CÓDIGO EN OCTAVE (PRECISION)

9.6 PROBLEMS

1. Determine the two solutions of the equation $x^3 - e^{0.8x} = 20$ between $x = 0$ and $x = 8$.

2. Determine the solution of the equation $3\sin(0.5x) - 0.5x + 2 = 0$.

3. Determine the three roots of the equation $x^3 - x^2 e^{-0.5x} - 3x = -1$.

4. Determine the positive roots of the equation $\cos^2 x - 0.5x e^{0.3x} + 5 = 0$.

Ejercicio 1. –

fplot('x^(3)-exp(0.8*x)-20',[0,8])

f=@ (x) x^(3)-exp(0.8*x)-20

x1=fzero(f,0.5)

x1=fzero(f,1)

x1=fzero(f,1.5)

x1=fzero(f,2)

x1=fzero(f,2.5)

x1=fzero(f,3)

x1=fzero(f,3.5)

x1=fzero(f,4)

x1=fzero(f,4.5)

```
>> fplot('x^(3)-exp(0.8*x)-20',[0,8])
>> f=@ (x) x^(3)-exp(0.8*x)-20
f =

@(x) x ^ (3) - exp (0.8 * x) - 20

>> x1=fzero(f,0.5)
x1 = 3.2082
>> x1=fzero(f,1)
x1 = 3.2082
>> x1=fzero(f,1.5)
x1 = 3.2082
>> x1=fzero(f,2)
x1 = 3.2082
>> x1=fzero(f,2.5)
x1 = 3.2082
>> x1=fzero(f,3)
x1 = 3.2082
>> x1=fzero(f,3.5)
x1 = 3.2082
>> x1=fzero(f,4)
x1 = 3.2082
>> x1=fzero(f,4.5)
x1 = 3.2082
>>
```

Ejercicio 2. –

fplot('3*sin(0.5*x)-0.5*x+2',[0,10])

f=@ (x) 3*sin(0.5*x)-0.5*x+2

x1=fzero(f,1)

x1=fzero(f,2)

x1=fzero(f,3)

x1=fzero(f,4)

x1=fzero(f,5)

x1=fzero(f,5.5)

x1=fzero(f,6)

x1=fzero(f,6.5)

x1=fzero(f,6.8)

x1=fzero(f,7)

x1=fzero(f,7.3)

x1=fzero(f,8)

```
>> fplot('3*sin(0.5*x)-0.5*x+2',[0,10])
>> f=@ (x) 3*sin(0.5*x)-0.5*x+2
f =

@(x) 3 * sin (0.5 * x) - 0.5 * x + 2

>> x1=fzero(f,1)
x1 = 5.7064
>> x1=fzero(f,2)
x1 = 5.7064
>> x1=fzero(f,3)
x1 = 5.7064
>> x1=fzero(f,4)
x1 = 5.7064
>> x1=fzero(f,5)
x1 = 5.7064
>> x1=fzero(f,5.5)
x1 = 5.7064
>> x1=fzero(f,6)
x1 = 5.7064
>> x1=fzero(f,6.5)
x1 = 5.7064
>> x1=fzero(f,6.8)
x1 = 5.7064
>> x1=fzero(f,7)
x1 = 5.7064
>> x1=fzero(f,7.3)
x1 = 5.7064
>> x1=fzero(f,8)
x1 = 5.7064
>>
```

Ejercicio 3. –

fplot('x^(3)-x^(2)*exp(-0.5*x)-3*(x)+1',[0,2])

f=@ (x) x^(3)-x^(2)*exp(-0.5*x)-3*(x)+1

x1=fzero(f,1.2)

x1=fzero(f,1.3)

x1=fzero(f,1.4)

x1=fzero(f,1.5)

x1=fzero(f,1.6)

x1=fzero(f,1.7)

x1=fzero(f,1.8)

x1=fzero(f,1.9)

x1=fzero(f,2)

x1=fzero(f,2.1)

x1=fzero(f,2.2)

x1=fzero(f,2.3)

```
>> fplot('x^(3)-x^(2)*exp(-0.5*x)-3*(x)+1',[0,2])
>> f=@ (x) x^(3)-x^(2)*exp(-0.5*x)-3*(x)+1
f =

@(x) x ^ (3) - x ^ (2) * exp (-0.5 * x) - 3 * (x) + 1

>> x1=fzero(f,1.2)
x1 = 1.7802
>> x1=fzero(f,1.3)
x1 = 1.7802
>> x1=fzero(f,1.4)
x1 = 1.7802
>> x1=fzero(f,1.5)
x1 = 1.7802
>> x1=fzero(f,1.6)
x1 = 1.7802
>> x1=fzero(f,1.7)
x1 = 1.7802
>> x1=fzero(f,1.8)
x1 = 1.7802
>> x1=fzero(f,1.9)
x1 = 1.7802
>> x1=fzero(f,2)
x1 = 1.7802
>> x1=fzero(f,2.1)
x1 = 1.7802
>> x1=fzero(f,2.2)
x1 = 1.7802
>> x1=fzero(f,2.3)
x1 = 1.7802
>>
```

