


DESAFIO - RAICES		
Materia:	INF 373 – Métodos Numéricos I	
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Estudiante:	Mamani Mamani Abigail Blanca	
	CI: 10062562	

## CORRIDAS DE LOS PROGRAMAS Y COMPARACIONES

### EJERCICIO 1:

1. Determine the two solutions of the equation  $x^3 - e^{0.8x} = 20$

CORRIDAS DEL PROGRAMA:

```

Run EJERCICIO_1 x
=====
EJERCICIO 1 - ABIGAIL MAMANI
=====
Función: f(x) = x³ - e^(0.8x) - 20

BUSCANDO INTERVALO CON CAMBIO DE SIGNO
-----
Intervalo [ 2, 2.5]: f( 2) = -16.953, f(2.5) = -11.764 × mismo signo
Intervalo [2.5, 3]: f(2.5) = -11.764, f( 3) = -4.023 × mismo signo
Intervalo [ 3, 3.5]: f( 3) = -4.023, f(3.5) = 6.430 ✓ CAMBIO DE SIGNO

Usando intervalo: [3, 3.5]
MÉTODO DE LA BISECCIÓN
=====
Función: f(x) = x³ - e^(0.8x) - 20
Intervalo inicial: [3, 3.5]
Tolerancia: 1e-06

```



Iter	a	b	m	f(a)	f(b)	f(m)	Error
0	3.000000	3.500000	3.250000	-4.023176	6.430353	0.864387	0.250000
1	3.000000	3.250000	3.125000	-4.023176	0.864387	-1.664916	0.125000
2	3.125000	3.250000	3.187500	-1.664916	0.864387	-0.421606	0.062500
3	3.187500	3.250000	3.218750	-0.421606	0.864387	0.216064	0.031250
4	3.187500	3.218750	3.203125	-0.421606	0.216064	-0.104104	0.015625
5	3.203125	3.218750	3.210938	-0.104104	0.216064	0.055647	0.007812
6	3.203125	3.210938	3.207031	-0.104104	0.055647	-0.024311	0.003906
7	3.207031	3.210938	3.208984	-0.024311	0.055647	0.015647	0.001953
8	3.207031	3.208984	3.208008	-0.024311	0.015647	-0.004337	0.000977
9	3.208008	3.208984	3.208496	-0.004337	0.015647	0.005654	0.000488
10	3.208008	3.208496	3.208252	-0.004337	0.005654	0.000658	0.000244
11	3.208008	3.208252	3.208130	-0.004337	0.000658	-0.001840	0.000122
12	3.208130	3.208252	3.208191	-0.001840	0.000658	-0.000591	0.000061
13	3.208191	3.208252	3.208221	-0.000591	0.000658	0.000033	0.000031
14	3.208191	3.208221	3.208206	-0.000591	0.000033	-0.000279	0.000015
15	3.208206	3.208221	3.208214	-0.000279	0.000033	-0.000123	0.000008
16	3.208214	3.208221	3.208218	-0.000123	0.000033	-0.000045	0.000004
17	3.208218	3.208221	3.208220	-0.000045	0.000033	-0.000006	0.000002
18	3.208220	3.208221	3.208220	-0.000006	0.000033	0.000014	0.000001
19	3.208220	3.208220	3.208220	-0.000006	0.000014	0.000004	0.000000
20	3.208220	3.208220	3.208220	-0.000006	0.000004	-0.000001	0.000000

✓ CONVERGENCIA ALCANZADA -  $f(m) \leq TOL$   
Raíz encontrada:  $x \approx 3.20821977$   
 $f(3.20821977) = -0.0000007243$

MÉTODO DE NEWTON-RAPHSON

Función:  $f(x) = x^3 - e^{(0.8x)} - 20$   
Derivada:  $f'(x) = 3x^2 - 0.8e^{(0.8x)}$   
Valor inicial:  $x_0 = 3.0$   
Tolerancia:  $1e-06$

