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Homework

Name => Little Jain .

Q1

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

x = 9.5

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

$$f(9.5) = \frac{1.5 \times 0.5 \times (-0.5) \times 3}{-1 \times -2 \times -3} + \frac{2.5 \times 0.5 \times (-0.5)}{1 \times -1 \times -2} + \frac{2.5 \times 1.5 \times (-0.5)}{2 \times 1 \times (-1)} + \frac{2.5 \times 1.5 \times 0.5 \times 9}{3 \times 2 \times 1}$$

$$f(9.5) = \frac{3}{16} + \frac{-5}{16} + \frac{15}{16} + \frac{45}{16} = \frac{58}{16} = 3.625$$

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Ques 2 ⇒

x	3	7	9	10
f(x)	168	120	72	63

$$f(6) = \frac{(6-7)(6-9)(6-10)}{(3-7)(3-9)(3-10)} \times 168 + \frac{(6-3)(6-9)(6-10)}{(7-3)(7-9)(7-10)} \times 120 + \frac{(6-3)(6-7)(6-10)}{(9-3)(9-7)(9-10)} \times 72 + \frac{(6-3)(6-7)(6-9)}{(10-3)(10-7)(10-9)} \times 63$$

$$f(6) = \left(\frac{+1 \times -3 \times +4}{+4 \times -6 \times -7} \times 168\right) + \frac{3 \times -3 \times -4}{4 \times -2 \times -3} \times 120 + \frac{3 \times 1 \times (-4)}{6 \times 2 \times 1} \times 72 + \frac{3 \times -1 \times (-3)}{7 \times 3 \times 1} \times 63$$

$$f(6) = 12 + 180 - 72 + 27 = \underline{147}$$

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Ques 5 ⇒

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

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

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

$$= -16/21 + 5/3 + 20/3 - 40/21 = 17/3 = 5.667$$

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Ques 4 →

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

$$f(5) = \frac{(5-2)(5-3)(5-4)(5-7)}{(1-2)(1-3)(1-4)(1-7)} \times 2$$

$$+ \frac{(5-1)(5-3)(5-4)(5-7)}{(2-1)(2-3)(2-4)(2-7)} \times 4$$

$$+ \frac{(5-1)(5-2)(5-4)(5-7)}{(3-1)(3-2)(3-4)(3-7)} \times 8$$

$$+ \frac{(5-1)(5-2)(5-3)(5-7)}{(4-1)(4-2)(4-3)(4-7)} \times 16$$

$$+ \frac{(5-1)(5-2)(5-3)(5-4)}{(7-1)(7-2)(7-3)(7-4)} \times 128$$

$$f(5) = \frac{3\times2\times1\times(-2)\times3}{-1\times-2\times-3\times-6} + \frac{4\times2\times1\times(-2)\times4}{-1\times-2\times-5} + \frac{4\times3\times-2\times8}{2\times(-1)(-4)}$$

$$+ \frac{4\times3\times2\times(-2)\times16}{3\times2\times1\times(-3)} + \frac{4\times3\times2\times1\times128}{6\times5\times4\times3}$$

$$f(5) = -\frac{2}{3} + \frac{32}{5} + -24 + \frac{128}{3} + \frac{128}{15} = 32.9333$$

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Ques 5 ⇒

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

$$f(15) = \frac{(15-20)(15-14)(15-16)}{(10-20)(10-14)(10-16)} \times 0.25$$

$$+ \frac{(15-10)(15-14)(15-16)}{(20-10)(20-14)(20-16)} \times 0.20$$

$$+ \frac{(15-10)(15-20)(15-16)}{(14-10)(14-20)(14-16)} \times 0.15$$

$$+ \frac{(15-10)(15-20)(15-14)}{(16-10)(16-20)(16-14)} \times 0.10$$

$$f(15) = \frac{-5 \times 1 \times -1}{-10 \times -4 \times -6} \times 0.25 + \frac{5 \times 1 \times -1 \times 0.20}{10 \times 6 \times 4}$$

