

Homework-1

d.1

x	7	8	9	10
$f(x)$	3	1	1	9

$$f(9.5) = ?$$

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$$f(9.5) = \frac{(9.5-8)(9.5-9)(9.5-10)(3)}{(7-8)(7-9)(7-10)} + \frac{(9.5-7)(9.5-9)(9.5-10)(1)}{(7-8)(7-9)(7-10)} + \frac{(9.5-7)(9.5-8)(9.5-10)(1)}{(8-7)(8-9)(8-10)} + \frac{(9.5-7)(9.5-8)(9.5-9)(9)}{(10-7)(10-8)(10-9)}$$

$$= \frac{3}{16} - \frac{5}{16} + \frac{5}{16} + \frac{45}{16}$$

$$= 3.625$$

d.2

x	3	7	9	10
$f(x)$	108	120	72	63

$$f(6) = ?$$

$$f(6) = \frac{(6-7)(6-9)(6-10)(108)}{(3-7)(3-9)(3-10)} + \frac{(6-3)(6-9)(6-10)(120)}{(7-3)(7-9)(7-10)} + \frac{(6-3)(6-7)(6-10)(72)}{(9-3)(9-7)(9-10)} + \frac{(6-3)(6-7)(6-9)(63)}{(10-3)(10-7)(10-9)}$$

$$= 12 + 180 + 27 + 72$$

$$= \underline{\underline{147}}$$

Q.3

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

$$f(6) = ?$$

$$\begin{aligned}
 f(6) &= \frac{(6-2)(6-7)(6-8)(4)}{(1-2)(1-7)(1-8)} + \frac{(6-1)(6-7)(6-8)(9)}{\cancel{(2-4)}(5)(2-1)(2-7)(2-8)} \\
 &+ \frac{(6-1)(6-2)(6-8)(5)}{(7-1)(7-2)(7-8)} + \frac{(6-1)(6-2)(6-7)(4)}{(8-1)(8-2)(8-7)} \\
 &= \frac{-16}{21} + \frac{5}{3} + \frac{20}{3} - \frac{40}{21} \\
 &= \underline{\underline{5.6667}}
 \end{aligned}$$

Q.4

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

$$f(5) = ?$$

$$\begin{aligned}
 f(5) &= \frac{(5-2)(5-3)(5-4)(5-7)(2)}{(1-2)(1-3)(1-4)(1-7)} + \frac{(5-1)(5-3)(5-4)(5-7)(4)}{(2-1)(2-3)(2-4)(2-7)} \\
 &+ \frac{(5-1)(5-2)(5-4)(5-7)(8)}{(3-1)(3-2)(3-4)(3-7)} + \frac{(5-1)(5-2)(5-3)(5-7)(16)}{(4-1)(4-2)(4-3)(4-7)} \\
 &+ \frac{(5-1)(5-2)(5-4)(5-3)(128)}{(7-1)(7-2)(7-3)(7-4)} \\
 &= \frac{-2}{3} + \frac{32}{5} - \frac{24}{3} + \frac{128}{3} + \frac{128}{15} \\
 &= \underline{\underline{32.9334}}
 \end{aligned}$$

Q.5

x	10	20	14	16
$f(x)$	0.25	0.20	0.15	0.10

$$f(15) = ?$$

$$\begin{aligned}
 f(15) &= \frac{(15-20)(15-14)(15-16)(0.25)}{(10-20)(10-14)(10-16)} + \frac{(15-10)(15-14)(15-16)(0.20)}{(20-10)(20-14)(20-16)} \\
 &\quad + \frac{(15-10)(15-20)(15-16)(0.15)}{(14-10)(14-20)(14-16)} + \frac{(15-10)(15-14)(15-20)(0.10)}{(16-10)(16-20)(16-14)} \\
 &= \frac{-1}{112} - \frac{1}{240} + \frac{5}{64} + \frac{5}{96} \\
 &= \underline{\underline{0.1208}}
 \end{aligned}$$

Homework-2

Q1 $x^3 + x - 1 = 0$; between 0.5 & 1

$$\therefore y = x^3 + x - 1$$

x	y
0.5	-0.315
0.6	-0.184
0.7	0.043

$$\left[\begin{aligned} x_p &= \frac{x_1 y_2 - x_2 y_1}{y_2 - y_1} \end{aligned} \right]$$

