D 73288 (Pages : 3) 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 $\lim_{x \to \infty} \frac{5x^2 - 3x + 2}{x^2 + 1}$.

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 $\lim_{x \to 0^+} x \ln x$.

10. Draw the graph of the step function g on [0,1] defined by $g(x) = \begin{cases} -2, & \text{if } 0 \le x < \frac{1}{3} \\ 3, & \text{if } \frac{1}{3} \le x \le \frac{3}{4} \\ 1, & \text{if } \frac{3}{4} < x \le 1 \end{cases}$. 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 $\dfrac{x^{\frac{1}{2}} + x^{\frac{3}{2}}}{x^{\frac{3}{2}} + 1}$.

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

21. (a) Find $\lim\limits_{x \to 0} \left(\dfrac{1}{x \sin x} - \dfrac{1}{x^2} \right)$.

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