Iter	x	f(x)	f'(x)	Error
0	3.000000	-4.023176	18.181459	0.221279
1	3.221279	0.268138	20.603587	0.013014
2	3.208265	0.000924	20.461587	0.000045
3	3.208220	0.000000	20.461094	0.000000

✓ CONVERGENCIA ALCANZADA -  $|f(x)| \leq TOL$   
Raíz encontrada:  $x \approx 3.20821980$   
 $f(3.20821980) = 0.0000000111$

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MÉTODO DE LA SECANTE

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Función:  $f(x) = x^3 - e^{(0.8x)} - 20$

Valores iniciales:  $x_0 = 3.0$ ,  $x_1 = 3.5$

Tolerancia:  $1e-06$

Iter	x	f(x)	Error
0	3.500000	6.430353	6.430353
1	3.192431	-0.321685	0.321685
2	3.207085	-0.023215	0.023215
3	3.208225	0.000098	0.000098
4	3.208220	-0.000000	0.000000

✓ CONVERGENCIA ALCANZADA -  $|f(x)| \leq TOL$

Raíz encontrada:  $x \approx 3.20821980$

$f(3.20821980) = -0.0000000298$

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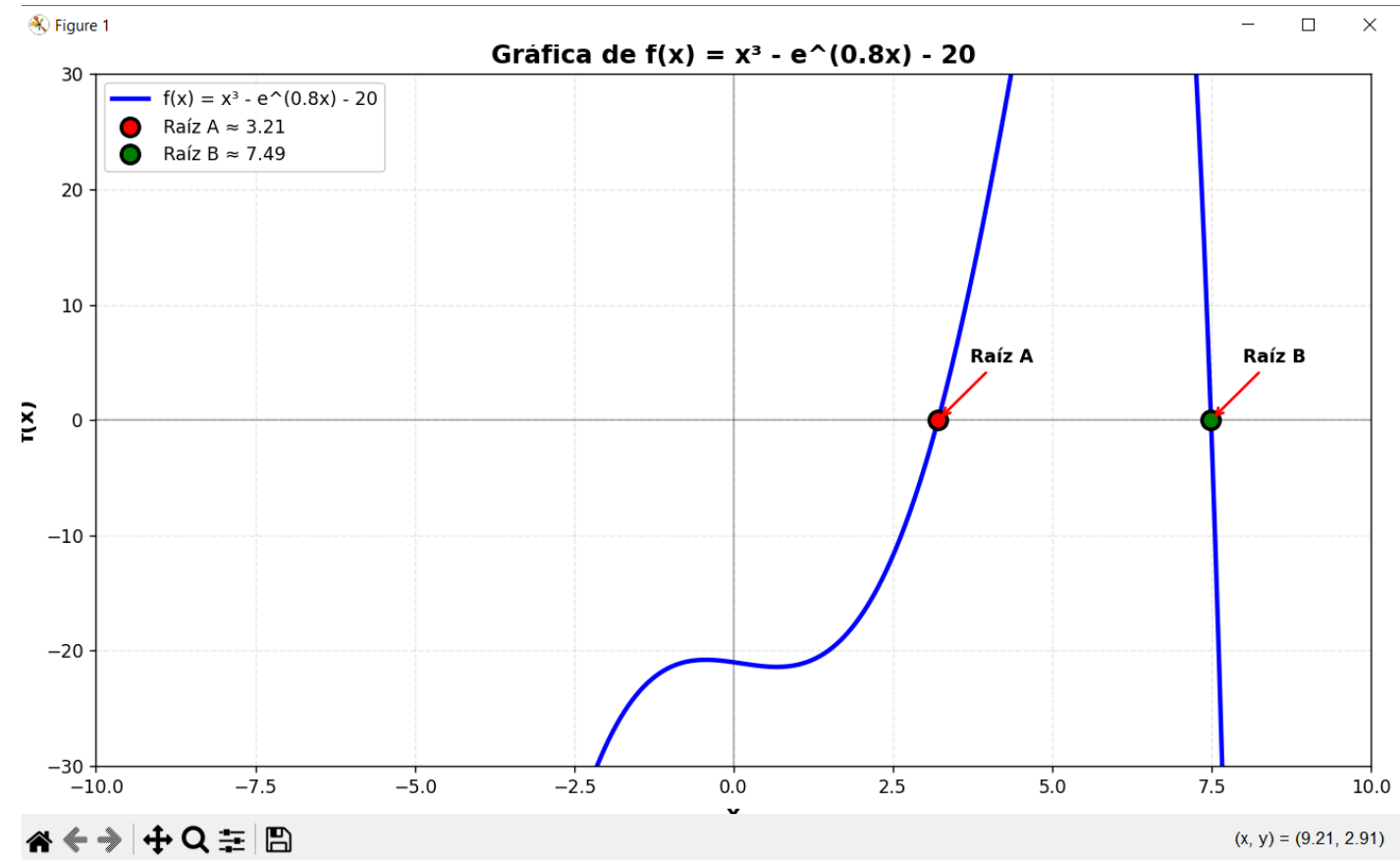
RESULTADOS COMPARATIVOS