$$x_1 = 0.6$$

$$y_1 = -0.184$$

$$x_2 = 0.7$$

$$y_2 = 0.043$$

$$x_p = \frac{(0.043)(0.6) + (0.7)(-0.184)}{0.043 - (-0.184)} = 0.6810$$

$$y = x^3 + x - 1$$

$$x_1 = 0.6810$$

$$y_1 = -0.003042$$

$$x_2 = 0.7$$

$$y_2 = 0.043$$

$$x_p = \frac{0.6810(0.043) + 0.7(-0.003042)}{0.043 + 0.003042}$$

$$= 0.6823$$

$$y = -0.000045$$

Root of $x^3 + x - 1 = 0$ is 0.6823

Q2

$$x^3 + 2x + 0.5 = 0$$

between 0 & 1

$$\therefore y = x^3 + 2x + 0.5$$

x	y
0	0.5
0.1	0.301
0.2	0.108
0.3	-0.073

$$x_1 = 0.2$$

$$y_1 = 0.108$$

$$x_2 = 0.3$$

$$y_2 = -0.073$$

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

$$= 0.259669$$

$$y = -0.001829$$

$$x_1 = 0.2$$

$$y_1 = 0.108$$

$$x_2 = 0.259669$$

$$y_2 = -0.001829$$

$$x = \frac{0.2(-0.001829) + 0.108(0.259669)}{-0.001829 - 0.108}$$

$$= 0.255675$$

$$y = -0.000041$$

$$\therefore \text{Root of } x^3 + 2x + 0.5 \text{ is } = 0.255675$$

Q3 $2^3 + 2x - 20 = 0$ between 2 & 2.5

$$y = x^3 + 2x - 20$$

x	y
2	-8
2.1	-6.531
2.2	-4.953
2.3	-3.233
2.4	-0.1625
2.5	0.625

$$x_1 = 2.4$$

$$y_1 = -0.1625$$

$$x_2 = 2.5$$

$$y_2 = 0.625$$

$$x = \frac{2.4(0.625) + 2.5(-0.1625)}{0.625 + 0.1625}$$

$$= 2.46818$$

$$y = -0.01582$$

$$x_1 = 2.46818$$

$$y_1 = -0.01582$$

$$x_2 = 2.5$$

$$y_2 = 0.625$$

$$x = \frac{2.46818(0.625) + 2.5(-0.01582)}{0.625 + 0.01582}$$

$$= 2.46954$$

$$y = -0.000176$$

$\therefore$ Root of $x^3 + 2x - 20 = 0$ is 2.46954

Q.4 $3x - 105x - 1 = 0$ between 0 & 1
 $\therefore y = 3x - 105x - 1$

x	y
0	-2
0.1	-1.69998
0.2	-1.39994
0.3	-1.09998
0.4	-0.79999
0.5	-0.49999
0.6	-0.19999
0.7	0.10001

$x_1 = 0.6$ $y_1 = -0.19999 - 0.1$

$x_2 = 0.7$ $y_2 = 0.10001$

$x = \frac{0.6(0.10001) + 0.7(-0.1)}{0.10001 + 0.1}$

$= \frac{0.060006 - 0.07}{0.20001}$

$= -0.009994$

$y = -0.0000003$

$\therefore$ Root of $3x - 105x - 1$ is -0.009994

Q.5 $x^3 - 3x - 5 = 0$ between 2 & 2.5

$\therefore y = x^3 - 3x - 5$

x	y
2	-3
2.1	-2.039
2.2	-0.952
2.3	0.267
2.4	1.629

$x_1 = 2.2$ $y_1 = -0.952$

$x_2 = 2.3$ $y_2 = 0.267$

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

$= \frac{0.5874 - 2.1916}{1.219}$

$y = -0.01159$

$$x_1 = 2.27809$$

$$y_1 = -0.01159$$

$$x_2 = 2.3$$

$$y_2 = 0.267$$

$$x = 0.267(2.27809) + 2.3(-0.01159)$$

$$0.267 + 0.01159$$

$$= 2.27901$$

$$y = 0.0001$$

$$\therefore \text{Root of } x^3 - 3x - 5 \text{ is } 2.27901$$

Q.6 $x \log_{10} x - 1.2 = 0$ between 2 & 3

$$\therefore y = x \log_{10} x - 1.2$$

x	y
2	-0.59794
2.1	-0.52339
2.2	-0.44667
2.3	-0.36806
2.4	-0.28749
2.5	-0.20514
2.6	-0.12106
2.7	-0.0353
2.8	0.05205

