

Home Work - 1

1 given,

x	y	$x_4 = 9.5$	$x_1 = 8$
7	3	$y_3 = 9$	$x_2 = 9$
8	1	$y_0 = 3$	$x_3 = 10$
9	1	$y_1 = 1$	$x_0 = 7$
10	9	$y_2 = 1$	

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

$$+ \frac{(9.5 - 7)(9.5 - 9)(9.5 - 10)}{(8 - 7)(8 - 9)(8 - 10)} \cdot 1$$

$$+ \frac{(9.5 - 7)(9.5 - 8)(9.5 - 10)}{(9 - 7)(9 - 8)(9 - 10)} \cdot 1$$

$$+ \frac{(9.5 - 7)(9.5 - 8)(9.5 - 9)}{(10 - 7)(10 - 8)(10 - 9)} \cdot 9$$

$$\Rightarrow 0.1875 - 0.3125 + 0.9375 + 2.8125 = 3.625$$



2. x	y	$x_k = 6$	$y_0 = 68$
3	168	$x_k = 6$	
7	120	$x_0 = 3$	$y_1 = 120$
9	72	$x_1 = 7$	
10	63	$x_2 = 9$	$y_2 = 72$
		$x_3 = 10$	$y_3 = 63$

$$\begin{aligned}
 f(6) &= \frac{(6-7)(6-9)(6-10)}{(3-7)(3-9)(3-10)} \cdot 168 \\
 &+ \frac{(6-3)(6-9)(6-10)}{(7-3)(7-9)(7-10)} \cdot 120 \\
 &+ \frac{(6-3)(6-7)(6-10)}{(9-3)(9-7)(9-10)} \cdot 72 \\
 &+ \frac{(6-3)(6-7)(6-9)}{(10-3)(10-7)(10-9)} \cdot 63 \\
 &\Rightarrow 12 + 180 - 72 + 27 \\
 &\Rightarrow 147
 \end{aligned}$$

So, $f(6) = 147$



3. x	y	$x_k = 6$	$y_0 = 4$
1	4	$x_0 = 1$	$y_1 = 5$
2	5	$x_1 = 2$	$y_2 = 5$
7	5	$x_2 = 7$	
8	4	$x_3 = 8$	$y_3 = 4$

$$\begin{aligned}
 f(6) &= \frac{(6-2)(6-7)(6-8)}{(1-2)(1-7)(1-8)} \cdot 4 \\
 &+ \frac{(6-1)(6-7)(6-8)}{(2-1)(2-7)(2-8)} \cdot 5 \\
 &+ \frac{(6-1)(6-2)(6-8)}{(7-1)(7-2)(7-8)} \cdot 5 \\
 &+ \frac{(6-1)(6-2)(6-7)}{(8-1)(8-2)(8-7)} \cdot 4 \\
 &\Rightarrow -0.76190 + 1.66667 + 6.66667 - 1.90476 \\
 &\Rightarrow 5.66668
 \end{aligned}$$



4. x	y	$x_k = 5$	$x_4 = 7$	$y_4 = 128$
1	2	$x_0 = 1$	$y_0 = 2$	
2	4	$x_1 = 2$	$y_1 = 4$	
3	8	$x_2 = 3$	$y_2 = 8$	
4	16	$x_3 = 4$	$y_3 = 16$	
7	128			

$$\begin{aligned}
 f(5) &= \frac{(5-2)(5-3)(5-4)(5-7)}{(1-2)(1-3)(1-4)(1-7)} \cdot 2 \\
 &+ \frac{(5-1)(5-3)(5-4)(5-7)}{(2-1)(2-3)(2-4)(2-7)} \cdot 4 \\
 &+ \frac{(5-1)(5-2)(5-4)(5-7)}{(3-1)(3-2)(3-4)(3-7)} \cdot 8 \\
 &+ \frac{(5-1)(5-2)(5-3)(5-7)}{(4-1)(4-2)(4-3)(4-7)} \cdot 16 \\
 &+ \frac{(\overset{5}{\cancel{7}}-1)(\overset{5}{\cancel{7}}-2)(\overset{5}{\cancel{7}}-3)(\overset{5}{\cancel{7}}-4)}{(\cancel{7}-1)(\cancel{7}-2)(\cancel{7}-3)(\cancel{7}-4)} \cdot 128
 \end{aligned}$$