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Método	Raíz	Iteraciones	f(raíz)
Bisección	3.20821977	21	-0.0000007243
Newton-Raphson	3.20821980	4	0.0000000111
Secante	3.20821980	5	-0.0000000298

Generando gráfica.... calculando raices

GRAFICA:



## EJERCICIO 2:

### CORRIDAS DEL PROGRAMA:

```
Run EJERCICIO_2 x
"\"C:\\II-2025\\INF-373(METODOS NUMERICOS)\\DEAFIO_RAICES_PROGRAMAS\\.venv\\Scripts\\python.exe\" \"C:\\II-2025\\INF-373(METODOS NUMERICOS)\\DEAFIO_RAICES_PROGRAMAS\\ejercicio_2.py\"
EJERCICIO 2 - ABIGAIL MAMANI
=====
Función: f(x) = 3 sin(0.5x) - 0.5x + 2

BUSCANDO INTERVALO CON CAMBIO DE SIGNO
-----
Intervalo [ 2, 3]: f( 2) = 3.524, f( 3) = 3.492 × mismo signo
Intervalo [ 3, 4]: f( 3) = 3.492, f( 4) = 2.728 × mismo signo
Intervalo [ 4, 5]: f( 4) = 2.728, f( 5) = 1.295 × mismo signo
Intervalo [ 5, 6]: f( 5) = 1.295, f( 6) = -0.577 ✓ CAMBIO DE SIGNO

Usando intervalo: [5, 6]
MÉTODO DE LA BISECCIÓN
=====
Función: f(x) = 3 sin(0.5x) - 0.5x + 2
Intervalo inicial: [5, 6]
Tolerancia: 1e-06

Iter a      b      m      f(a)      f(b)      f(m)      Error
-----
0  5.000000  6.000000  5.500000  1.295416  -0.576640  0.394983  0.500000
1  5.500000  6.000000  5.750000  0.394983  -0.576640  -0.084662  0.250000
2  5.500000  5.750000  5.625000  0.394983  -0.084662  0.157054  0.125000
3  5.625000  5.750000  5.687500  0.157054  -0.084662  0.036626  0.062500
4  5.687500  5.750000  5.718750  0.036626  -0.084662  -0.023916  0.031250
5  5.687500  5.718750  5.703125  0.036626  -0.023916  0.006381  0.015625
6  5.703125  5.718750  5.710938  0.006381  -0.023916  -0.008761  0.007812
7  5.703125  5.710938  5.707031  0.006381  -0.008761  -0.001189  0.003906
8  5.703125  5.707031  5.705078  0.006381  -0.001189  0.002597  0.001953
9  5.705078  5.707031  5.706055  0.002597  -0.001189  0.000704  0.000977
10 5.706055  5.707031  5.706543  0.000704  -0.001189  -0.000242  0.000488
11 5.706055  5.706543  5.706299  0.000704  -0.000242  0.000231  0.000244
12 5.706299  5.706543  5.706421  0.000231  -0.000242  -0.000006  0.000122
13 5.706299  5.706421  5.706360  0.000231  -0.000006  0.000113  0.000061
