

16U113

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Name.....

Reg. No.....

FIRST SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2016

(Regular/ Supplementary/ Improvement)

(CUCBCSS - UG)

CC15UMAT1C01- MATHEMATICS

(Mathematics Complementary course)

(2015 Admission onwards)

Time: 3 hrs

Max Mark: 80

I Answer all questions

(12 x 1 = 12 Marks)

1. The function $f(x) = \frac{|x|}{x}$ is not continuous at $x = \dots\dots\dots$
2. Evaluate $\lim_{x \rightarrow \infty} \frac{5x^2 + 8x - 3}{3x^2 + 2}$
3. At what points do the graph of the function $f(x) = x^2 + 4x - 1$ has horizontal tangents
4. What is the parametric form of $x^2 + y^2 = 4$
5. How fast does the area of the circle change with respect to the diameter when the diameter is 8m.
6. The interval on which the function f given by $f(x) = 2x^3 - 3x^2 - 36x + 7$ decreasing is.....
7. The horizontal asymptote for the curve $y = \frac{1}{x}$ is.....
8. If $f(x) = -9$ on $[-1,6]$, $\int_{-1}^6 f(x)dx = \dots\dots\dots$
9. State the mean value theorem for the definite integrals.
10. The dominant terms of $f(x) = \frac{x^2 - 4}{x - 1}$ are
11. Find dy/dx if $y = \int_0^{\tan x} \frac{dt}{1+t^2}$
12. Evaluate $\int_{-\pi}^{\pi} \sin^2 x dx$

II Answer any nine questions

(9 x 2 = 18 Marks)

13. Find $\lim_{x \rightarrow 0^+} \frac{|x|}{x}$ and $\lim_{x \rightarrow 0^-} \frac{|x|}{x}$
14. State Sandwich theorem and use it to find $\lim_{x \rightarrow 0} g(x)$ if $3 - x^2 \leq g(x) \leq 3 \sec x \quad \forall x$
15. Find the linearization of $f(x) = x^3 - x$ at $x = 1$
16. Evaluate $\lim_{x \rightarrow 1} \left(\frac{1-x}{\ln x} \right)$
17. Find the average value of $f(x) = 3x^2 - 3$ on $[0,1]$
18. Find the function $f(x)$ whose derivate is $\sin x$ and whose graph passes through the point $(0, 2)$
19. Find the interval in which $f(x) = x^2$ is decreasing

20. State why the function $f(x) = x^{\frac{2}{3}}$; $[-1, 8]$ does not satisfy the conditions of Mean value theorem
21. Express the following limit as a definite integral $\lim_{\|P\| \rightarrow 0} \sum_{k=1}^n \frac{1}{1-c_k} \Delta x_k$ where P is a partition of $[2, 3]$.
22. If $\int_0^3 f(z) dz = 3$, $\int_0^4 f(z) dz = 7$, and f is continuous. Find $\int_4^3 f(z) dz$.
23. The curve $y = ax^2 + bx + c$ passes through the point $(1, 2)$ and is tangent to the line $y = x$ at the origin. Find a, b , and c
24. The radius of a circle is increased from $2m$ to $2.02m$. Estimate the resulting change in the area.

III Answer any six questions

(6 x 5 = 30 Marks)

25. Using $\epsilon - \delta$ definition, prove that $\lim_{x \rightarrow 0} x^2 \sin \frac{1}{x} = 0$
26. Is there a real number that is one less than its fifth power?
27. Prove that if a function is differentiable at $x = c$, then it is continuous at $x = c$. Is the converse true? Justify?
28. Verify mean value theorem for the function $f(x) = \ln x$ on the interval $[1, e]$
29. Prove that for the curve $y = c \sin \frac{x}{a}$, every point at which it meets the x -axis is a point of inflexion.
30. Find all the asymptotes of the curve $y = 2 + \frac{\sin x}{x}$
31. Show that if f is continuous on $[a, b]$, $a \neq b$ and if $\int_a^b f(x) dx = 0$, then $f(x) = 0$ at least once in $[a, b]$
32. Evaluate $\int_0^1 x dx$ using Riemann definition
33. Find the area of the region enclosed by the parabola $x = y^2$ and the line $x = y + 2$

IV Answer any two questions

(2 x 10 = 20 Marks)

34. Using the definition of limit prove that $\lim_{x \rightarrow 1} f(x) = 2$ if $f(x) = \begin{cases} 4 - 2x, & x < 1 \\ 6x - 4, & x \geq 1 \end{cases}$
35. Graph the function $y = x^{\frac{5}{3}} - 5x^{\frac{2}{3}}$
36. Use definite integral to estimate the sum of the square roots of the first n positive integers
- $$\sqrt{1} + \sqrt{2} + \dots + \sqrt{n}$$
