$ at the point $(1, 2)$.

$(1 \times 10 = 10 \text{ marks})$