

Q.P Code: D132761	Total Pages:2	Name
		Register No.
FIRST SEMESTER UG DEGREE EXAMINATION, NOVEMBER 2025		
(CUFYUGP)		
MAT1MN101-CALCULUS		
2024 Admission onwards		
Maximum Time :2 Hours		Maximum Marks :70

Section A

All Question can be answered. Each Question carries 3 marks (Ceiling : 24 Marks)

1	Find the instantaneous rate of change of the function $g(x) = x^2 + x + 2$ at $a = 2$
2	Find equations of the lines passing through the point (3, 2) that are tangent to the parabola $y = x^2 - 2x$.
3	Find the derivatives of all order of $f(x) = 2x^4 - 4x^2 + 1$.
4	Find the critical numbers of $f(x) = x - 3x^{1/3}$
5	State the Mean Value Theorem
6	Graph the function $y = \begin{cases} 2x & \text{if } 0 \leq x \leq 3 \\ x - 3 & \text{if } 3 < x \leq 6 \end{cases}$
7	Evaluate $\int 2x\sqrt[3]{1-4x^2} dx$
8	Given that $\int_0^2 f(x)dx = 3$ and $\int_2^5 f(x)dx = 1$, evaluate the integral $\int_0^5 (3f(x) - 2) dx$
9	Find the average value of $f(x) = \cos x + \sin x$ on the interval $[0, \pi]$
10	Write a short note about Volume of a Solid of Revolution

Section B

All Question can be answered. Each Question carries 6 marks (Ceiling : 36 Marks))

11	Show that the function $f(x) = x^{1/3}$ is not differentiable at 0.
12	A man who is 6 ft tall walks away from a streetlight that is 15 ft from the ground at a speed of 4 ft/sec. How fast is the tip of his shadow moving along the ground when he is 30 ft from the base of the light pole?
13	Show that the function $f(x) = x^3 + x + 1$ has exactly one zero in the interval $[-2, 0]$.
14	Find the intervals on which $f = x \sin x + \cos x; 0 < x < 2\pi$ is increasing or decreasing, and also find the relative maxima and relative minima of f .
15	A car traveling along a straight road at 66 ft/sec accelerated to a speed of 88 ft/sec over a distance of 440 ft. What was the acceleration of the car, assuming that the acceleration was constant?
16	Using Riemann sum, show that $\int_a^b x \, dx = \frac{b^2 - a^2}{2}$
17	Sketch the region bounded by the graphs of the equation $y = x^2 - 4x, y = -x + 4$ and find the area of that region.
18	Find the volume of the solid generated by revolving the region bounded by the graphs of the equations $y = x, y = x^2$ about the line $y = 2$.

Section C

Answer any ONE. Each Question carries 10 marks (1x10=10 Marks))

19	<p>The depth (in feet) at time t (measured in minutes) of the prototype of a twin-piloted submarine is given by</p> $h(t) = t^3(t - 7)^4; 0 \leq t \leq 7$ <p>Find the inflection points of h, and explain their significance.</p>
20	Find the length of the graph $f(x) = \frac{1}{3}x^3 + \frac{1}{4x}$ on the interval $[1, 3]$

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Section A

All Question can be answered. Each Question carries 3 marks (Ceiling : 24 Marks)

1	Define Instantaneous Rate of Change of a Function
2	Let $f(x) = x^2 + 2x + 1$. Find the point on the graph of f where the tangent line to the curve is horizontal.
3	Find the linearization $L(x)$ of the function $f(x) = x^3 - 2x^2$ at $a = 1$.
4	Find the absolute maximum and absolute minimum values, if any, of the function $y = x^2 + x$.
5	Find the relative maxima for the function $f(x) = 4x^2 - 4x$ in the interval $[-5, 5]$
6	Graph the function $y = 2x^2$ over the interval $[-2, 2]$.
7	Evaluate $\int (x^2 + 2)(x - 2) dx$
8	Find the average value of $f(x) = 2x^2$ on the interval $[2, 5]$
9	State the Mean Value Theorem for Integrals
10	Write a short note about Volume by Washer Method

Section B

All Question can be answered. Each Question carries 6 marks (Ceiling : 36 Marks))

11	<p>Show that the Heaviside function</p> $H(x) = \begin{cases} 0 & \text{if } x \leq 0 \\ 1 & \text{if } x > 0 \end{cases}$ <p>which is discontinuous at 0, is not differentiable at 0</p>
12	<p>Find an equation of the tangent line to the bifolium</p> $4x^4 + 8x^2y^2 - 25x^2y + 4y^4 = 0$ <p>at the point (2, 1).</p>
13	<p>The side of a cube is measured with a maximum possible error of 2%. Use differentials to estimate the maximum percentage error in its computed volume.</p>
14	<p>Prove that the equation $x^7 + 6x^5 - 2x + 6 = 0$ has exactly one real root.</p>
15	<p>Find the function f given that the slope of the tangent line to the graph of f at any point $(x, f(x))$ is $x^2 - 2x + 3$ and the graph of f passes through the point (1, 2).</p>
16	<p>Find $\int (x + 1)\sqrt{2x - 1} dx$</p>
17	<p>Find the value of c guaranteed by the Mean Value Theorem for Integrals for $f(x) = 2x^2 + 3$ on the interval $[0, 2]$.</p>
18	<p>Find the area of the region bounded by the graphs of $y = 2 - x^2$ and $y = -x$</p>

Section C

Answer any ONE. Each Question carries 10 marks (1x10=10 Marks))

19	<p>By the Method of Cross Sections, find the volume of a right pyramid with a square base of side b and height h</p>
20	<p>Solve the initial value problem $f'(x) = x^3(x^2 + 1)^{1/2}$; $f(0) = 0$.</p>