

## NUMERICAL METHODS RESULTS REPORT

Project: Numerical Analysis Calculator Date: September 24, 2025

James Andrey Valencia Cano, Jose Luis Restrepo, Samuel Sanchez Gutierrez, samuel cadavid

1. BISECTION Input Parameters: Function:  $\log(\sin(x))^2 + 1) - 1/2$  a = 0 b = 1 Tolerance = 0.0000001

Nmax = 100

Numerical Calculator — Web Interface (Python)

Methods for nonlinear equations and linear systems. Use expressions like  $x^{**3} - x - 2$  or mathematical functions supported by SymPy.  
Available functions:  $\sin(x)$ ,  $\cos(x)$ ,  $\tan(x)$ ,  $\log(x)$  or  $\ln(x)$  (natural log),  $\log10$  (log base 10),  $\exp(x)$ ,  $\arcsin(x)$ ,  $\arccos(x)$ ,  $\arctan(x)$ ,  $\sinh(x)$ ,  $\cosh(x)$ ,  $\tanh(x)$ ,  $x^{**n}$ , and  $abs(x)$ .

Function f(x) (for roots) — use x as variable

Choose method

☒ Bisection

☐ False Position

☐ Incremental Search

☐ Fixed Point (g(x))

☐ Newton-Raphson

☐ Secant

☐ Newton (Multiple Roots)

☐ Gaussian Elimination

☐ Partial Pivoting

☐ Total Pivoting

a

0

b

1

tolerance

0.0000001

Nmax

100

Execute

Clear

Output

Raiz aproximada: 0.9364847858476074

i	a	c	b	f(c)	Error
0	0	0.5	1	-0.29118873	0.5
1	0.5	0.75	1	-0.11839639	0.25
2	0.75	0.875	1	-0.038817681	0.125
3	0.875	0.9375	1	0.00063391616	0.0625
4	0.875	0.90625	0.9375	-0.017772289	0.03125
5	0.90625	0.921875	0.9375	-0.0084865822	0.015625
6	0.921875	0.9296875	0.9375	-0.0039053986	0.0078125
7	0.9296875	0.9339375	0.9375	-0.0016184181	0.00390625
8	0.9339375	0.9354688	0.9375	-0.00049693512	0.001953125
9	0.9354688	0.93652344	0.9375	6.8822445e-05	0.0009765625
10	0.9354688	0.9368516	0.93652344	-0.0002197351	0.00048828125
11	0.9368516	0.9362793	0.93652344	-7.2554788e-05	0.00024414062
12	0.9362793	0.93640137	0.93652344	-1.8609849e-06	0.00012207031
13	0.93640137	0.9364024	0.93652344	-1.3482027e-05	6.305156e-05
14	0.93640137	0.93641188	0.9364024	1.5838845e-05	3.0137578e-05
15	0.93640137	0.93641663	0.93641188	6.9758112e-06	1.528789e-05
16	0.93640137	0.936489	0.93641663	2.557034e-06	7.629394e-06
17	0.93640137	0.93640518	0.936489	-3.4802931e-07	3.8346973e-06
18	0.93640137	0.93648127	0.93640518	-7.5647653e-07	1.9873486e-06
19	0.93648127	0.93648423	0.93640518	-2.0422329e-07	9.5367432e-07
20	0.93648423	0.93648471	0.93640518	7.1903091e-08	4.7683731e-07

2. FALSE POSITION Input Parameters: Function:  $\log(\sin(x))^2 + 1) - 1/2$  a = 0 b = 1 Tolerance =

0.0000001 Nmax = 100

Function f(x) (for roots) — use x as variable

Choose method

☐ Bisection

☒ False Position

☐ Incremental Search

☐ Fixed Point (g(x))

☐ Newton-Raphson

☐ Secant

☐ Newton (Multiple Roots)

☐ Gaussian Elimination

Linear systems: Enter A by rows (spaces) and b in a separate line. For example, for  $2x+3y=5$  and  $x-y=1$  write in A:  
2 3 and 1 -1 and in b: 5 1

Function examples:

- $\sin(x) - x/3$  (trigonometric)
- $\log(x) - 2$  or  $\ln(x) - 2$  (natural logarithm)
- $\ln(\sin(x)**2+1)-(1/2)$  (your example!)
- $\exp(x) - 5$  (exponential)
- $\sqrt{x} - 3$  (square root)
- $x**2 * \cos(x) - 1$  (combined functions)