14 5.706360  5.706421  5.706390  0.000113  -0.000006  0.000054  0.000031
15 5.706390  5.706421  5.706406  0.000054  -0.000006  0.000024  0.000015
16 5.706406  5.706421  5.706413  0.000024  -0.000006  0.000009  0.000008
17 5.706413  5.706421  5.706417  0.000009  -0.000006  0.000002  0.000004
18 5.706417  5.706421  5.706419  0.000002  -0.000006  -0.000002  0.000002
19 5.706417  5.706419  5.706418  0.000002  -0.000002  -0.000000  0.000001

✓ CONVERGENCIA ALCANZADA - f(m) <= TOL
Raíz encontrada: x ≈ 5.70641804
f(5.70641804) = -0.0000000779
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MÉTODO DE NEWTON-RAPHSON

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Función:  $f(x) = 3 \sin(0.5x) - 0.5x + 2$

Derivada:  $f'(x) = 1.5 \cos(0.5x) - 0.5$

Valor inicial:  $x_0 = 2.0$

Tolerancia:  $1e-06$

Iter	x	f(x)	f'(x)	Error
0	2.000000	3.524413	0.310453	11.352468
1	-9.352468	9.674273	-0.554221	17.455635
2	8.103167	-4.420078	-1.420630	3.111351
3	4.991816	1.309329	-1.698032	0.771086
4	5.762902	-0.109798	-1.949530	0.056320
5	5.706581	-0.000317	-1.938092	0.000163
6	5.706418	-0.000000	-1.938057	0.000000

✓ CONVERGENCIA ALCANZADA -  $|f(x)| \leq TOL$

Raíz encontrada:  $x \approx 5.70641800$

$f(5.70641800) = -0.0000000028$

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MÉTODO DE LA SECANTE

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Función:  $f(x) = 3 \sin(0.5x) - 0.5x + 2$

Valores iniciales:  $x_0 = 5.0, x_1 = 6.0$

Tolerancia:  $1e-06$

Iter	x	f(x)	Error
0	6.000000	-0.576640	0.576640
1	5.691975	0.027969	0.027969
2	5.706224	0.000376	0.000376
3	5.706418	-0.000000	0.000000

✓ CONVERGENCIA ALCANZADA -  $|f(x)| \leq TOL$

Raíz encontrada:  $x \approx 5.70641815$

$f(5.70641815) = -0.0000003014$

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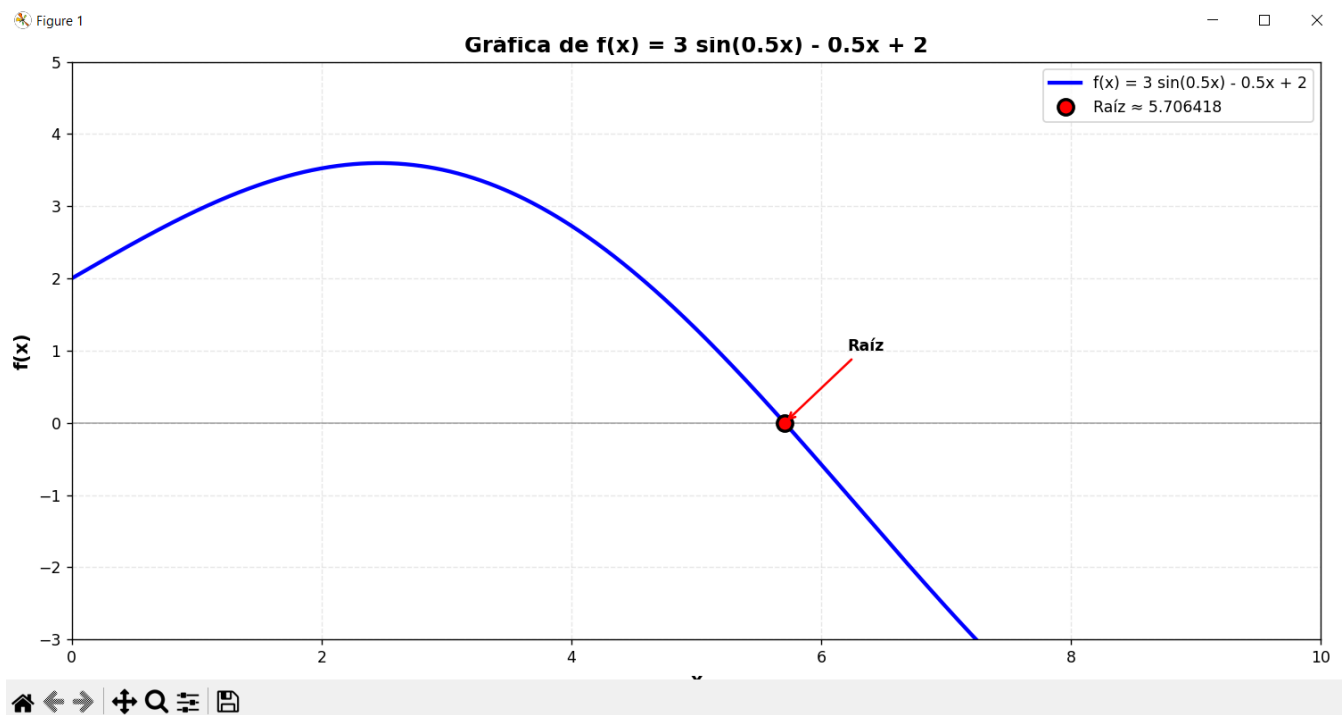
RESULTADOS COMPARATIVOS

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Método	Raíz	Iteraciones	f(raíz)
Bisección	5.70641804	20	-0.0000000779
Newton-Raphson	5.70641800	7	-0.0000000028
Secante	5.70641815	4	-0.0000003014

Generando gráfica....encontrando raices

GRAFICO:



### EJERCICIO 3:

CORRIDAS DEL PROGRAMA:



