



Reg. No. :
Name :

Third Semester B.Sc. Honours in Mathematics Degree (CBCSS – Regular)
Examination, November 2022
(2021 Admission)
3B13BMH : NUMERICAL ANALYSIS

Time : 3 Hours Max. Marks : 60

SECTION – A

Answer **any four** questions from the following. **Each** question carries **1** mark.

1. Does the equation $f(x) = 3\sin x - x$ has a real root ? Justify your answer.
2. Show that $\nabla = 1 - E^{-1}$.
3. Show that the first difference of a polynomial of degree n is a polynomial of degree $n - 1$.
4. Write Lagrange's polynomial of degree one passing through the points (x_0, y_0) , (x_1, y_1) .
5. Write the formula of Simpson's 3/8 rule for integration.

SECTION – B

Answer **any six** questions. **Each** question carries **2** marks.

6. Write a short note on Newton-Raphson Method.
7. Show that the equation $f(x) = x^3 - x - 1$ has a real root lies between 1 and 2.
8. By the regula falsi method, find the first approximation to the root of $f(x) = x^3 - 2x - 5 = 0$.
9. Show that $\mu = \frac{1}{2}(E^{1/2} + E^{-1/2})$.

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10. With the usual notations, show that the second differences of the polynomial $f(x)$ is $f(x + 2h) - 2f(x + h) + f(x)$.
11. If $y_1 = 4, y_3 = 12, y_4 = 19$ and $y_x = 7$, find x .
12. Write Newton's Forward and Backward Interpolation formulas.
13. With the usual notations show that $[x_0, x_1] = [x_1, x_0]$.
14. Use Trapezoidal Rule to evaluate $\int_0^1 (1+x)^{-1} dx$ with $h = 0.25$.

SECTION – C

Answer **any eight** questions. **Each** question carries **4** marks.

15. Solve $x = 1/2 + \sin x$ by iteration method by taking $x_0 = 1$.
16. Use the Newton-Raphson method to find a root of the equation $x^3 - 2x - 5 = 0$.
17. Explain briefly on Ramanujan's method to determine the smallest root of the equation $f(x) = 0$.
18. With the usual notations prove that $(1 + \Delta)(1 - \nabla) = 1$.
19. Prove that $u_1 + u_2 + \dots + u_n = nC_1 u_0 + nC_2 \Delta u_0 + \dots + \Delta^{n-1} u_0$.
20. Evaluate $\Delta(x(x + 1)(x + 2)(x + 3))$ where the interval of differencing being unity.
21. Find the missing term in the following table :

x	y
0	1
2	9
3	-
4	81

Explain why the result differs from $3^3 = 27$.
22. Using Gauss's forward formula, find the value of $f(32)$ given that $f(25) = 0.2707$, $f(30) = 0.3027$, $f(35) = 0.3386$, $f(40) = 0.3794$.
23. Derive Newton's forward interpolation formula.



24. Apply Simpson's one-third rule to evaluate $\int_2^{10} \frac{1}{1+x} dx$ taking $h = 1$.
25. Show that the Newton-Raphson process has a second order convergence.
26. State any four advantages of Simpson's 3/8 rule than that of 1/3 rule.

SECTION – D

Answer **any two** questions. **Each** question carries **6** marks.

27. Using Bisection method, find a positive root the equation $xe^x = 1$ which lies between 0 and 1 correct to three decimal places.
28. Form a table of differences for the function $f(x) = x^3 + 5x - 7$ for $x = -1, 0, 1, 2, 3, 4, 5$. Continue the table to obtain $f(6)$.
29. Find the cubic polynomial which takes the following values : $y(1) = 24$, $y(3) = 120$, $y(5) = 336$, $y(7) = 720$. Hence obtain the value of $y(8)$.
30. From the following table of values of x and y obtain $\frac{d^2y}{dx^2}$ at $x = 3$.

x	y
2.94	0.1826
2.96	0.1811
2.98	0.1797
3.00	0.1783
3.02	0.1769
3.04	0.1755
3.06	0.1742