19U201 (Pages: 3) Name ....

Reg.No : ....

SECOND SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2020

(CBCSS-UG)

CC19U MTS2 B02 : CALCULUS OF SINGLE VARIABLE - I

(Mathematics - Core Course)

(2019 Admission - Regular)

Time: 2.5 Hrs Max. Marks: 80

Credit: 4

Section - A

I. Short answer questions. Each question carries 2 mark

1. Find the domain of the function $f(x) = \frac{\sqrt{x-1}}{x^2-x-6}$
2. Find $f(x)$ if $f(x+1) = 2x^2 + 7x + 4$
3. Find $\lim_{x \to 2} \frac{\sqrt{x+2}-2}{x-2}$
4. Evaluate $\lim_{x \to 0} \frac{\tan 2x}{3x}$
5. Let the functions f and g are continuous at a. Prove that the function f+g is continuous at a .
6. Find the rate of change of $y = \sqrt{2x}$ with respect to x at $x = 2$.
7. Find the differential of the function $f(x) = 2\sin x + 3\cos x$ at the point $x = \pi/4$
8. Find the linearization of $f(x) = x^3 + 2x^2$ at $a = 1$
9. Define absolute minimum at a point and the minimum value. Explain it with a map.
10. Find the interval on which $f(x) = x\sin x + \cos x, \quad 0 < x < 2\pi$ is increasing or decreasing.
11. Give the precise definition of infinite limit.
12. Find the vertical asymptote of the graph of $f(x) = \frac{1}{x-1}$
13. Evaluate the definite integral $\int_0^4 \sqrt{16-x^2}dx$ by interpreting it geometrically.

 Turn Over

14. What do you mean by solid of revolution? Explain with an example.

15. Find the center of mass of a system of three objects located at the points $-3, -1$ and 4, on the x-axis (x in meters), with masses 2, 4 and 6 kilograms respectively.

(Ceiling: 25 Marks)

Section - B

II. Paragraph questions. Each question carries 5 ma

16. Let $f(x) = 3x^2 + 2$
(a) Find $f'(x)$
(b) What is the slope of the tanget line to the graph of f at $x = 2$?
(c) How fast f is changing at $x = 1$?

17. Let $s(t) = \dfrac{1}{t+1}$ be position of a body moving along a coordinate line. Find the position, velocity and accelaration of the body at $t = 0$.

18. Find the intervals where the graph of $f(x) = x^4 - 4x^3 + 12$ is concave upward and the intervals where it is concave downward.

19. Using Riemann sum find the area of the region under the graph of $f(x) = 2x + 1$ on $[0, 2]$ by choosing C_k as the left end point.

20. Suppose that f is continuous on $[-a, a]$. Then show that
(a) If f is even, then $\int_{-a}^{a} f(x)dx = 2 \int_0^a f(x)dx$

(b) If f is odd, then $\int_{-a}^{a} f(x)dx = 0$.

21. Find the length of the graph $f(x) = \dfrac{1}{3}x^3 + \dfrac{1}{4x}$ on the interval $[1, 3]$

22. Evaluate $\int_{-\frac{\pi}{2}}^{\pi} f(x)dx$, where

$$f(x) = \begin{cases} x^2 + 1 & if \quad x < 0 \\ cosx & if \quad x \geq 0 \end{cases}$$

23. A tank has the shape of an inverted right circular cone with a base of radius 5 ft and a height of 12 ft. If the tank is filled with water to a height of 8 ft, find the work required to empty the tank by pumping the water over the top of the tank

(Ceiling: 35 Marks)

Section - C

III. Essay questions. Answer any two questi

24. State and prove the Mean Value Theorem

25. Sketch the graph of the function $f(x) = \dfrac{1}{1 + \sin x}$

26. State and prove both Part 1 and Part 2 of Fundamental theorem of Calculus.

27. Find the area in the first quadrant that is bounded above by the curve $y^2 = x$ and below by the x- axis and the line $y = x - 2$ by integrating (i) with respect to x (ii) y

(2 × 10 = 20 Marks)

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