```
"C:\II-2025\INF-373(METODOS NUMERICOS)\DEAFIO_RAICES_PROGRAMAS\.venv\Scripts\python.exe" "C:\II-2025\INF-373(METODOS NUMERICOS)\DEAFIO_RAICES_PROGRAMAS\ejercicio_3.py"
EJERCICIO 3 - ABIGAIL MAMANI
```

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```
Función:  $f(x) = x^3 - x^2e^{(-0.5x)} - 3x + 1$ 
```

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BUSCANDO INTERVALO CON CAMBIO DE SIGNO
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Intervalo [ 1, 2]: f( 1) = -1.607, f( 2) = 1.528 ✓ CAMBIO DE SIGNO
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```
Usando intervalo: [1, 2]
```

```
MÉTODO DE LA BISECCIÓN
```

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=====
```

```
Función:  $f(x) = x^3 - x^2e^{(-0.5x)} - 3x + 1$ 
```

```
Intervalo inicial: [1, 2]
```

```
Tolerancia: 1e-06
```



Iter	a	b	m	f(a)	f(b)	f(m)	Error
-----							
0	1.000000	2.000000	1.500000	-1.606531	1.528482	-1.187825	0.500000
1	1.500000	2.000000	1.750000	-1.187825	1.528482	-0.167265	0.250000
2	1.750000	2.000000	1.875000	-0.167265	1.528482	0.590058	0.125000
3	1.750000	1.875000	1.812500	-0.167265	0.590058	0.189523	0.062500
4	1.750000	1.812500	1.781250	-0.167265	0.189523	0.005756	0.031250
5	1.750000	1.781250	1.765625	-0.167265	0.005756	-0.082086	0.015625
6	1.765625	1.781250	1.773438	-0.082086	0.005756	-0.038499	0.007812
7	1.773438	1.781250	1.777344	-0.038499	0.005756	-0.016455	0.003906
8	1.777344	1.781250	1.779297	-0.016455	0.005756	-0.005370	0.001953
9	1.779297	1.781250	1.780273	-0.005370	0.005756	0.000188	0.000977
10	1.779297	1.780273	1.779785	-0.005370	0.000188	-0.002593	0.000488
11	1.779785	1.780273	1.780029	-0.002593	0.000188	-0.001203	0.000244
12	1.780029	1.780273	1.780151	-0.001203	0.000188	-0.000508	0.000122
13	1.780151	1.780273	1.780212	-0.000508	0.000188	-0.000160	0.000061
14	1.780212	1.780273	1.780243	-0.000160	0.000188	0.000014	0.000031
15	1.780212	1.780243	1.780228	-0.000160	0.000014	-0.000073	0.000015