$$\begin{aligned}
 &\Rightarrow -0.6667 + 6 \cdot 4 - 24 + 42 \cdot 6667 \\
 &+ 8 \cdot 53333 \\
 &\Rightarrow 320.93334
 \end{aligned}$$



5. x	y	$x_k = 15$	$y_0 = 0.25$
10	0.25	$x_0 = 10$	$y_1 = 0.20$
20	0.2	$x_1 = 20$	$y_2 = 0.15$
14	0.15	$x_2 = 14$	$y_3 = 0.10$
16	0.10	$x_3 = 16$	

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

$$+ \frac{(15-10)(15-14)(15-16)}{(20-10)(20-14)(20-16)} \cdot 0.2$$

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

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

$$\Rightarrow 0.00520 - 0.00416 + 0.07812 + 0.05208$$

$$\Rightarrow 0.12084$$



Homework - 2

1. ~~$x^3 + x - 1 = 0$~~ $x^3 + x - 1 = f(x)$

x	y
0.5	-0.375
0.6	-0.184
0.7	0.043
0.8	0.312
0.9	0.629
1	1

$$x_1 = 0.6, y_1 = -0.184$$

$$x_2 = 0.7, y_2 = 0.043$$

Approximate value of x

$$\frac{x_1 y_2 - x_2 y_1}{y_2 - y_1} = \frac{(0.6 \times 0.043) - (0.184 \times 0.7)}{0.043 - (-0.184)}$$

$$= \frac{0.0258 + 0.1288}{0.227}$$

$$= 0.68105$$

$$y = (0.68105)^3 + (0.68105) - 1$$

$$= -0.00303$$

2. $x^3 - 2x + 0.5 = 0$ lying between 0 & 1

x	y
0	0.5
0.1	0.301
0.2	0.108
0.3	-0.073
0.4	-0.236
0.5	-0.375
0.6	-0.484
0.7	-0.557
0.8	-0.588
0.9	-0.571
1	-0.5

$$x_2 = 0.3, y_2 = -0.073$$

$$x_1 = 0.2, y_1 = 0.108$$

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

$$\Rightarrow \frac{47}{181} = 0.25966$$

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

$$\Rightarrow (0.2596)^3 - 2(0.2596)$$

$$+ 0.5$$

$$\Rightarrow -0.0017$$

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

x	y
2	-8
2.1	-6.539
2.2	-4.952
2.3	-3.233
2.4	-1.376
2.5	0.625

$$x_1 = 2.4, y_1 = -1.376$$

$$x_2 = 2.5, y_2 = 0.625$$

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

$$\Rightarrow 2.4687$$



$$y = -0.01715$$

4) $3x - \cos x - 1 = 0$ lying between 0 & 1

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
0.8	0.4
0.9	0.7001
1	1.0001