$$x_1 = 2.7$$

$$y_1 = -0.0353$$

$$x_2 = 2.8$$

$$y_2 = 0.05205$$

$$x = 2.7(0.05205) + 2.8(-0.0353)$$

$$0.05205 + 0.0353$$

$$= 2.7404$$

$$y = -0.00014$$

$$\therefore \text{Root of } x \log_{10} x - 1.2 \text{ is } 2.7404$$

0.7

$$x^3 - 4x + 1 = 0$$

$$\therefore y = x^3 - 4x + 1$$

x	y
0	1
0.1	0.60
0.2	0.108
0.3	-0.1103

$$x_1 = 0.2 \quad y_1 = 0.108$$

$$x_2 = 0.3 \quad y_2 = -0.113$$

$$x = \frac{0.2(-0.113) + 0.3(0.108)}{-0.113 - 0.108}$$

$$= 0.2546$$

$$y = -0.00187$$

$$x_1 = 0.2 \quad y_1 = 0.108$$

$$x_2 = 0.2546 \quad y_2 = -0.00187$$

$$x = \frac{0.2(-0.00187) + 0.2546(0.108)}{-0.00187 - 0.108}$$

$$= 0.2541$$

$$y = -0.00002$$

$\therefore$ Root of $x^3 - 4x + 1$ is 0.2541

0.8

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

$$\therefore y = x^3 + 2x^2 - 8$$

x	y
0	-8
1	-5
2	8

$$x_1 = 1 \quad y_1 = -5$$

$$x_2 = 2 \quad y_2 = 8$$

$$x = \frac{1 \cdot 8 + 2 \cdot (-5)}{8 - 5}$$

$$= 1.3846$$

$$y = -1.5112$$

$$x_1 = 1.3846 \quad y_1 = -1.5112$$

$$x_2 = \cancel{-1.5} 2 \quad y_2 = 8$$

$$x = \frac{8(1.3846) + 2(-1.5112)}{8 + 1.5112}$$

$$= 1.4824$$

$$y = -0.3475$$

$$y = -0.3475$$

$$x_1 = 1.4824 \quad y_1 = -0.3475$$

$$x_2 = 2 \quad y_2 = 8$$

$$x = \frac{8(1.4824) + 2(-0.3475)}{8 + 0.3475}$$

$$= 1.5039$$

$$y = -0.0747$$

$$y = -0.0747$$

$$x_1 = 1.5039 \quad y_1 = -0.0747$$

$$x_2 = 2 \quad y_2 = 8$$

$$x = \frac{8(1.5039) + 2(-0.0747)}{8 + 0.0747}$$

$$= 1.5085$$

$$y = -0.0158$$

$$y = -0.0158$$

$$x_1 = 1.5085 \quad y_1 = -0.0158$$

$$x_2 = 2 \quad y_2 = 8$$

$$x = \frac{8(1.5085) + 2(-0.0158)}{8 + 0.0158}$$

$$= 1.8095$$

$$y = -0.0033$$

$$y = -0.0033$$

$$x_1 = 1.8095 \quad y_1 = -0.0033$$

$$x_2 = 2 \quad y_2 = 8$$

$$x = \frac{8(1.8095) + 2(-0.0033)}{8 + 0.0033} = 1.5097$$

$$y = -0.0007$$

$$y = -0.0007$$

$\therefore$ Root of $x^3 + 2x^2 - 8$ is $\boxed{1.5097}$

Q9

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

$$\therefore y = x^3 - 9x + 1$$

x	y
0	1
0.1	0.101
0.2	-0.792

$$x_1 = 0.1$$

$$y_1 = 0.101$$

$$x_2 = 0.2$$

$$y_2 = -0.792$$

$$x = \frac{0.1(-0.792) + 0.2(0.101)}{-0.792 - 0.101}$$

$$= 0.1113$$

$$y = 0.02041$$

$\therefore$ Root of $x^3 - 9x + 1$ is 0.1113

Q10

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

$$\therefore y = x^3 - x - 4$$

x	y
0	-4
1	-4
2	2

$$x_1 = 1$$

$$y_1 = -4$$

$$x_2 = 2$$

$$y_2 = 2$$

$$x = \frac{1(-4) + 2(2)}{2 - 4}$$

$$= 1.3334$$

$$y = -2.9629$$

$$y = -2.9629$$

$$x_1 = 1.3334$$

$$y_1 = -2.9629$$

$$x_2 = 2$$

$$y_2 = 2$$

$$x = \frac{1.3334(-2.9629) + 2(2)}{2 - 2.9629}$$

$$= 1.7313$$

$$y = -0.5415$$

$$y = -0.5415$$

$$x_1 = 1.7313$$

$$y_1 = -0.5415$$

$$x_2 = 2$$

$$y_2 = 2$$

$$x = \frac{2(1.7313) + 2(-0.5415)}{2 + 0.5415}$$

$$= \frac{1.985}{1.985}$$

$$= 1.7885$$

$$y = -0.6680$$

$$x_1 = 1.7885$$

$$y_1 = -0.6680$$

$$x_2 = 2$$

$$y_2 = 2$$

$$x = \frac{2(1.7885) + 2(-0.6680)}{2 + 0.6680}$$

$$= \frac{1.7954}{1.7954}$$

$$= 1.7954$$

$$y = -0.0078$$

$$x_1 = 1.7954$$

$$y_1 = -0.0078$$

$$x_2 = 2$$

$$y_2 = 2$$

$$x = \frac{2(1.7954) + 2(-0.0078)}{2 + 0.0078}$$

$$= \frac{1.7912}{1.7912}$$

$$= 1.7912$$

$$y = 0.00091$$

$\therefore$ Root of $x^3 - x - 4 = 0$ is ~~1.7912~~ 1.7912