S.N.J.B.'s K.K.H.A. Arts, S.M.G.L. Commerce & S.P.H.J. Science College,

Neminagar, Chandwad, Dist. Nashik

Department of Mathematics

NUMERICAL ANALYSIS

Practical 1: ERRORS

1. Round off the numbers 0.987250, 40.0468, 0.467268, 2.26357, 6.39458, 47.57105, 0.50019, 0.0004261, 61.255 correct to four significant figures and find percentage error for the first number.
2. Round off the numbers 3.3465827, 5.375829, 54.2549757, 0.00457328 correct to four decimal places and the numbers 4.2368, 1.765, 2.435, 12.975 correct to two decimal places.
3. Find relative error of the number 11.426
4. Find relative error of the number $\frac{5}{7}$ whose approximate value is 0.714
5. Three approximate value of number 1/6 are given as 0.165, 0.166, and 0.167 which of these three is the best approximation?
6. An approximate value of e is 2.1795518 and its true value is given by x=2.17821828. Find relative error.
7. An approximate value of π is 3.14278152 and its true value is 3.14159265. Find relative error.
8. Find the sum of the numbers 0.1532, 15.45, 0.000354, 305.1, 8.12, 143.3, 0.0212, 0.643 and 0.1734 where each number is correct to digits given. Estimate the errors in the sum.
9. Find the product of two numbers 56.54 & 12.4 which are both correct to the significant digits given.
10. Find the quotient; $q = \frac{x}{y}$ where $x = 5.647$ & $y = 2.52$ Correct to the given digits. Find also the relative error in results.

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NUMERICAL ANALYSIS

Practical 2: Solutions of Algebraic and Transcendental Equations

1. Using bisection method find root of the equation $x^3 - 5x + 3 = 0$ correct upto three decimal places.
2. Find root of the following equations by using bisection method.
   i. $e^{-x} = \sin x$ ii. $x^3 - x - 1 = 0$
   ii. iii. $x^2 - 5x + 3 = 0$ iv. $x^3 - 3x - 5 = 0$
3. Using false position method find root, correct to three decimate places of the equation $x^3 - x - 4 = 0$.
4. Find the root of the equation $x^3 - x^2 - 1 = 0$ using false position method.
5. Evaluate the following by using false position method $\sqrt[4]{72}$.
6. Find an approximate root of the equation $x^3 - 2x - 5 = 0$ between x=2 & x=2.5 using false position method correct upto two decimal places(perform three iterations)
7. Using iteration method find a root, correct to 4 significant figures of the following equation, $5x^3 - 20x + 3 = 0$.
8. Find the root of the equation $3x = cos\ x + 1$ using iteration method and Aitken's Δ^2-process, take $x_0 = \frac{\pi}{2}$
9. Find $\sqrt{10}$, $\sqrt[4]{72}$, $\sqrt[3]{13}$, $\sqrt[4]{74}$, $\sqrt[3]{19}$ by using Newton-Raphson Method.
10. Solve $logx = \cos x$ by Newton-Raphson Method.
11. Using Newton-Raphson Method find root of the following equations
    i. $x^2 + 5x + 1 = 0$
    ii. $x^5 + 5x + 1 = 0$ Between $x = -1$ & $x = 0$.
    iii. $x^3 - x - 4 = 0$

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NUMERICAL ANALYSIS

Practical No.3: Interpolation

1. Find the form of the function given.

x	0	1	2	3	4
$f(x)$	3	6	11	18	27

2. Use Lagrange's interpolation formula to express the function

$$\frac{3x^2 + x + 2}{(x-1)(x-2)(x-3)}$$

as sums of partial fractions.

3. The population of a town in decimal census is given below. Estimate the population for the year 1955.

Year	1921	1931	1941	1951	1961
Population (in thousands)	46	66	81	93	101

4. Find missing term in the following table.

x	0	1	2	3	4
y	1	3	9	-	81

5. Find the cubic polynomial which takes the values $y(1) = 24, y(3) = 120,$ $y(5) = 336, y(7) = 720$. Hence find $y(8)$.

6. Find $log_{10}301$ by using following data.

x	300	304	305	307
$y = log_{10}x$	2.4771	2.4829	2.4843	2.4871

7. Construct divided difference table for the values

x	0	1	4	5
y	8	11	68	123

8. Find $y(x)$ as a polynomial in x by using following table.

x	-1	0	3	6	7
y	3	-6	39	822	1611

9. Express $f(x+nh)$ in terms of $f(x)$ where 'h' is interval of differencing.
10. From the following data find y when x=1.45

x	1	1.2	1.4	1.6	1.8	2
y	0	-0.112	-0.016	0.336	0.992	2

11. Find $sin38^{\circ}$ by using following data

x°	15	20	25	30	35	40
$sinx^{\circ}$	0.2588	0.3420	0.4226	0.5	0.5735	0.6427

12. Find the third divided difference with arguments 2, 4, 9, 10 of the function $f(x)=x^3-2x$.
13. Find the polynomial satisfied by (- 4 , 1245) , (-1 , 33) , (0 , 5) , (2, 9) and (5, 1335) using Newton's general interpolation formula.
14. Using Newton divided difference formula find the value of $f(15)$ from the following data.

x	4	5	7	10	11	13
$y(x)$	48	100	294	900	1210	2028

15. If l_x represents the number of persons living at age x in a life table, find l_x for x=35. Given $l_{20}=512, l_{30}=390, l_{40}=360, l_{50}=243$.

