

Assst Homework - Numerical Algebra

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

Find $f(9.5)$.

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

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

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

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

$$= \frac{1.5 \times 0.5 \times -0.5}{-1 \times -2 \times -3} \times 3 = 0.1875$$

$$= \frac{2.5 \times 0.5 \times -0.5}{1 \times -1 \times -2} \times 1 = -0.3125$$

$$= \frac{2.5 \times 1.5 \times -0.5}{2 \times 1 \times -1} \times 1 = 0.9375$$

$$= \frac{2.5 \times 1.5 \times 0.5}{3 \times 2 \times 1} \times 9 = 2.8125$$

$$f(9.5) = \underline{\underline{3.625}}$$

Q2]

x	3	7	9	10
obs	168	120	72	63

5 End obs at 6

$$\therefore f(6) = \frac{(6-7)(6-9)(6-10)}{(3-7)(3-9)(3-10)} \times 168$$

$$10 + \frac{(6-3)(6-9)(6-10)}{(7-3)(9-7)(9-10)} \times 120$$

$$+ \frac{(6-3)(6-7)(6-10)}{(9-3)(9-7)(9-10)} \times 72$$

$$15 + \frac{(6-3)(6-7)(6-9)}{(10-3)(10-7)(10-9)} \times 63$$

$$= \frac{+1 \times +3 \times -4}{-4 \times +6 \times +7} \times 168 = 12$$

$$= \frac{3 \times -3 \times -4}{4 \times -2 \times -3} \times 120 = 180$$

$$25 = \frac{3}{62} \times \frac{-1}{2} \times \frac{-4}{-1} \times 72 = -72$$

$$= \frac{3}{7} \times \frac{-1}{3} \times \frac{-3}{1} \times 63 = 27$$

30 $\therefore$ obs at position 6 $\therefore$ = 147

83

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

Find $f(6)$

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

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

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

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

$$= \frac{4 \times -1 \times -2 \times 4}{-1 \times +6 \times -7} = -0.761905$$

$$= \frac{5 \times +1 \times +2 \times 5}{1 \times +6 \times +3} = 1.66667$$

$$= \frac{5 \times 4 \times +2 \times 5}{3 \times +6 \times +1} = 6.66667$$

$$= \frac{5 \times 4 \times -1 \times 4}{7 \times 6 \times 1} = -1.90476$$

$$f(6) = 5.6667$$

	x	1	2	3	4	7
qu]	f(x)	2	4	8	816	128

$$y(5) =$$

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

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

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

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

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

$$= \frac{-3 \times -2 \times -1 \times -2}{-1 \times -1 \times -3 \times -61} \times 2 \times 2 = -\frac{2}{3}$$

$$+ \frac{4 \times 2 \times 1 \times -2}{1 \times -1 \times -2 \times -5} \times 4 = \frac{16 \times 2}{5}$$

$$+ \frac{4 \times 3 \times 1 \times 2}{2 \times 1 \times -1 \times 4} \times 8 = -24$$

$y(5)$
32.933

$$+ \frac{4 \times 8 \times 2 \times 2}{3 \times 2 \times 1 \times 3} \times 16 = \frac{8 \times 16}{3}$$

$$+ \frac{4 \times 3 \times 2 \times 1}{3 \times 5 \times 4 \times 3} \times 128 = \frac{128}{15}$$

Q5]

x	10	20	14	16
$f(x)$	0.25	0.2	0.15	0.1

$$f(15)$$

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

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

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

$$+ \frac{(15-10)(15-20)(15-14)}{(16-10)(16-20)(16-14)} \times 0.1$$

$$= \frac{-5 \times 1 \times -1}{10 \times 6 \times 4} + \frac{5 \times 1 \times +1}{10 \times 4 \times -6} \times 0.25 = -1/192$$

$$\frac{5 \times 1 \times -1}{10 \times 6 \times 4} \times 0.2 = -1/240$$

$$\frac{5 \times +5 \times +1}{4 \times +6 \times +2} \times 0.15 = 5/64$$

$$\frac{5 \times +5 \times -1}{6 \times +4 \times 2} \times 0.1 = -1/96$$

$$\therefore f(15) = 0.0583$$

Homework 2 - Regula Falsi Method

Q1]

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

5

x	y
0.5	-0.375
0.6	-0.184
0.7	0.043

10

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

$$= 0.681057$$

$$y_1 = -0.0030418$$

15

∴ New table

0.681057	-0.0030418
0.7	0.043

20

$$x_2 = \frac{(0.681057 \times 0.043) - (0.7 \times (-0.0030418))}{0.043 - (-0.0030418)}$$

$$[= 0.682308]$$

$$y_2 = -0.00004629$$

25

Q2]