$$+ \frac{5 \times (-5) \times (-1) \times 0.15}{4 \times (-6) \times (-2)} + \frac{5 \times (-5) \times 1 \times 0.1}{6 \times (-4) \times 2}$$

$$= \frac{-1}{192} - \frac{1}{240} + \frac{5}{64} + \frac{5}{96} = \frac{29}{240}$$

$$= 0.120833$$

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Homework - 2

Regula Falsi Method

1 ⇒ $x^3 + x - 1 = 0$

$f(x) = x^3 + x - 1$

x	y
0.5	-0.375
0.6	-0.184
0.7	0.043

$x_1 = 0.6$ $\quad x_2 = 0.7$

$y_1 = -0.184$ $\quad y_2 = 0.043$

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

$x_n = 0.681057$

$y_n = -0.003042$

Now

$x_1 = 0.681057$ $\quad x_2 = 0.7$

$y_1 = -0.003042$ $\quad y_2 = 0.043$

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

$= 0.682309$

$y'_n = -0.000045$

Thus, the root of $x^3 + x - 1 = 0$ is 0.682309.

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Ques 2 ⇒ $x^3 - 2x + 0.5 = 0$ b/w 0 & 1

x	y
0	0.5
0.1	0.301
0.2	0.108
0.3	-0.073

$x_1 = 0.2$ $\quad x_2 = 0.3$

$y_1 = 0.108$ $\quad y_2 = -0.073$

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

$$= 0.259669$$

$$y_n = -0.001829$$

Now

$x_2 = 0.259669$ $\quad x_{n-1} = 0.2$

$y_2 = -0.001829$ $\quad y_{n-1} = 0.108$

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

$$x'_n = 0.258675$$

$$y'_n = -0.000041$$

Thus root of $x^3 - 2x + 0.5$ is 0.258675

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Ques 5 $x^3+2x-20=0$ b/w 2 & 2.5

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

x	y
2.3	-3.233
2.4	-1.376
2.5	0.625

$x_1 = 2.4$ $\quad x_2 = 2.5$

$y_1 = -1.376$ $\quad y_2 = 0.625$

$$x_n = \frac{x_1y_2 - x_2y_1}{y_2 - y_1}$$

$$= 2.468766$$

$$y_n = -0.015819$$

Now $x_1 = 2.468766$, $x_2 = 2.5$

$y_1 = -0.015819$, $y_2 = 0.625$

$$x'_n = \frac{x_1y_2 - x_2y_1}{y_2 - y_1}$$

$$= 2.469537$$

$$y'_n = -0.000176$$

The root of given equation is $\approx$ 2.469537

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Ques 4 $3x - \cos x - 1 = 0$, b/w 0 and 1

Function is, $y = 3x - \cos x - 1$

x	y
0.3	-1.099986
0.4	-0.799976
0.5	-0.499962
0.6	-0.199945
0.7	0.100075

$x_1 = 0.6$ $\quad$ $x_2 = 0.7$

$y_1 = -0.199945$ $\quad$ $y_2 = 0.100075$

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

$$= 0.666644$$

$y_n = -0.00006313$

Root of $3x - \cos x - 1$ is 0.666644

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Ques 5 = $x^3 - 3x - 5$ b/w 2 and 2.5

x	y
2.0	-3
2.1	-2.039
2.2	-0.952
2.3	0.267

$x_1 = 2.2 \quad x_2 = 2.3$

$y_1 = -0.952 \quad y_2 = 0.267$

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

$$= 2.278097$$

$$y_n = -0.011592$$

Now, $x_1 = 2.278097$, $x_2 = 2.3$

$y_1 = -0.011592$, $y_2 = 0.267$

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

$$= 2.279008$$

$$y'_n = -0.000136$$

Thus, the root of $x^3 - 3x - 5$ is 2.279008.