16	1.780228	1.780243	1.780235	-0.000073	0.000014	-0.000030	0.000008
17	1.780235	1.780243	1.780239	-0.000030	0.000014	-0.000008	0.000004
18	1.780239	1.780243	1.780241	-0.000008	0.000014	0.000003	0.000002
19	1.780239	1.780241	1.780240	-0.000008	0.000003	-0.000003	0.000001
20	1.780240	1.780241	1.780241	-0.000003	0.000003	0.000000	0.000000

```
✓ CONVERGENCIA ALCANZADA - f(m) <= TOL
```

```
Raíz encontrada:  $x \approx 1.78024054$ 
```

```
 $f(1.78024054) = 0.0000001998$ 
```



```
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MÉTODO DE NEWTON-RAPHSON
=====
Función: f(x) = x³ - x²e^(-0.5x) - 3x + 1
Derivada: f'(x) = 3x² - [(2x - x²)e^(-0.5x)] - 3
Valor inicial: x0 = 2.0
Tolerancia: 1e-06

Iter x          f(x)          f(x)          Error
-----
0    2.000000    1.528482    9.000000    0.169831
1    1.830169    0.298251    6.924074    0.043075
2    1.787094    0.039300    6.425422    0.006116
3    1.780978    0.004203    6.355538    0.000661
4    1.780316    0.000433    6.347996    0.000068
5    1.780248    0.000044    6.347218    0.000007
6    1.780241    0.000005    6.347138    0.000001
7    1.780241    0.000000    6.347130    0.000000

✓ CONVERGENCIA ALCANZADA - |f(x)| <= TOL
Raíz encontrada: x ≈ 1.78024058
f(1.78024058) = 0.0000004666
=====
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=====
MÉTODO DE LA SECANTE
=====
Función: f(x) = x³ - x²e^(-0.5x) - 3x + 1
Valores iniciales: x0 = 1.0, x1 = 2.0
Tolerancia: 1e-06

Iter x          f(x)          Error
-----
0    2.000000    1.528482    1.528482
1    1.512448    -1.151455    1.151455
2    1.721928    -0.313686    0.313686
3    1.800364    0.116868    0.116868
4    1.779074    -0.006639    0.006639
5    1.780218    -0.000127    0.000127
6    1.780241    0.000000    0.000000

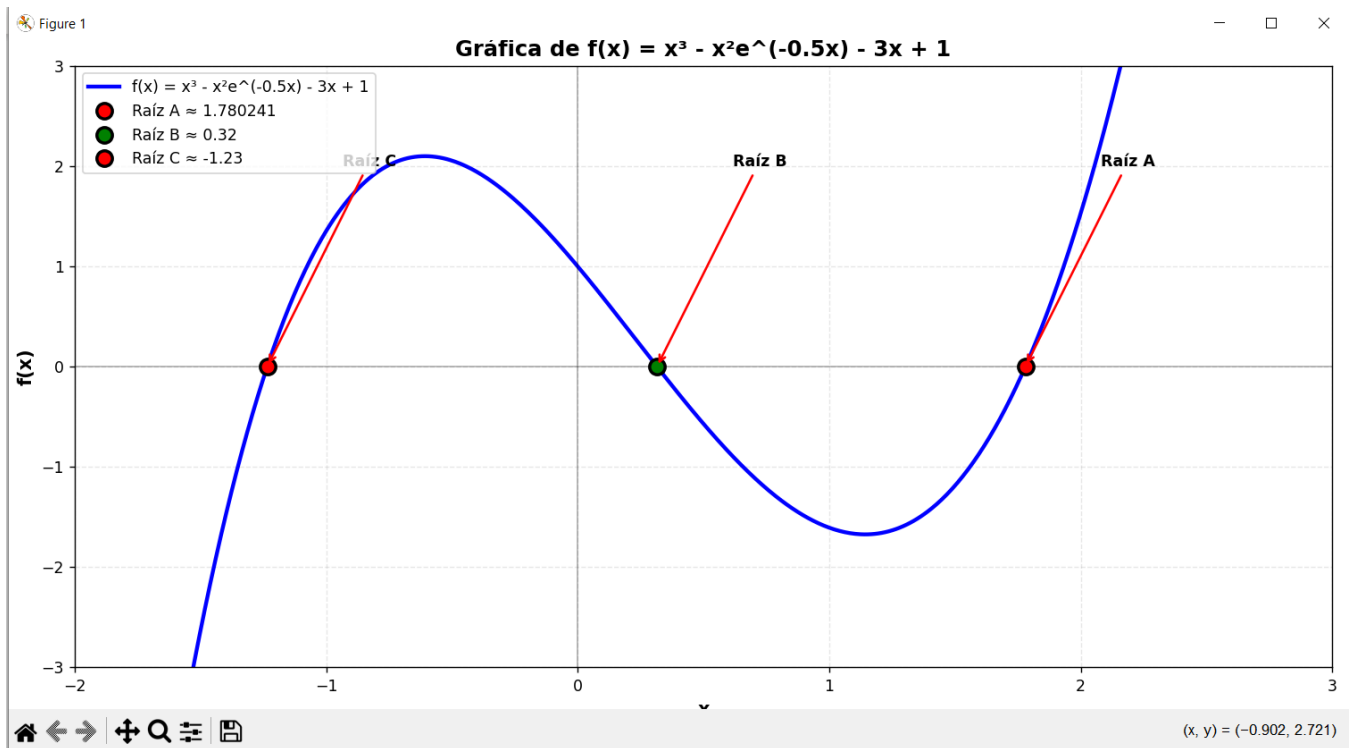
✓ CONVERGENCIA ALCANZADA - |f(x)| <= TOL
Raíz encontrada: x ≈ 1.78024053
f(1.78024053) = 0.0000001434
=====
```