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

30

x	y
0	0.5
1	-0.5
0.5	-0.375
0	0.5

$$x_1 = \frac{(0.5 \times 0.5) - (0 \times (-0.375))}{0.5 - (-0.375)}$$

$$= \frac{0.25}{0.875}$$

$$= 2/7 = 0.285714$$

$$y_1 = -0.048105$$

New table

0	0.285714	- 0.048105
	0	0.5

$$x_2 = \frac{(0.285714 \times 0.5) - 0}{0.5 + 0.048105}$$

$$= 0.260638$$

$$y_2 = -0.0035703$$

∴	0.260638	- 0.0035703
∴	0	0.5

$$\therefore x_3 = \frac{(0.260638 \times 0.5) - 0}{(0.5 + 0.0035703)}$$

$$[= 0.25879]$$

$$y_3 = 0.000248398$$

Q3) $x^3 + 2x - 20$

x	y
-----	-----

2	-8
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2.1	-6.539
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2.4	-1.376
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2.5	0.625
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$$x_1 = \frac{(2.4 \times 0.625) - (2.5 \times (-1.376))}{0.625 - (-1.376)}$$

$$= 2.468766$$

$$y_1 = -0.015827$$

$\therefore$	2.468766	-0.015827
	2.5	0.625

$$[x_2 = 2.46954]$$

$$y_2 = -0.0000959747$$

Q4) $3x - \cos x - 120$

x	y
-----	-----

0	-2
---	----

0.5	-0.499962
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1	1.00015
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$$\therefore x_1 = \frac{(1.0001523 \times 0.5) + (0.499962)}{1.00015 + 0.499962}$$

$$[= 0.666642]$$

$$y_1 = -0.0000053408$$

$$x^3 - 3x - 5$$

057

x

y

2

-3

2.4

1.624

2.2

-0.952

2.3

0.267

2.2

-0.952

$$x_1 = \frac{(0.267 \times 2.2) - (2.3 \times (-0.952))}{0.267 + 0.952}$$

$$= 2.278096$$

$$y_1 = -0.0115944$$

$$2.278096$$

$$-0.0115944$$

$$2.3$$

$$0.267$$

$$[x_2 = 2.279008]$$

$$y_2 = -0.0001408$$

06] $x \cdot \log_{10} x - 1.2 = 0$

x

y

2

-0.59794

2.5

-0.2051499

2.6

-0.12106929

2.8

0.05204248

$$x_1 = \frac{(2.6 \times 0.05204248) - (-0.12106929 \times 2.8)}{0.05204248 - (-0.12106929)}$$

$$[= 2.739874]$$

$$y_1 = -0.006673222$$

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

$x \quad y$

$0 \quad 1$

$1 \quad -4$

$0.5 \quad -0.875$

$0.4 \quad -0.536$

$0.2 \quad 0.208$

$x_1 = \frac{(0.2 \times 0.208) - (-0.536 \times 0.2)}{0.208 - (-0.536)}$

$= 0.255914$

$y_1 = -0.0068956$

0.255914

-0.0068956

0.2

0.208

$x_2 = \frac{(0.208 \times 0.255914) - (-0.0068956 \times 0.2)}{0.208 - (-0.0068956)}$

$[= 0.254119]$

$y_2 = -0.000069028$

Q8] $x^3 + 2x^2 - 8$

$x \quad y$

$0 \quad -8$

$1 \quad -5$

$2 \quad 8$

$x_1 = \frac{(1 \times 8) - (2 \times -5)}{8 - (-5)}$

$= 1.384615$

$y_1 = -1.511515$

$$1.384615$$

$$-1.5111515$$

$$1.5$$

$$-0.125$$

$$1.6$$

$$1.216$$

$$x_1 = \frac{(1.5 \times 1.216) - (1.6 \times -0.125)}{(1.216) - (-0.125)}$$

$$= 1.5093214$$

$$y_1 = -0.00558654$$

$$1.5093214$$

$$-0.00558654$$

$$1.6$$

$$1.216$$

$$[x_2 = 1.509736]$$

$$y_2 = -0.000247786$$

$$q9] x^3 - 9x + 1$$

x	y
0	-1
1	-7
0.5	-3.375
0.6	-4.124
0.4	-2.536
0.3	-1.673
0.2	0.648
0.3	0.217
0.4	

$$x$$

$$y$$

$$0$$

$$1$$

$$1$$

$$-7$$

$$0.5$$

$$-3.375$$

$$0.2$$

$$-0.792$$

$$0.1$$

$$0.101$$

$$x_1 = (0.2 \times 0.101) -$$

$$(0.1 \times -0.792)$$

$$0.101 - (-0.792)$$

$$[-0.1113]$$

$$y_1 = -0.0004125$$

Q10]

$$x^3 - x - 4$$

div 24

$$8 - 2 - 4$$

$$2x$$

$$y$$

$$0$$

$$-4$$

$$1$$

$$-4$$

$$2$$

$$2$$

$$1.5$$

$$-2.125$$

$$1.6$$

$$-1.504$$

$$1.7$$

$$-0.787$$

$$1.8$$

$$0.032$$

$$\therefore x_1 = \frac{(1.7 \times 0.032) + (0.787 \times 1.8)}{0.032 - (-0.787)}$$

$$= 1.7960927$$

$$y_1 = -0.0019884$$

$$1.7960927$$

$$-0.0019884$$

$$1.8$$

$$0.032$$

$$[x_1 = 1.7963212]$$

$$y_1 = -0.000008535$$