



Name _____ R. No. _____ Class / Div. _____ Date _____

Subject Numerical and Topic Error, Dimension, Page No. _____
Algebra Methods Algebra
Interpolation

Assignment - 1

Home work - 1 : Lagrange's Interpolation

1)

~~x~~

y

7

3

8

1

9

1

10

9

$$f(9.5) = \frac{(1.8)(0.8)(-0.2)}{(1-1)(-2)(-3)} \cdot (3) + \frac{(2.8)(0.8)(-0.2)}{(1)(-1)(-2)} \cdot (1) \\ + \frac{(2.8)(1.8)(-0.2)}{(2)(1)(-1)} \cdot (1) + \frac{(2.8)(1.8)(0.8)}{(3)(2)(1)} \cdot (9) \\ = 0.144 - 0.224 + 0.504 + 6.048$$

$$f(9.5) = 6.472$$



2)

x

f(x)

3

168

7

120

9

72

10

63

$$f(6) = \frac{(-1)(-3)(-4)}{(-4)(-6)(-7)} \cdot (168) + \frac{(3)(-3)(-4)}{(4)(-2)(-3)} \cdot (120) \\ + \frac{(3)(-1)(-4)}{(6)(2)(-1)} \cdot (72) + \frac{(3)(-1)(-3)}{(7)(3)(1)} \cdot (63) \\ = 12 + 180 - 72 + 27$$

$$f(6) = 147$$



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3)

X	f(x)
1	4
2	5
7	5
8	4

$$\begin{aligned} f(6) &= \frac{(4)(-1)(-2)}{(-1)(-6)(-7)} \cdot (4) + \frac{(5)(-1)(-2)}{(1)(-5)(-6)} \cdot (5) \\ &\quad + \frac{(5)(4)(-2)}{(6)(5)(-1)} \cdot (5) + \frac{(5)(4)(-1)}{(-7)(6)(1)} \cdot (4) \\ &= \frac{-16}{21} + \frac{5}{3} + \frac{20}{3} - \frac{40}{21} \end{aligned}$$

$$f(6) = 5.667$$

4)

X	f(x)
1	2
2	4
3	8
4	16
7	128

$$\begin{aligned} f(5) &= \frac{(3)(2)(1)(-2)}{(-1)(-2)(-3)(-6)} \cdot (2) + \frac{(4)(2)(1)(-2)}{(1)(-1)(-2)(-5)} \cdot (4) + \frac{(4)(3)(1)(-2)}{(2)(1)(-1)(-4)} \cdot (8) \\ &\quad + \frac{(4)(3)(2)(-2)}{(3)(2)(1)(-3)} \cdot (16) + \frac{(4)(3)(2)(1)}{(6)(5)(4)(3)} \cdot (128) \\ &= \frac{-2}{3} + \frac{32}{5} - 24 + \frac{128}{3} + \frac{128}{15} \end{aligned}$$

$$f(5) = 32.934$$

5)	x	f(x)
	10	0.25
	20	0.2
	14	0.15
	16	0.10

$$\begin{aligned}
 f(15) &= \frac{(-5)(11)(-1)(0.25)}{(-10)(-4)(-6)} + \frac{(5)(11)(-1)(0.2)}{(10)(-6)(-4)} \\
 &+ \frac{(5)(-5)(-1)(0.15)}{(4)(-6)(-2)} + \frac{(5)(-5)(7)(0.1)}{(6)(-4)(2)} \\
 &= -\frac{1}{192} - \frac{1}{240} + \frac{1}{16} + \frac{5}{96}
 \end{aligned}$$

