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HOMEWORK - 1

(1)

Q1]

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

$f(9.5) = 9$

$$\therefore f(9.5) = \frac{[9.5-8](9.5-9)(9.5-10)(3)}{(7-8)(7-9)(7-10)} + \frac{(9.5-7)(9.5-9)(9.5-10)}{(1)(-1)(-2)} + \frac{(9.5-7)(9.5-8)(9.5-10)}{(2)(1)(-1)} + \frac{(9.5-7)(9.5-8)(9.5-9)}{(3)(2)(1)}$$

$$= \frac{3}{16} - \frac{5}{16} + \frac{9}{16} + \frac{45}{16}$$

$$= 3.625$$

Ans) 3.625

Q2)

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

$f(6) = ?$

$$\therefore f(6) = \frac{(6-7)(6-9)(6-10)(10\cdot 8)}{(3-7)(3-9)(3-10)} + \frac{(6-3)(6-9)(6-10)(120)}{(7-3)(7-9)(7-10)} + \frac{(6-3)(6-7)(6-10)(72)}{(9-3)(9-7)(9-10)} + \frac{(6-3)(6-7)(6-9)(63)}{(10-3)(10-7)(10-9)}$$

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

$$= 147$$

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Q3)

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

$f(6) = ?$

$$f(6) = \frac{(6-2)(6-7)(6-8)(4)}{(1-2)(1-7)(1-8)} + \frac{(6-1)(6-7)(6-8)(5)}{(2-1)(2-7)(2-8)}$$
$$+ \frac{(6-1)(6-2)(6-7)(4)}{(8-1)(8-2)(8-7)} + \frac{(6-1)(6-2)(6-8)(5)}{(7-1)(7-2)(7-8)}$$

$$= \frac{-16}{21} + \frac{5}{3} - \frac{40}{21} + \frac{20}{3}$$

$$= 5.6667$$

Q4)

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

$$f(15) = \frac{(5-2)(5-3)(5-4)(5-7)(2)}{(1-2)(1-3)(1-4)(1-7)} + \frac{(5-1)(5-3)(5-4)(5-7)(4)}{(2-1)(2-3)(2-4)(2-7)}$$
$$+ \frac{(5-1)(5-2)(5-4)(5-7)(8)}{(3-1)(3-2)(3-4)(3-7)} + \frac{(5-1)(5-2)(5-3)(5-7)(16)}{(4-1)(4-2)(4-3)(4-7)}$$
$$+ \frac{(5-1)(5-2)(5-3)(5-4)(16)}{(7-1)(7-2)(7-3)(7-4)}$$

$$\Rightarrow \frac{-2}{3} + \frac{32}{5} - 24 + \frac{128}{3} + \frac{128}{15}$$

$$\Rightarrow 32.9334$$

Q5)

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

$$f(15) = \frac{(15-20)(15-14)(15-16)(0.25)}{(10-20)(10-14)(10-16)} + \frac{(15-10)(15-14)(15-16)(0.20)}{(20-10)(20-14)(20-16)}$$
$$+ \frac{(15-10)(15-20)(15-16)(0.15)}{(14-10)(14-20)(14-16)} + \frac{(15-10)(15-20)(15-14)(0.10)}{(16-10)(16-20)(16-14)}$$

$$\Rightarrow \frac{-1}{112} - \frac{1}{240} + \frac{5}{64} + \frac{5}{96} = 0.1208$$

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Q21

① $x^3 + x - 1 = 0$ blw 0.5 and 1

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

x	y
0.5	-0.315
0.6	-0.184
0.7	0.043

$x_1 = 0.6$ $x_2 = 0.7$

$y_1 = 0.184$ $y_2 = 0.043$

using,

$$x_n = \frac{x_1 y_2 - x_2 y_1}{y_2 - y_1}$$

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

$= 0.6810$

$\therefore n = -0.003042$

Now, $x_1 = 0.6810$ $x_2 = 0.7$

$y_1 = -0.003042$ $y_2 = 0.043$

$$x_n = \frac{(0.6810)(0.043) + (0.7)(0.003042)}{0.0043 + 0.003042}$$

$= 0.6823$

$y_n = -0.000045$

Root $y' x^3 + x - 1 = 0$

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Q2) $x^3 + 2x + 0.5 = 0$ b/w 0 & 1

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

x	y
0	0.5
0.1	0.301
0.2	0.108
0.3	-0.073

$x_1 = 0.2$ $x_2 = 0.3$

$y_1 = 0.108$ $y_2 = 0.073$

$$x_n = \frac{(-0.073)(0.2) - (0.3)(0.10)}{-0.073 - 0.108}$$

$$= 0.259669$$

$y_x = -0.001824$

$x_1 = 0.2$ $x_2 = 0.259669$

$y_1 = 0.108$ $y_2 = -0.001829$

$$x_n = \frac{(-0.001829) - (0.259669)(0.10)}{-0.001829 - 0.103}$$

$$= 0.255675$$

$y_n = -0.000041$

Root of $x^3 + 2x + 0.5 = 0.258625$

Q4) $3x - 105x - 1 = 0$ b/w 0 & 1

$y = 3x - 105x - 1$

x	y
0	-2
0.1	-1.69998
0.2	-1.39994
0.3	-10498
0.4	-0.79999
0.5	-0.49999
0.6	-0.1999
0.7	0.10007

Now,

$x_1 = 0.6$ $x_2 = 0.7$

$y_1 = 01999$ $y_2 = 0.10007$

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$$x_n = \frac{(0.10007)(0.6) + (0.7)(0.1999)}{0.10007 + 0.1999}$$

$$= 0.6666$$

$y_n = -0.0000003$.