Ques 6 => $x \log_{10} x - 1.2 = 0$ b/w 2&3

$f(x) = x \log_{10} x - 1.2$

x	y
2.4	-0.287493
2.5	-0.205149
2.6	-0.121069
2.7	-0.035318
2.8	0.052042

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

$= 2.740428$

$y_n = -0.0001902$

Thus, root of function 2.740428

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Ques 7 ⇒ $x^3 - 4x + 1 = 0$

$f(x) = x^3 - 4x + 1$

x	y
0	1
0.1	0.601
0.2	0.208
0.3	−0.173

$x_1 = 0.2$ $\quad$ $x_2 = 0.3$

$y_1 = 0.208$ $\quad$ $y_2 = -0.173$

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

$$= 0.254593$$

$y_n = -0.001869$

Now,

$x_1 = 0.2$, $x_2 = 0.254593$

$y_1 = 0.208$, $y_2 = -0.001869$

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

$$= 0.254107$$

$y'_n = -0.00002022$

Thus, the root of given equation is 0.254107.

Ques 8 ⇒ $x^3 + 2x^2 - 8 = 0$

Function is $y = x^3 + 2x^2 - 8$

x	y
0	-8
1	-5
2	8

$x_1 = 1$, $x_2 = 2$

$y_1 = -5$, $y_2 = 8$

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

$$= 1.384615$$

$$y_n = -1.511156$$

Now $x_1 = 1.384615$, $x_2 = 2$

$y_1 = -1.511156$, $y_2 = 8$

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

$$= 1.482389$$

$$y'_n = -0.347529$$

Now,

$x_1 = 1.482389$, $x_2 = 2$

$y_1 = -0.347529$, $y_2 = 8$

$$x''_n = \frac{x_1 y_2 - x_2 y_1}{y_2 - y_1} = 1.509938$$

$y'''n = -0.074689$

Now,

$x_1 = 1.503938$, $x_2 = 2$

$y_1 = -0.074689$, $y_2 = 8$

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

$$= 1.508526$$

$y''''n = -0.0158204$

Now, $x_1 = 1.508526$, $x_2 = 2$

$y_1 = -0.0158204$, $y_2 = 8$.

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

$$= 1.509496$$

$y'''''n = -0.003339$

Now,

$x_1 = 1.509496$, $x_2 = 2$

$y_1 = -0.003339$, $y_2 = 8$

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

$$= 1.50970064$$

$$y_n = -0.000704$$

So, the root of the given equation is 1.50970064

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

function, $y = x^3 - 9x + 1$

x	y
0	1
0.1	0.101
0.2	-0.792

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

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

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

$$= 0.1113102$$

$$y_n = -0.000413$$

Thus, the root of given equation is 0.1113702.

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

Function is $y = x^3 - x - 4$

x	y
0	-4
1	-4
2	2

$x_1 = 1$, $x_2 = 2$

$y_1 = -4$ $y_2 = 2$

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

$$= 1.333334$$

$$y_n = -2.96296$$

Now,

$x_1 = 1.333334$, $x_2 = 2$

$y_1 = -2.96296$, $y_2 = 2$

$$x'_n = \frac{x_1 y_2 - y_1 x_2}{y_2 - y_1} = 1.7313434$$

$$y'_n = -0.541555$$

Now, $x_1 = 1.7313434$, $x_2 = 2$

$y_1 = -0.541555$, $y_2 = 2$

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

$$= 1.788589$$

$$y''_n = -0.066802$$

Now,

$x_1 = 1.788589$, $x_2 = 2$

$y_1 = -0.066802$, $y_2 = 2$

$$x'''_n = \frac{x_1 y_2 - x_2 y_1}{y_2 - y_1} = 1.795422$$

$$y'''_n = -0.007807$$

Now, $x_1 = 1.795422$, $x_2 = 2$

$y_1 = -0.007807$, $y_2 = 2$

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

$$= 1.796217$$

$$y_n = -0.0009105$$

Thus a root of $x^3 - x - 4$ is 1.796217.