

# FIRST FOLLOWAGE

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**Subject:** Numerical Analysis  
**Professor in charge:** Edwar Samir Posada Murillo  
**Semester:** 6th  
**System name (project):** SADA ANALYTICS  
**repository from where we will work:**  
[https://github.com/jsperezsalar2001/SADA\\_ANALYTICS](https://github.com/jsperezsalar2001/SADA_ANALYTICS)

## 1 Methods test

- Fixed Point Method

1. *Function* :  $\ln(\sin(x)^2 + 1) - (1/2) - x$
2. *Function* :  $\ln(\sin(x)^2 + 1) - (1/2)$
3.  $X_0$  :  $-0,5$
4. *Tolerance* :  $0,0000001$
5. *Iterations* : 100

Iteration	xi	g(xi)	f(xi)	Error
0	-0.5	-0.293108727	0.206891273	N/A
1	-0.293108727	-0.419821544	-0.126712817	0.206891273
2	-0.419821544	-0.346304519	0.073517024	0.126712817
3	-0.346304519	-0.390958457	-0.044653937	0.073517024
4	-0.390958457	-0.364405035	0.026553422	0.044653937
5	-0.364405035	-0.380426303	-0.016021268	0.026553422
6	-0.380426303	-0.370836795	0.009589508	0.016021268
7	-0.370836795	-0.376605645	-0.00576885	0.009589508
8	-0.376605645	-0.373145418	0.003460228	0.00576885
9	-0.373145418	-0.375224641	-0.002079224	0.003460228

10	-0.375224641	-0.373976586	0.001248055	0.002079224
11	-0.373976586	-0.374726216	-0.00074963	0.001248055
12	-0.374726216	-0.374276133	0.000450082	0.00074963
13	-0.374276133	-0.374546428	-0.000270295	0.000450082
14	-0.374546428	-0.374384126	0.000162302	0.000270295
15	-0.374384126	-0.374481591	-9.75E-05	0.000162302
16	-0.374481591	-0.374423065	5.85E-05	9.75E-05
17	-0.374423065	-0.37445821	-3.51E-05	5.85E-05
18	-0.37445821	-0.374437106	2.11E-05	3.51E-05
19	-0.374437106	-0.374449779	-1.27E-05	2.11E-05
20	-0.374449779	-0.374442169	7.61E-06	1.27E-05
21	-0.374442169	-0.374446739	-4.57E-06	7.61E-06
22	-0.374446739	-0.374443994	2.74E-06	4.57E-06
23	-0.374443994	-0.374445642	-1.65E-06	2.74E-06
24	-0.374445642	-0.374444653	9.90E-07	1.65E-06
25	-0.374444653	-0.374445247	-5.94E-07	9.90E-07
26	-0.374445247	-0.37444489	3.57E-07	5.94E-07
27	-0.37444489	-0.374445104	-2.14E-07	3.57E-07
28	-0.374445104	-0.374444976	1.29E-07	2.14E-07
29	-0.374444976	-0.374445053	-7.73E-08	1.29E-07
30	-0.374445053	-0.374445007	4.64E-08	7.73E-08

• Aitken Method

1. *Function* :  $(x^2) - x + 1.25 - (e^x)$
2.  $x_0$  : 0
3.  $x_1$  : 1
4. *Tolerance* : 0,0000001
5. *Iterations* : 100

Iteration	xi	f(xi)	Error
1	0	0.25	0
2	0.166666666666667	-0.070249301754535	0.166666666666667
3	0.166666666666667	-0.070249301754535	0
4	0.125	0.0074765469331737	0.041666666666667
5	0.125	0.0074765469331737	0
6	0.125	0.0074765469331737	0
7	0.130208333333333	-0.0023197872175773	0.0052083333333333
8	0.130208333333333	-0.0023197872175773	0