$$f(15) = \frac{101}{960}$$

$$f(15) = 0.105208$$

HW-2 : Regula Falsi Method

1) $x^3 + x - 1 = 0$

x	y
0.5	-0.375
0.6	-0.184
0.7	0.043

$$x' = \frac{x_1 y_2 - x_2 y_1}{y_2 - y_1}$$

$$= \frac{(0.6)(0.043) - (0.7)(-0.184)}{0.043 - (-0.184)}$$

$$x_1 = 0.681$$

$$\therefore y' = -0.00317876$$

$$x'' = \frac{(0.681)(0.043) - (0.7)(-0.00317876)}{0.043 - (-0.00317876)}$$

$$x'' = 0.682308$$

$$\therefore y'' = -0.0000475$$

root of equation = 0.682308

$$2) \quad x^3 - 2x + 0.5 = 0$$

x	y
0	0.5
0.1	0.301
0.2	0.108
0.3	-0.073

$$x_1 = \frac{(0.2)(-0.073) - (0.3)(0.108)}{-0.073 - (0.108)}$$

$$x_1 = 0.2597$$

$$\therefore y' = -0.0018848$$

$$x'' = \frac{(0.2)(-0.0018848) - (0.3)(0.108)}{-0.0018848 - 0.108}$$

$$x'' = 0.25867$$

$$\therefore y'' = -0.0000429$$

$$\text{Root of equation} = 0.25867$$

$$3) \quad x^3 + 2x - 20 = 0$$

x	y
2	-8
2.1	-0.531
2.2 2.2	-4.952
2.3	-3.24
2.4	-1.376
2.5	0.625

$$x' = \frac{(2.4)(0.625) - (2.5)(-1.376)}{0.625 - (-1.376)}$$

$$x' = 2.46876$$

$$\therefore y' = -0.015827$$

$$x'' = \frac{(2.46876)(0.625) - (-0.015827)(2.5)}{0.625 - (-0.015827)}$$

$$x'' = 2.4695$$

$$\therefore y'' = -0.00028$$

Root of equation = 2.4695

4) $3x - \cos x - 1 = 0$

x	y
0	-2
0.1	-1.699
0.2	-1.399
0.3	-1.099
0.4	-0.799
0.5	-0.499
0.6	-0.199
0.7	0.1

$$x' = \frac{(0.6)(0.1) - (-0.199)(0.7)}{0.1 - (-0.199)}$$

$$x' = 0.6645$$

$$\therefore y' = -0.00623$$

$$x'' = \frac{(0.6645)(0.1) - (-0.00623)(0.7)}{0.1 - (-0.00623)}$$

$$x'' = 0.6667$$

$$\therefore y'' = -0.00015$$

Root of equation = 0.6667

$$5) \quad x^3 - 3x - 5 = 0$$

x	y
2	-3
2.1	-2.039
2.2	-0.952
2.3	0.267

$$x' = \frac{(2.2)(0.267) - (-0.952)(2.3)}{0.267 - (-0.952)}$$

$$x' = 2.2781$$

$$\therefore y' = -0.01159$$

$$x'' = \frac{(2.2781)(0.267) - (0.01159)(2.3)}{0.267 - (-0.01159)}$$

$$x'' = 2.279$$

$$\therefore y'' = -0.0000968$$

Root of equation = 2.279

$$6) \quad x \log_{10} x - 1.2 = 0$$

x	y
2	-0.5979
2.1	-0.5233
2.2	-0.4467
2.3	-0.3680
2.4	-0.2875
2.5	-0.2052
2.6	-0.1211
2.7	-0.0353
2.8	0.052

$$x' = \frac{(2.7)(0.052) - (-0.0353)(2.8)}{0.052 - (-0.0353)}$$

$$x' = 2.7404$$

$$\therefore y' = -0.0001839$$

$$x'' = \frac{(2.7404)(0.052) - (-0.0001839)(2.8)}{0.052 - (-0.0001839)}$$

$$x'' = 2.7406$$

$$\therefore y'' = -0.00003145$$

Root of equation = 2.7406

$$7) \quad x^3 - 4x + 1 = 0$$

x	y
0	0 1
1	-2
2	1

$$x' = \frac{(1)(1) - (-2)(2)}{1+2}$$

$$x' = 1.667$$

$$\therefore y' = -1.037$$

$$x'' = \frac{(1.667)(1) + (2)(1.037)}{1 - (-1.0037)}$$

$$x'' = ~~1.8~~ 1.8365$$

$$\therefore y'' = -0.152$$

$$x''' = \frac{(1.8365)(1) - (-0.152)(2)}{1 - (-0.152)}$$

$$x''' = 1.8581$$

Root of equation = 1.8581

5) $x^3 + 2x^2 - 8 = 0$

x	y
0	-8
1	-5
1.5	8 -0.125
2	8

$$x' = \frac{(1.5)(8) - (-0.125)(2)}{8 + 0.125}$$

$$x' = 1.50769$$

$$\therefore y' = -0.02654$$

$$x'' = \frac{(1.50769)(8) - (-0.02654)(2)}{8 + 0.02654}$$

$$x'' = ~~1.50769~~ \text{ hence } 1.5093$$

$$y'' = -0.005862$$

Root of equation = 1.5093

9) $x^3 - 9x + 1 = 0$

x	y
0	1
1	-7
2	-9
2.5	-5.875
2.9	-0.711
3	7

$$x' = \frac{(2.9)(1) + (0.711)(3)}{(1) + 0.711}$$

$$x' = 2.9415$$

$$\therefore y' = -0.02147$$

$$x'' = \frac{(2.9415)(1) - (-0.02147)(3)}{(1) - (-0.02147)}$$

$$x'' = 2.9427$$

$$y'' = -0.0015$$

Root of equation = 2.9427

10) $x^3 - x - 4 = 0$

~~x~~

x	y
0	-4
1	-4
1.5	-2.125
1.6	-1.504
1.7	-0.787
1.8	0.032
2	2

$$x' = \frac{(0.032)(1.7) - (1.8)(-0.787)}{0.032 - (-0.787)}$$

$$x' = 1.7961$$

$$\therefore y' = -0.00199$$

$$x'' = \frac{(1.7961)(0.032) - (-0.00199)(1.8)}{0.032 - (-0.00199)}$$

$$x'' = 1.7964$$

$$\therefore y'' = -0.0000278$$

Root of equation = 1.7969