Output

Raiz aproximada: 0.9364847387426411

i	a	c	b	f(c)	Error
0	0	0.93394838	1	-0.0014290767	0.93394838
1	0.93394838	0.93658685	1	5.8756888e-05	0.0025656789
2	0.93394838	0.93648473	0.93658685	8.6782541e-08	0.00010132092

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3. INCREMENTAL SEARCH Input Parameters: Function:  $\log(\sin(x)**2 + 1) - 1/2$   $x_0 = -3$  delta = 0.5

Nmax = 100

Function f(x) (for roots) — use x as variable

Choose method

☐ Bisection

☐ False Position

☒ Incremental Search

☐ Fixed Point (g(x))

☐ Newton-Raphson

☐ Secant

☐ Newton (Multiple Roots)

☐ Gaussian Elimination

☐ Partial Pivoting

☐ Total Pivoting

x0

delta

Nmax

Output

Se encontraron 32 intervalos con cambio de signo:

Hay una raíz de f en [-2.5000000000,-2.0000000000]

Hay una raíz de f en [-1.0000000000,-0.5000000000]

Hay una raíz de f en [0.5000000000,1.0000000000]

Hay una raíz de f en [2.0000000000,2.5000000000]

Hay una raíz de f en [4.0000000000,4.5000000000]

Hay una raíz de f en [5.0000000000,5.5000000000]

Hay una raíz de f en [7.0000000000,7.5000000000]

Hay una raíz de f en [8.0000000000,8.5000000000]

Hay una raíz de f en [10.0000000000,10.5000000000]

Hay una raíz de f en [11.5000000000,12.0000000000]

Hay una raíz de f en [13.5000000000,14.0000000000]

Hay una raíz de f en [14.5000000000,15.0000000000]

Hay una raíz de f en [16.5000000000,17.0000000000]

Hay una raíz de f en [17.5000000000,18.0000000000]

Hay una raíz de f en [19.5000000000,20.0000000000]

Hay una raíz de f en [21.0000000000,21.5000000000]

Hay una raíz de f en [22.5000000000,23.0000000000]

Hay una raíz de f en [24.0000000000,24.5000000000]

Hay una raíz de f en [26.0000000000,26.5000000000]

Hay una raíz de f en [27.0000000000,27.5000000000]

Hay una raíz de f en [29.0000000000,29.5000000000]

Hay una raíz de f en [30.0000000000,30.5000000000]

Hay una raíz de f en [32.0000000000,32.5000000000]

Hay una raíz de f en [33.5000000000,34.0000000000]

Hay una raíz de f en [35.0000000000,35.5000000000]

Hay una raíz de f en [36.5000000000,37.0000000000]

Hay una raíz de f en [38.5000000000,39.0000000000]

Hay una raíz de f en [39.5000000000,40.0000000000]

Hay una raíz de f en [41.5000000000,42.0000000000]

Hay una raíz de f en [43.0000000000,43.5000000000]

Hay una raíz de f en [44.5000000000,45.0000000000]

Hay una raíz de f en [46.0000000000,46.5000000000]

i	x0	f(x0)	x1	f(x1)
0	-3	-0.48028085	-2.5	-0.1938626
1	-2.5	-0.1938626	-2	0.3825774

## 4. NEWTON-RAPHSON

Input Parameters: Function:  $\log(\sin(x)**2 + 1) - 1/2$   $x_0 = 0.5$  Tolerance = 0.0000001

Nmax = 100

Function f(x) (for roots) — use x as variable

Choose method

☐ Bisection

☐ False Position

☐ Incremental Search

☐ Fixed Point (g(x))

☒ Newton-Raphson

☐ Secant

☐ Newton (Multiple Roots)

☐ Gaussian Elimination

☐ Partial Pivoting

☐ Total Pivoting

Output

Raíz aproximada: -0.9364845888795621

i	x	f(x)	f'(x)	x_next	Error
0	-3	-0.48028085	0.27395963	1.2468919	1.7532081
1	1.2468919	0.14117153	-0.31781712	-0.80270881	0.44419189
2	-0.80270881	-0.083068091	-0.65867121	-0.92881546	0.12611405
3	-0.92881546	-0.0044340491	-0.58412428	-0.9363706	0.0075551355
4	-0.9363706	-1.9678027e-05	-0.57918257	-0.93648458	3.398821e-05
5	-0.93648458	-4.0389802e-10	-0.57987891	-0.93648458	6.9401586e-10