9	0.12890625	0.00012710057301279	0.0013020833333333
10	0.12890625	0.00012710057301279	0
11	0.12890625	0.00012710057301279	0
12	0.12890625	0.00012710057301279 0	
13	0.12898763020833	-2.59E+08	8.14E+08
14	0.12898763020833	-2.59E+08	0
15	0.12896728515625	1.24E+08	2.03E+08
16	0.12896728515625	1.24E+08	0
17	0.12897237141927	2.81E+07	5.09E+07
18	0.12897491455078	-1.97E+06	2.54E+07
19	0.12897364298503	4.19E+06	1.27E+07
20	0.12897364298503	4.19E+06	0
21	0.12897396087646	-1.78E+06	3.18E+06
22	0.12897396087646	-1.78E+06	0
23	0.12897388140361	-2.90E+05	7.95E+05

• Incremental Search Method

1. *Function* :  $\ln((\sin(x)^2) + 1) - (1/2)$
2.  $x_0$  : -3
3. *Delta* : 0.5
4. *Iterations* : 100

a	b
-2.5	-2
-1	-0.5
0.5	1
2	2.5
4	4.5
5	5.5
7	7.5
8	8.5
10	10.5
11.5	12
13.5	14
14.5	15
16.5	17
17.5	18
19.5	20
21	21.5
22.5	23

24	24.5
26	26.5
27	27.5
29	29.5
30	30.5
32	32.5
33.5	34
35	35.5
36.5	37
38.5	39
39.5	40
41.5	42
43	43.5
44.5	45
46	46.5

• Muller Method

1. *Function* :  $(\exp(-x)) - x$
2.  $x_0$  : 0
3.  $x_1$  :
4.  $x_0$  : 0.5
5. *Delta* : 0.5
6. *Iterations* : 5
7. *Tolerance* : 0.001

Iteration	Xi	f(xi)	Error
0	0.5743219537827	10653065971263	0.074321953782698
1	0.56728708306567	-0.011235415687905	.0070348707170277
2	0.56714294562848	-0.00022533783294354	0.00014413743718888

• Steffensen Method

1. *Function* :  $x^2 - x + 1.25 - e^x$
2.  $x_0$  : 0.5
3. *Iterations* : 100
4. *Tolerance* : 0.0000001

Iteration	Xi	f(xi)	xi + f(xi)	f(xi + f(xi))	Error
0	0.5	-0.648721271	-0.148721271	0.559029994	N/A
1	0.151551359	-0.042221608	0.109329751	0.037093107	0.348448641
2	0.129075527	-0.000191089	0.128884438	0.000168103	0.022475832
3	0.128973868	-3.92E-09	0.128973864	3.45E-09	0.000101659
4	0.128973866	0	0.128973866	0	2.09E-09

- Bisection Method

1. *Function* :  $\ln((\sin(x)^2) + 1) - (1/2)$
2. *a* : 0
3. *b* : 1
4. *Iterations* : 100
5. *Tolerance* : 0.0000001

Iteration	a	Xm	b	f(Xm)	Error
1	0	0.5	1	-0.29310872673138	N/A
2	0.5	0.75	1	-0.11839639385348	0.25
3	0.75	0.875	1	-0.03681769075738	0.125
4	0.875	0.9375	1	0.00063391615923869	0.0625
5	0.875	0.90625	0.9375	-0.017772289226861	0.03125
6	0.90625	0.921875	0.9375	-0.008486582211768	0.015625
7	0.921875	0.9296875	0.9375	-0.0039053586270641	0.0078125
8	0.9296875	0.93359375	0.9375	-0.0016304381170097	0.00390625
9	0.93359375	0.935546875	0.9375	-0.00049693531531952	0.001953125
10	0.935546875	0.9365234375	0.9375	6.88E+08	0.0009765625
11	0.935546875	0.93603515625	0.9365234375	-0.00021397350516406	0.00048828125
12	0.93603515625	0.936279296875	0.9365234375	-7.26E+08	0.000244140625
13	0.936279296875	0.9364013671875	0.9365234375	-1.86E+07	0.0001220703125
14	0.9364013671875	0.93646240234375	0.9365234375	3.35E+07	6.10E+04
15	0.9364013671875	0.93643188476562	0.93646240234375	1.58E+08	3.05E+05
16	0.9364013671875	0.93641662597656	0.93643188476562	6.98E+07	1.53E+06
17	0.9364013671875	0.93640899658203	0.93641662597656	2.56E+07	7.63E+05
18	0.9364013671875	0.93640518188477	0.93640899658203	3.48E+06	3.81E+06
19	0.9364013671875	0.93640327453613	0.93640518188477	-7.56E+06	1.91E+07
20	0.93640327453613	0.93640422821045	0.93640518188477	-2.04E+06	9.54E+06
21	0.93640422821045	0.93640470504761	0.93640518188477	7.19E+05	4.77E+06
22	0.93640422821045	0.93640446662903	0.93640470504761	-6.62E+05	2.38E+06
23	0.93640446662903	0.93640458583832	0.93640470504761	2.87E+04	1.19E+06
24	0.93640446662903	0.93640452623367	0.93640458583832	-3.16E+05	5.96E+05