RESULTADOS COMPARATIVOS			
Método	Raíz	Iteraciones	f(raíz)
Bisección	1.78024054	21	0.0000001998
Newton-Raphson	1.78024058	8	0.0000004666
Secante	1.78024053	7	0.0000001434

Generando gráfica...encontrando raices

GRAFICO:





## EJERCICIO 4:

CORRIDAS DEL PROGRAMA:



"C:\II-2025\INF-373(METODOS NUMERICOS)\DEAFIO\_RAICES\_PROGRAMAS\.venv\Scripts\python.exe" "C:\II-2025\INF-373(METODOS NUMERICOS)\DEAFIO\_RAICES\_PROGRAMAS\ejercicio\_4.py"

EJERCICIO 4 - ABIGAIL MAMANI

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Función:  $f(x) = \cos^2(x) - 0.5x e^{(0.3x)} + 5$

BUSCANDO INTERVALO CON CAMBIO DE SIGNO

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Intervalo [ 1, 2]:  $f(1) = 4.617$ ,  $f(2) = 3.351$  × mismo signo

Intervalo [ 2, 3]:  $f(2) = 3.351$ ,  $f(3) = 2.291$  × mismo signo

Intervalo [ 3, 4]:  $f(3) = 2.291$ ,  $f(4) = -1.213$  ✓ CAMBIO DE SIGNO

Usando intervalo: [3, 4]

MÉTODO DE LA BISECCIÓN

=====

Función:  $f(x) = \cos^2(x) - 0.5x e^{(0.3x)} + 5$

Intervalo inicial: [3, 4]