Linear systems: Enter A by rows (spaces) and b in a separate line. For example, for  $2x+3y=5$  and  $x-y=1$  write in A:

2 3 and in b: 5 1

Function examples:

- $\sin(x)$  - x/3 (trigonometric)
- $\log(x)$  - 2 or  $\ln(x)$  - 2 (natural logarithm)
- $\ln(\sin(x)**2+1)$  - (1/2) (your example)
- $\exp(x)$  - 5 (exponential)
- $\sqrt{x}$  - 3 (square root)
- $x**2 * \cos(x)$  - 1 (combined functions)

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5. SECANT Input Parameters: Function:  $\log(\sin(x)**2 + 1) - 1/2$   $x_0 = 0.5$   $x_1 = 1$  Tolerance = 0.0000001 Nmax = 100

Function  $f(x)$  (for roots) — use  $x$  as variable

Choose method

☐ Bisection

☐ False Position

☐ Incremental Search

☐ Fixed Point ( $g(x)$ )

☐ Newton-Raphson

☒ Secant

☐ Newton (Multiple Roots)

☐ Gaussian Elimination

☐ Partial Pivoting

☐ Total Pivoting

Output

Raiz aproximada: 0.9364045808795638

i	$x_0$	$x_1$	$f(x_0)$	$f(x_1)$	$x_2$	Error
0	-3	1	-0.48028085	0.035366079	0.72565663	0.27434337
1	1	0.72565663	0.035366079	-0.13507879	0.94307573	0.2174191
2	0.72565663	0.94307573	-0.13507879	0.0038475685	0.93705431	0.0060214267
3	0.94307573	0.93705431	0.0038475685	0.00037609511	0.93640195	0.00065235389
4	0.93705431	0.93640195	0.00037609511	-1.5222702e-06	0.93640458	2.6298017e-06
5	0.93640195	0.93640458	-1.5222702e-06	5.9497518e-10	0.93640458	1.0274493e-09

Linear systems: Enter A by rows (spaces) and b in a separate line. For example, for  $2x+3y=5$  and  $x-y=1$  write in A: 2 3 and 1 -1 and in b: 5 1

Function examples:

- $\sin(x) - x/3$  (trigonometric)
- $\log(x) - 2$  or  $\ln(x) - 2$  (natural logarithm)
- $\ln(\sin(x)**2+1) - (1/2)$  (your example!)
- $\exp(x) - 5$  (exponential)
- $\sqrt{x} - 3$  (square root)
- $x**2 * \cos(x) - 1$  (combined functions)

6. MULTIPLE ROOTS Input Parameters: Function:  $\exp(x) - x - 1$   $x_0 = 1$  Tolerance = 0.0000001 Nmax = 100

Function  $f(x)$  (for roots) — use  $x$  as variable

Choose method

☐ Bisection

☐ False Position

☐ Incremental Search

☐ Fixed Point ( $g(x)$ )

☐ Newton-Raphson

☐ Secant

☒ Newton (Multiple Roots)

Output

Raiz aproximada: 2.2794061621637204e-08

i	x	$f(x)$	$f''$	$f'$	$x_{next}$
0	-3	2.0497871	-0.95021293	0.0497824	-0.56795067
1	-0.56795067	0.13463624	-0.43331442	0.56668448	-0.044559794
2	-0.044559794	0.00097820428	-0.043581589	0.95641717	-0.00032610953
3	-0.00032610953	5.3167934e-08	-0.0003260564	0.99967368	-1.7931202e-08
4	-1.7931202e-08	2.220446e-16	-1.7874591e-08	0.99999786	2.2794062e-08

Linear systems: Enter A by rows (spaces) and b in a separate line. For example, for  $2x+3y=5$  and  $x-y=1$  write in A: 2 3 and 1 -1 and in b: 5 1

Function examples:

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7. GAUSSIAN ELIMINATION Input Parameters: Matrix A: 4x4 (shown above) Vector b: [1, 1, 1, 1]