- Secant Method

1. *Function* :  $\ln(\sin(x)^2 + 1) - (1/2)$
2.  $x_0$  : 0.5
3. *Iterations* : 100
4. *Tolerance* : 0.0000001

Iteration	xi	f(xi)	Error
0	0.5	-0.293108727	N/A
1	1	0.035366079	N/A
2	0.946166222	0.005619393	0.053833778
3	0.935996581	-0.000236322	0.010169642
4	0.936407002	1.40E-06	0.000410422
5	0.936404581	3.44E-10	2.42E-06
6	0.936404581	-5.00E-16	5.94E-10

- False Position

1. *Function* :  $\ln((\sin(x)^2) + 1) - (1/2)$
2. *a* : 0
3. *b* : 1
4. *Iterations* : 100
5. *Tolerance* : 0.0000001

Iteration	a	xm	b	f(xm)	Error
1	0	0.93394038071822	1	-0.0014290767036855	N/A
2	0.93394038071822	0.93650605166563	1	5.88E+08	0.0025656709474096
3	0.93394038071822	0.93640473074264	0.93650605166563	8.68E+05	0.0001013209229842
4	0.93394038071822	0.93640458110087	0.93640473074264	1.28E+02	1.50E+06
5	0.93394038071822	0.93640458087989	0.93640458110087	1.89E+00	2.21E+03

- Newton Method

1. *Function* :  $\ln((\sin(x)^2) + 1) - (1/2)$
2.  $d'(f) : 2 * ((\sin(x)^2) + 1)^{\wedge} - 1 * \sin(x) * \cos(x)$
3.  $x_0$  : 0.5
4. *Iterations* : 100
5. *Tolerance* : 0.0000001

Iteration	xi	f(xi)	Error
0	0.5	-0.29310872673138	N/A
1	0.92839198991257	-0.0046621570973721	0.42839198991257
2	0.93636674126733	-2.19E+08	0.0079747513547594
3	0.93640458001899	-4.98E+02	3.78E+08
4	0.93640458087956	-1.11E-03	8.61E+02

- Multiple Root Method

1. *Function* :  $e^x - x - 1$
2.  $d'(f) : e^x - 1$
3.  $d''(f) : e^x$
4.  $x_0 : 1$
5. *Iterations* : 100
6. *Tolerance* : 0.0000001

Iteration	xi	f(xi)	Error
0	1	0.71828182845905	N/A
1	-0.23421061355351	0.025405775475346	1.23421E+13
2	-0.0084582799107629	3.57E+08	0.22575233364275
3	-1.19E+08	7.07E+02	0.0084463897269468
4	-4.22E+02	0	1.19E+08
5	-4.22E+02	0	0

• Simple Gaussian Method

1. Step 0

2.0000000	-1.0000000	0.0000000	3.0000000	1.0000000
1.0000000	0.5000000	3.0000000	8.0000000	1.0000000
0.0000000	13.0000000	-2.0000000	11.0000000	1.0000000
14.0000000	5.0000000	-2.0000000	3.0000000	1.0000000