$\therefore$ Root $= -0.666$

Q6) $x^3 - 3x - 5 = 0$ blw 0 and 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	1.679

Now,

$x_1 = 2.2$ $\quad x_2 = 0.3$

$y_1 = -0.952$ $\quad y_2 = 0.267$

$$x_n = \frac{(0.267)(0.2) + (0.952)(2.3)}{0.267 + 0.952} = 2.27809$$

$y_x = -0.01159$.

$x_1 = 2.27809$ $\quad x_2 = 2.3$

$y_1 = -0.01159$ $\quad y_2 = 0.261$

$$x'_n = \frac{(0.267)(2.27809) + (2.3)(0.01159)}{(0.207) + (0.01159)}$$

$$= 2.27901$$

$y'_n = 0.0001$

Root $= 2.27901$

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Q7) $x^3 - 4x + 1 = 0$

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

x	y
0	1
0.1	0.60
0.2	0.108
0.3	-0.173

NOW,

$x_1 = 0.2$ $x_2 = 0.3$

$y_1 = 0.208$ $y_2 = 0.173$

$$x_n = \frac{(-0.173)(0.3) - (0.3)(0.208)}{-0.173 - 0.208}$$

$= 0.254666$

$y_n = -0.00187$

$x_1 = 0.2$ $y_1 = 0.208$

$x_2 = 0.2546$ $y_2 = -0.00187$

$$x'_n = \frac{(-0.00181)(0.2) - (0.208)(0.2546)}{-0.00187 - 0.208}$$

$= 0.2541$

$y''x = -0.0002$

Root = 0.254

Q8) $x^3 + 2x^2 - 8 = 0$.

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

x	y
0	-8
1	-5
2	8

$x_1 = 1$ $x_2 = 2$

$y_1 = -5$ $y_2 = 8$.

$$x_n = \frac{8(1) + 5(2)}{8 + 5}$$

$= 1.3846$

$y_n = -1.5112$

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Now,

$x_1 = 1.3846 \qquad y_1 = -1.5112$

$x_2 = 2 \qquad y_2 = 8$

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

$$= 1.4824.$$

$y'(x) = -0.3475$

$x_1 = 1.4824 \qquad y_1 = -0.3475$

$x_2 = 2 \qquad y_2 = 8.$

$$x_n^4 = \frac{8(1.4824) + 2(-0.3475)}{8 + (-0.3475)}$$

$$= 1.5039$$

$$x''_n = \frac{8(1.5033) + (0.0747)(2)}{8 + 0.747} = 1.5085.$$

$y''_n = -0.0158$

$x_1 = 1.5085 \qquad y_1 = 0.1158$

$x_2 = 2 \qquad y_2 = 2$

$$x'''_n = \frac{8(1.5085) + (0.958)(2)}{8 + 0.0158} = 1.5095$$

$y_n = -0.0033.$

$$x_n = \frac{8(1.8095) + (0.0033)(2)}{8 + 0.0033} = 1.5097.$$

Root therefore becomes 1.5097.

Q9) $x^3 - 9x + 1 = 0$

$y = x^3 - 9x + 1$.

x	y
0	y_1
0.1	0.101
0.2	0.792

$x_1 = 0.1$ $\quad x_2 = 0.2$

$y_1 = 0.101$ $\quad y_2 = -0.792$

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

$$= 0.1113.$$

$y_n = 0.00041$

$\therefore$ Root is 0.1113.

Q10) $x^3 - x - 4 = 0$

$\therefore y = x^3 - x - 4 = 0.$

x	y
0	-4
1	-4
2	2.

$x_1 = 1$ $\quad x_2 = 2$

$y_1 = -4$ $\quad y_2 = 2$

$$x_n = \frac{2(1) + 4(2)}{2 + 4} = 1.334$$

$y_n = -2.9629$

$x_1 = 1.334$ $\quad x_2 = 2$

$y_1 = -2.9629$ $\quad y_2 = 2$

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$x_n = \frac{2(1.334) + 2(2.9624)}{2 + 2.9624}$

$= 1.7319$

$y_n = -0.5415$

Now, $x_1 = 1.7313 \quad x_2 = 2$

$y_1 = -0.5415 \quad y_2 = 2$

$x_n = \frac{2(1.7313) + 2(0.5415)}{2 + 0.5415} = 1.2885.$

$y_n = 0.6680$

$x_1 = 1.7885 \quad x_2 = 2$

$y_1 = 0.6680 \quad y_2 = 2$

$x_n = \frac{2(1.7885) + 2(0.6680)}{2 + 0.6680} = 1.7954.$

$y_n = -0.0078$

Now Again,

$x_1 = 1.7954 \quad x_2 = 2$

$y_1 = 0.0078 \quad y_2 = 2$

$x_n = \frac{2(1.7984) + 2(0.0078)}{2 + 0.0078} = 1.7912.$

$y_n = 0.0009)$

Root = 1.7962.