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NUMERICAL ANALYSIS

Practical No. 4: Least Square: Curve Fitting Procedures

1. Find the function of the type $y = ax^b$ to the following data.

x	2	4	7	10	20	40	60	80
y	43	25	18	13	8	5	3	2

2. Find the best values of a, b and c so that parabola $y = a + bx + cx^2$ fits the data

x	1	1.5	2	2.5	3	3.5	4
y	1.1	1.2	1.5	2.6	2.8	3.3	4.1

3. Determine the best linear fit , to the following data points ,

x	5	10	15	20	25
y	15	19	23	26	30

4. Determine the best quadratic polynomial to the following data points.

x	1	2	3	4
y	6	11	18	27

5. Find a curve $y = cx^d$ to the data

x	2.2	2.7	3.5	4.1
y	65	60	53	50

6. Find a second degree polynomial by using following data.

x	0	1	2	3	4
y	1	0	3	10	21

7. Find the exponential curve $y = ce^{dx}$ to the following data

x	0	2	4
y	5.012	10	31.62

8. Fit a power function $y = ax^b$ to the following data.

x	1	2	3	4	5
y	0.5	2	4.5	8	12.5

9. Fit a straight line of the form $y = a + bx$ to the data

x	0	2	5	7
y	-1	5	12	20

10. Fit a polynomial of second degree to the following data

x	0	1	2
y	1	6	17

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NUMERICAL ANALYSIS

Practical No. 5: Numerical Differentiation and Integration

1. Evaluate $\int_0^1 x^2\,dx$ using Trapezoidal rule and Simpson's $\frac{1}{3}^{rd}$ rule.
2. Find the value of $\int_0^6 \frac{1}{\sqrt{x+1}}dx$ by Simpson's $\frac{3}{8}^{th}$ rule.
3. Evaluate $\int_0^1 \frac{1}{1+x}dx$ with $h=\frac{1}{6}$ by Simpson's $\frac{1}{3}^{rd}$ rule and Simpson's $\frac{3}{8}^{th}$ rule.
4. Evaluate $\int_0^1 \frac{1}{1+x^2}dx$ by Trapezoidal rule and Simpson's rule. Hence find approximation to the value of π.
5. Calculate the approximate value of $\int_0^{\pi/2} sinx\ \ dx$ by Trapezoidal rule.
6. Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ for x=1.2 by using following table.

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

7. Evaluate $\int_0^1 cosx\ \ dx$ by Trapezoidal rule, take h=0.2.
8. Evaluate $\int_0^1 \frac{1}{1+x}dx$ with $h=0.2$ by Simpson's $\frac{3}{8}^{th}$ rule
9. Find the value of $\frac{dy}{dx}$at $x=5$ from the following data.

x	3	4	5	6	7	8
y	1.0986	1.3863	1.6094	1.7918	1.9459	2.0794

10. The velocity of a car at intervals of 2 mint are given below ,

Time in mint.	0	2	4	6	10	12
Velocity in km/hr	0	22	30	27	7	0

Apply Simpson's rule to find the distance covered by the car.

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NUMERICAL ANALYSIS

Practical No. 6: Numerical Solution of First Order Differential Equation

1. Given the differential equation $\frac{dy}{dx} = x^2 + y;\ y(4) = 4$. Obtain $y(4.1)$ and $y(4.2)$ by Taylor's Series Method.
2. (a) Solve by Euler's Method.

   $\frac{dy}{dx} = x + y\ ,\ y(0) = 0$ Choose $h = 0.1$ and compute $y(0.4)$ & $y(0.6)$

   (b) do the same with h=0.2
3. Given that ,

   $\frac{dy}{dx} = x^2 + xy, y(0) = 1$, determine $y(0.02)$& $y(0.04)$ using modified Euler's Method.
4. Use Runge – Kutta fourth order formula to find $y(0.1)$ correct upto four decimal places for the differential equation $\frac{dy}{dx} = y - x\ , y(0) = 2$ take $h = 0.1$.
5. Use Runge – Kutta second / fourth order formula to find $y(1)$ if

   $\frac{dy}{dx} = \frac{x^2+y^2}{10}$, y(0)=1. Take h=1
6. Using Taylor's series method solve $\frac{dy}{dx} = x + y$, y(1)=0, numerically upto x=1.2 with h=0.1.
7. Obtain y(0.2) by using Euler's Method for the differential equation $\frac{dy}{dx} = -2y\ ;\ y(0) = 1$.

   Take h=0.1
8. Obtain y(0.1) by Taylor's series method for the differential equation $\frac{dy}{dx} = 1 + xy,\ y(0) = 1$.
9. Find y(1.5) and y(2) by Modified Euler's Method for the differential equation

   $\frac{dy}{dx} = 2 + \sqrt{xy}\ ; y(1) = 1$,

   Take h=0.5
10. Compute y(0.1) by Taylor's series method for the differential equation $\frac{dy}{dx} - 1 = xy\ ; y(0) = 1$.