Tolerancia:  $1e-06$

Iter	a	b	m	f(a)	f(b)	f(m)	Error
-----							
0	3.000000	4.000000	3.500000	2.290680	-1.212984	0.876062	0.500000
1	3.500000	4.000000	3.750000	0.876062	-1.212984	-0.102089	0.250000
2	3.500000	3.750000	3.625000	0.876062	-0.102089	0.406551	0.125000
3	3.625000	3.750000	3.687500	0.406551	-0.102089	0.156780	0.062500
4	3.687500	3.750000	3.718750	0.156780	-0.102089	0.028437	0.031250
5	3.718750	3.750000	3.734375	0.028437	-0.102089	-0.036559	0.015625
6	3.718750	3.734375	3.726562	0.028437	-0.036559	-0.003994	0.007812
7	3.718750	3.726562	3.722656	0.028437	-0.003994	0.012239	0.003906
8	3.722656	3.726562	3.724609	0.012239	-0.003994	0.004127	0.001953
9	3.724609	3.726562	3.725586	0.004127	-0.003994	0.000068	0.000977
10	3.725586	3.726562	3.726074	0.000068	-0.003994	-0.001963	0.000488
11	3.725586	3.726074	3.725830	0.000068	-0.001963	-0.000948	0.000244
12	3.725586	3.725830	3.725708	0.000068	-0.000948	-0.000440	0.000122
13	3.725586	3.725708	3.725647	0.000068	-0.000440	-0.000186	0.000061
14	3.725586	3.725647	3.725616	0.000068	-0.000186	-0.000059	0.000031
15	3.725586	3.725616	3.725601	0.000068	-0.000059	0.000004	0.000015
16	3.725601	3.725616	3.725609	0.000004	-0.000059	-0.000028	0.000008
17	3.725601	3.725609	3.725605	0.000004	-0.000028	-0.000012	0.000004
18	3.725601	3.725605	3.725603	0.000004	-0.000012	-0.000004	0.000002
19	3.725601	3.725603	3.725602	0.000004	-0.000004	0.000000	0.000001

✓ CONVERGENCIA ALCANZADA -  $f(m) \leq TOL$

Raíz encontrada:  $x \approx 3.72560215$

$f(3.72560215) = 0.0000001102$



Función:  $f(x) = \cos^2(x) - 0.5x e^{(0.3x)} + 5$   
 Derivada:  $f'(x) = -2\cos(x)\sin(x) - 0.5e^{(0.3x)}(1 + 0.3x)$   
 Valor inicial:  $x_0 = 3.0$   
 Tolerancia:  $1e-06$

Iter	x	f(x)	f'(x)	Error
0	3.000000	2.290680	-2.057207	1.113490
1	4.113490	-1.747337	-4.768330	0.366446
2	3.747044	-0.089651	-4.204399	0.021323
3	3.725721	-0.000493	-4.157912	0.000119
4	3.725602	-0.000000	-4.157649	0.000000

## MÉTODO DE LA SECANTE

Función:  $f(x) = \cos^2(x) - 0.5x e^{(0.3x)} + 5$   
Valores iniciales:  $x_0 = 3.0$ ,  $x_1 = 4.0$   
Tolerancia:  $1e-06$

Iter	x	f(x)	Error
0	4.000000	-1.212984	1.212984
1	3.653796	0.292650	0.292650
2	3.721087	0.018748	0.018748
3	3.725693	-0.000379	0.000379
4	3.725602	0.000000	0.000000

```
✓ CONVERGENCIA ALCANZADA - |f(x)| <= TOL
Raíz encontrada: x ≈ 3.72560207
f(3.72560207) = 0.0000004576
```

## RESULTADOS COMPARATIVOS

Método	Raíz	Iteraciones	f(raíz)
Bisección	3.72560215	20	0.0000001102
Newton-Raphson	3.72560218	5	-0.0000000156
Secante	3.72560207	5	0.0000004576

Generando gráfica... encontrando raíces

**GRAFICO:**

Gráfica de  $f(x) = \cos^2(x) - 0.5x e^{(0.3x)} + 5$ 