$$x_1 = 0.6 \quad y_1 = -0.199$$

$$x_2 = 0.7 \quad y_2 = 0.1$$

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

$$\Rightarrow \frac{0.6 \times 0.1 - 0.7 \times -0.199}{0.1 - (-0.199)}$$

$$\Rightarrow 0.66655$$

$$y = -0.00028$$

5) $x^3 - 3x - 5$ lying between 2 & 2.5

x	y
2	-3
2.1	-2.039
2.2	-0.952
2.3	0.267
2.4	1.624
2.5	3.125

$$x_1 = 2.2$$

$$x_2 = 2.3$$

$$y_1 = -0.952$$

$$y_2 = 0.267$$

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

$$= \frac{0.5874 - (-2.1896)}{0.267 - (-0.952)}$$

$$= 2.27809$$

$$y = (2.27809)^3 - 3(2.27809) - 5$$

$$= -0.01157$$

6) $x \log_{10} x - 1.2$ lying between 2 & 3

$$x \quad y$$

$$2 \quad -0.597$$

$$2.1 \quad -0.523$$

$$2.2 \quad -0.446$$

$$2.3 \quad -0.368$$

$$2.4 \quad -0.287$$

$$2.5 \quad -0.205$$

$$2.6 \quad -0.121$$

$$2.7 \quad -0.035$$

$$2.8 \quad 0.052$$

$$2.9 \quad 0.1409$$

$$3 \quad 0.2313$$

$$x_1 = 2.7 \quad x_2 = 2.8$$

$$y_1 = -0.035 \quad y_2 = 0.052$$

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

$$= \frac{2.7 \times (0.052) - 2.8 \times (-0.035)}{0.052 - (-0.035)}$$

$$\Rightarrow \frac{0.1404 + 0.098}{0.087}$$

$$\Rightarrow 2.74023$$



$$y = (2.74023) \log_{10} (2.74023) - 1.2$$

$$\Rightarrow -0.0008629$$

$$7. x^3 - 4x + 1 = 0 \quad \text{between } 1 \& 2$$

x	y
1.7	-0.887
1.8	-0.368
1.9	0.259

$$x_1 = 1.8 \quad y_1 = -0.368$$

$$x_2 = 1.9 \quad y_2 = 0.259$$

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

$$\Rightarrow \frac{(1.8 \times 0.259) - (1.9 \times -0.368)}{0.259 - (-0.368)}$$

$$\Rightarrow \frac{0.4662 + 0.6992}{0.627} = 1.85869$$

$$y = (1.85869)^3 - 4(1.85869) + 1$$

$$\Rightarrow -0.0134$$

$$x = \frac{(1.85869 \times 0.259) - (1.9 \times -0.1349)}{0.259 - (-0.368)}$$

$$= 1.87283$$

$$y = 0.077616$$



$$8. x^3 + 2x^2 - 8$$

$$1.50 < x < 1.52$$

x	y
1.506	-0.049
1.508	-0.022
1.51	0.0031
1.512	0.0289

$$x_1 = 1.508$$

$$x_2 = 1.51$$

$$y_1 = -0.022$$

$$y_2 = 0.0031$$

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

$$\Rightarrow \frac{(1.508 \times 0.0031) - (1.51 \times -0.022)}{0.0031 + 0.022}$$

$$\Rightarrow 1.50975$$

$$y = (1.50975)^3 + 2(1.50975)^2 - 8$$

$$\Rightarrow -0.000068$$

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

$$2.9 < x < 2.95$$

x	y
2.93	-0.216
2.94	-0.047
2.95	0.1223

$$x_1 = 2.94 \quad x_2 = 2.95$$

$$y_1 = -0.047$$

$$y_2 = 0.1223$$



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

$$\Rightarrow \frac{(2.94 \times 0.1223) - (2.95 \times -0.047)}{0.1223 + 0.047}$$

$$\Rightarrow \frac{0.498212}{0.1223 + 0.047} = 2.94277$$

$$y = (2.94277)^3 - 9(2.94277) + 1$$

$$\Rightarrow -0.00085$$

$$10. \quad x^3 - x - 4 = 0 \quad 1.7 < x < 1.8$$

x	y	
1.78	-0.14	$x = \frac{x_1 y_2 - x_2 y_1}{y_2 - y_1}$
1.79	-0.054	
1.8	0.032	

$$\Rightarrow \frac{(1.79 \times 0.032) - (1.8 \times -0.054)}{0.032 + 0.054}$$

$$\Rightarrow 1.79627$$



$$y = (1.79627)^3 - (1.79627) - 4$$

$$\Rightarrow -0.00045$$