2. Step 1

2.0000000	-1.0000000	0.0000000	3.0000000	1.0000000
0.0000000	1.0000000	3.0000000	6.5000000	0.5000000
0.0000000	13.0000000	-2.0000000	11.0000000	1.0000000
0.0000000	12.0000000	-2.0000000	-18.0000000	-6.0000000

3. Step 2

2.0000000	-1.0000000	0.0000000	3.0000000	1.0000000
0.0000000	1.0000000	3.0000000	6.5000000	0.5000000
0.0000000	0.0000000	-41.0000000	-73.5000000	-5.5000000
0.0000000	0.0000000	-38.0000000	-96.0000000	-12.0000000

4. Step 3

2.0000000	-1.0000000	0.0000000	3.0000000	1.0000000
0.0000000	1.0000000	3.0000000	6.5000000	0.5000000
0.0000000	0.0000000	-41.0000000	-73.5000000	-5.5000000
0.0000000	0.0000000	0.0000000	-27.8780488	-6.9024390

5. X Solution

0.0384952	-0.1802275	-0.3097113	0.2475941
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• Partial Gaussian Method

1. Step 0

2.0000000	-1.0000000	0.0000000	3.0000000	1.0000000
1.0000000	0.5000000	3.0000000	8.0000000	1.0000000
0.0000000	13.0000000	-2.0000000	11.0000000	1.0000000
14.0000000	5.0000000	-2.0000000	3.0000000	1.0000000

2. Step 1

14.0000000	5.0000000	-2.0000000	3.0000000	1.0000000
0.0000000	0.1428571	3.1428571	7.7857143	0.9285714
0.0000000	13.0000000	-2.0000000	11.0000000	1.0000000
0.0000000	-1.7142857	0.2857143	2.5714286	0.8571429

3. Step 2

14.0000000	5.0000000	-2.0000000	3.0000000	1.0000000
0.0000000	13.0000000	-2.0000000	11.0000000	1.0000000
0.0000000	0.0000000	3.1648352	7.6648352	0.9175824
0.0000000	0.0000000	0.0219780	4.0219780	0.9890110

4. Step 3

14.0000000	5.0000000	-2.0000000	3.0000000	1.0000000
0.0000000	13.0000000	-2.0000000	11.0000000	1.0000000
0.0000000	0.0000000	3.1648352	7.6648352	0.9175824
0.0000000	0.0000000	0.0000000	3.9687500	0.9826389

5. X Solution

0.0384952	-0.1802275	-0.3097113	0.2475941
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• Total Gaussian Method

1. Step 0

2.0000000	-1.0000000	0.0000000	3.0000000	1.0000000
1.0000000	0.5000000	3.0000000	8.0000000	1.0000000
0.0000000	13.0000000	-2.0000000	11.0000000	1.0000000
14.0000000	5.0000000	-2.0000000	3.0000000	1.0000000

2. Step 1

14.0000000	5.0000000	-2.0000000	3.0000000	1.0000000
0.0000000	0.1428571	3.1428571	7.7857143	0.9285714
0.0000000	13.0000000	-2.0000000	11.0000000	1.0000000
0.0000000	-1.7142857	0.2857143	2.5714286	0.8571429

3. Step 2



14.0000000	5.0000000	-2.0000000	3.0000000	1.0000000
0.0000000	13.0000000	-2.0000000	11.0000000	1.0000000
0.0000000	0.0000000	3.1648352	7.6648352	0.9175824
0.0000000	0.0000000	0.0219780	4.0219780	0.9890110

4. Step 3

14.0000000	5.0000000	3.0000000	-2.0000000	1.0000000
0.0000000	13.0000000	11.0000000	-2.0000000	1.0000000
0.0000000	0.0000000	7.6648352	3.1648352	0.9175824
0.0000000	0.0000000	0.0000000	-1.6387097	0.5075269

5. X Solution

0.0384952	-0.1802275	-0.3097113	0.2475941
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## 2 Signatures

- Daniel Felipe Gómez Martínez
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