

D 73288

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Name.....

Reg. No.....

FIRST SEMESTER B.A./B.Sc. DEGREE EXAMINATION, NOVEMBER 2019

(CBCSS—UG)

Mathematics

MTS 1C 01—MATHEMATICS—I

(2019 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 derivative of  $f(x) = 3x^2 + 8x$  at  $x_0 = -2$  and  $x_0 = \frac{1}{2}$ .
2. A rock thrown down from a bridge has fallen  $4t + 4.9t^2$  meter after  $t$  seconds. Find its velocity at  $t = 3$ .
3. Find  $\lim_{x \rightarrow \infty} \frac{5x^2 - 3x + 2}{x^2 + 1}$ .
4. Suppose that  $f(t) = \frac{1}{4}t^2 - t + 2$  denotes the position of a bus at time  $t$ . Find the acceleration.
5. A bagel factory produces  $30x - 2x^2 - 2$  dollars worth of bagels for each  $x$  worker hours of labour. Find the marginal productivity when 5 worker hours are employed.
6. The velocity of a particle moving along a line is  $3t + 5$  at time  $t$ . At time 1, the particle is at position 4. Where is at time 10?
7. Use the second derivative test to analyze the critical points of the function  $f(x) = x^3 - 6x^2 + 10$ .

Turn over

8. Find inflection point of the function  $f(x) = x^2 + \frac{1}{x}$ .
9. Find  $\lim_{x \rightarrow 0^+} x \ln x$ .
10. Draw the graph of the step function  $g$  on  $[0,1]$  defined by  $g(x) = \begin{cases} -2, & \text{if } 0 \leq x < \frac{1}{3} \\ 3, & \text{if } \frac{1}{3} \leq x \leq \frac{3}{4} \\ 1, & \text{if } \frac{3}{4} < x \leq 1 \end{cases}$ . Compute the signed area of the region between its graph and the  $x$ -axis.
11. Find the sum of the first  $n$  integers.
12. Find  $\int_0^4 \left( t^2 + 3t^{\frac{7}{2}} \right) dt$ .

### Section B

*Answer any number of questions.*

*Each question carries 5 marks.*

*Maximum Marks 30.*

13. (a) Differentiate  $\frac{1}{(x^3 + 3)(x^2 + 4)}$ .
- (b) Calculate approximate value for  $\sqrt{8}$  using the linear approximation around  $x_0 = 9$ .
14. Find the equation of the tangent line to the curve  $2x^6 + y^4 = 9xy$  at the point  $(1, 2)$ .
15. Water is flowing into a tub at  $3t + \frac{1}{(t+1)^2}$  gallons per minute after  $t$  minutes. How much water is in the tub after 2 minutes if it started out empty.
16. State mean value theorem. Let  $f(x) = \sqrt{x^3 - 8}$ . Show that somewhere between 2 and 3 the tangent line to graph of  $f$  has slope  $\sqrt{19}$ .

17. Find the dimensions of a box of minimum cost if the manufacturing costs are 10 cents per square meter on the bottom, 5 cents per square meter on the sides, and 7 cents per square meter on the top. The volume is to be 2 cubic metres and height is to be 1 metre.
18. The region between the graph of  $x^2$  on  $[0, 1]$  is revolved about the  $x$ -axis. Sketch the resulting solid and find its volume.
19. Find the area between the graphs of  $y = x^3$  and  $y = 3x^2 - 2x$  between  $x = 0$  and  $x = 2$ .

**Section C**

*Answer any one question.*

*Each question carries 10 marks.*

*Maximum Marks 10.*

20. (a) Differentiate  $\frac{x^{\frac{1}{2}} + x^{\frac{3}{2}}}{x^2 + 1}$ .

(b) Find inflection point of the function  $f(x) = x^2 + \frac{1}{x}$ .

21. (a) Find  $\lim_{x \rightarrow 0} \left( \frac{1}{x \sin x} - \frac{1}{x^2} \right)$ .

(b) Find average value of  $f(x) = x^2 \sin x^3$  on  $[0, \pi]$ .