Size n = 4

Function f(x) (for roots) — use x as variable

e.g:  $\sin(x) - x/2$ ,  $x^{**3} - x - 2$

Choose method

☐ Bisection

☐ False Position

☐ Incremental Search

☐ Fixed Point (g(x))

☐ Newton-Raphson

☐ Secant

☐ Newton (Multiple Roots)

☒ Gaussian Elimination

☐ Partial Pivoting

☐ Total Pivoting

Size n

4

A (each row in a line, separate coefficients with spaces)

2 -1 0 3  
1 0.5 3 8  
0 13 -2 11  
14 5 -2 3

b (values separated by spaces)

1 1 1 1

Output

Solución: 0.038495188, -0.18022747, -0.30971129, 0.24759485

Linear systems: Enter A by rows (spaces) and b in a separate line. For example, for  $2x+3y=5$  and  $x-y=1$  write in A:  
2 3 and 1 -1 and in b: 5 1

Function examples:

- $\sin(x) - x/3$  (trigonometric)
- $\log(x) - 2$  or  $\ln(x) - 2$  (natural logarithm)
- $\ln(\sin(x)**2+1) - (1/2)$  (your example!)
- $\exp(x) - 5$  (exponential)
- $\text{sqrt}(x) - 3$  (square root)
- $x**2 + \cos(x) - 1$  (combined functions)

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8. PARTIAL PIVOTING Input Parameters: Matrix A: 4x4 (same matrix) Vector b: [1, 1, 1, 1] Size n = 4

Function f(x) (for roots) — use x as variable

e.g:  $\sin(x) - x/2$ ,  $x^3 - x - 2$

Choose method

☐ Bisection

☐ False Position

☐ Incremental Search

☐ Fixed Point (g(x))

☐ Newton-Raphson

☐ Secant

☐ Newton (Multiple Roots)

☐ Gaussian Elimination

☒ Partial Pivoting

☐ Total Pivoting

Size n

4

A (each row in a line, separate coefficients with spaces)

2 -1 0 3  
1 0.5 3 8  
0 13 -2 11  
14 5 -2 3

▲  
▼

✎

b (values separated by spaces)

1 1 1 1

Output

Solución: 0.038495188, -0.18822747, -0.30971129, 0.24759405

Linear systems: Enter A by rows (spaces) and b in a separate line. For example, for  $2x+3y=5$  and  $x-y=1$  write in A:  
2 3 and 1 -1 and in b: 5 1

Function examples:

- $\sin(x) - x/3$  (trigonometric)
- $\log(x) - 2$  or  $\ln(x) - 2$  (natural logarithm)
- $\ln(\sin(x)^{2+1}) - (1/2)$  (your example!)
- $\exp(x) - 5$  (exponential)
- $\sqrt{x} - 3$  (square root)
- $x^2 * \cos(x) - 1$  (combined functions)

## NUMERICAL METHODS RESULTS REPORT

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9. TOTAL PIVOTING Input Parameters: Matrix A: 4x4 (same matrix) Vector b: [1, 1, 1, 1] Size n = 4

Function f(x) (for roots) — use x as variable

Choose method

☐ Bisection

☐ False Position

☐ Incremental Search

☐ Fixed Point (g(x))

☐ Newton-Raphson

☐ Secant

☐ Newton (Multiple Roots)

☐ Gaussian Elimination

☐ Partial Pivoting

☒ Total Pivoting

Size n

A (each row in a line, separate coefficients with spaces)

2 -1 0 3

1 0.5 3 8

0 13 -2 11

14 5 -2 3

▲

▼

✎

b (values separated by spaces)

Output

Solución: 0.038495188, -0.18022747, -0.30971129, 0.24759405

Linear systems: Enter A by rows (spaces) and b in a separate line. For example, for  $2x+3y=5$  and  $x-y=1$  write in A:  

2 3

 and 

1 -1

 and in b: 

5 1

Function examples:

- $\sin(x) - x/3$  (trigonometric)
- $\log(x) - 2$  or  $\ln(x) - 2$  (natural logarithm)
- $\ln(\sin(x)**2+1) - (1/2)$  (your example!)
- $\exp(x) - 5$  (exponential)
- $\text{sqrt}(x) - 3$  (square root)
- $x**2 + \cos(x) - 1$  (combined functions)