Ejercicio 4. –

fplot('cos(x)^(2)-0.5*x*exp(0.3*x)+5',[0,8])

f=@ (x) cos(x)^(2)-0.5*x*exp(0.3*x)+5

x1=fzero(f,0.5)

x1=fzero(f,1)

x1=fzero(f,2)

x1=fzero(f,2.5)

x1=fzero(f,3)

x1=fzero(f,3.2)

x1=fzero(f,3.5)

x1=fzero(f,4)

x1=fzero(f,5)

x1=fzero(f,5.5)

x1=fzero(f,6)

x1=fzero(f,6.2)

```
>> fplot('cos(x)^(2)-0.5*x*exp(0.3*x)+5',[0,8])
>> f=@ (x) cos(x)^(2)-0.5*x*exp(0.3*x)+5
f =

@(x) cos (x) ^ (2) - 0.5 * x * exp (0.3 * x) + 5

>> x1=fzero(f,0.5)
x1 = 3.7256
>> x1=fzero(f,1)
x1 = 3.7256
>> x1=fzero(f,2)
x1 = 3.7256
>> x1=fzero(f,2.5)
x1 = 3.7256
>> x1=fzero(f,3)
x1 = 3.7256
>> x1=fzero(f,3.2)
x1 = 3.7256
>> x1=fzero(f,3.5)
x1 = 3.7256
>> x1=fzero(f,4)
x1 = 3.7256
>> x1=fzero(f,5)
x1 = 3.7256
>> x1=fzero(f,5.5)
x1 = 3.7256
>> x1=fzero(f,6)
x1 = 3.7256
>> x1=fzero(f,6.2)
x1 = 3.7256
>>
```

Comparación de Resultados. -

- Ejercicio 1:

OCTAVE	EXCEL		
3.2082	Método de la Bisección	Método de Newton	Método de la Secante
	3.20822144	**3.2082198**	**3.2082198**

- Ejercicio 2:

OCTAVE	EXCEL		
5.7064	Método de la Bisección	Método de Newton	Método de la Secante
	5.7064209	**5.706418**	**5.706418**

- Ejercicio 3:

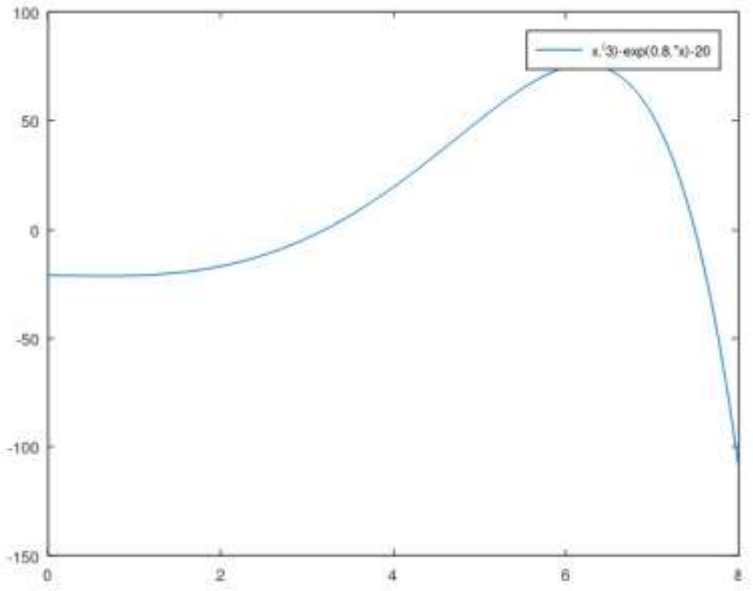
OCTAVE	EXCEL		
1.7802	Método de la Bisección	Método de Newton	Método de la Secante
	1.78024292	**1.7802405**	**1.7802405**

- Ejercicio 4:

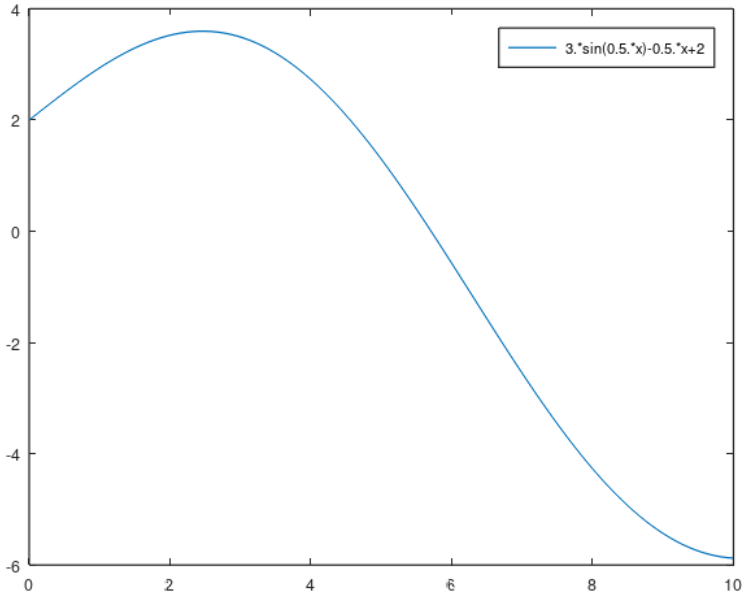
OCTAVE	EXCEL		
3.7256	Método de la Bisección	Método de Newton	Método de la Secante
	3.72558594	**3.72560218**	**3.72560218**

Gráficos. –

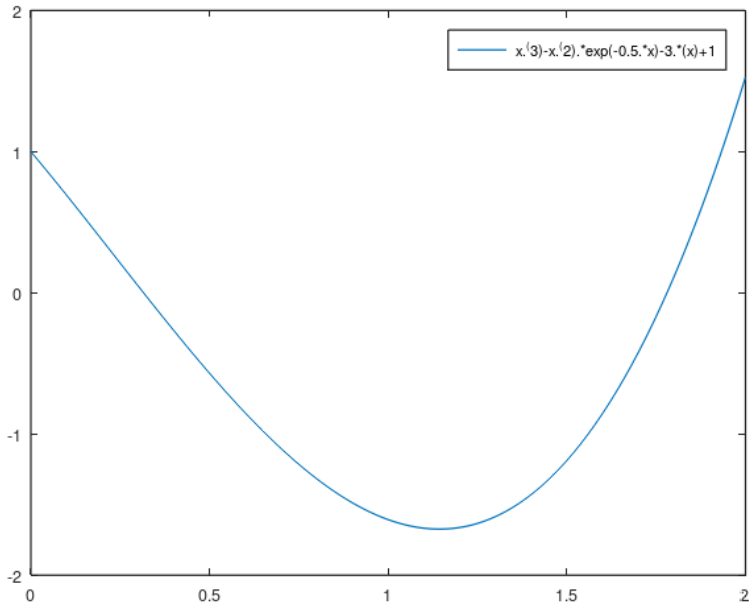
- ✓ Gráfico Ejercicio 1:



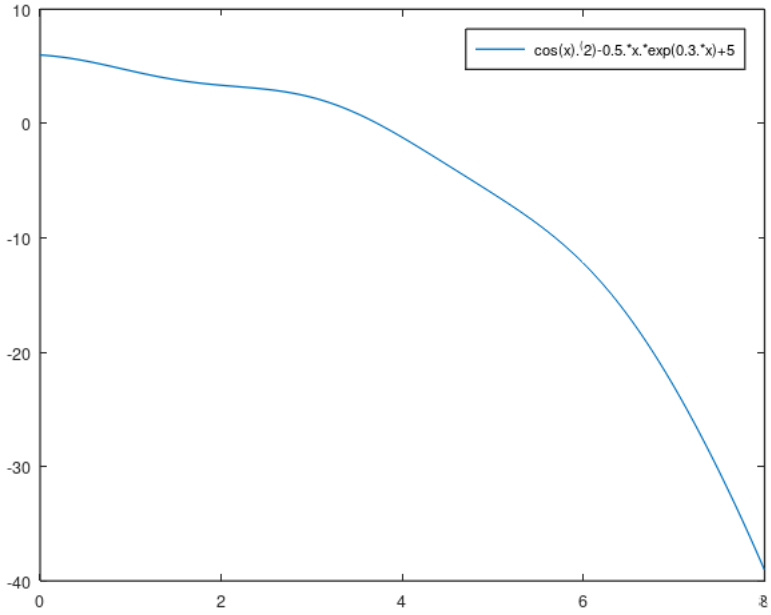
- ✓ Gráfico Ejercicio 2:



✓ Gráfico Ejercicio 3:

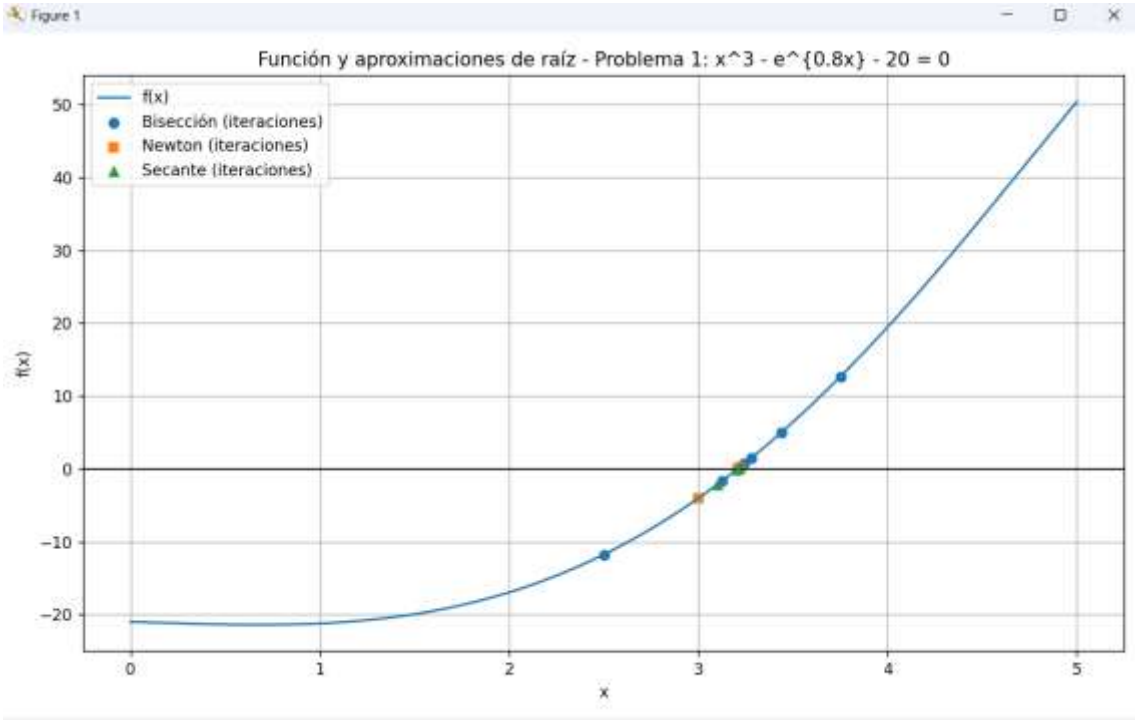


✓ Gráfico Ejercicio 4:



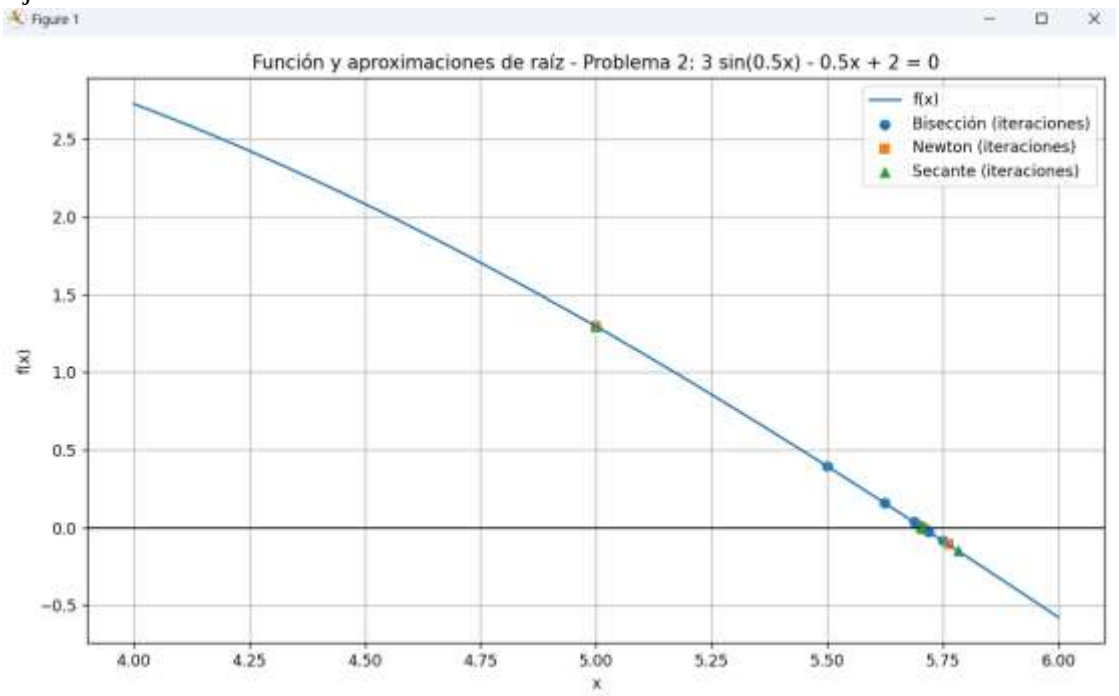
Corrida de ejercicios en Python. -

- Ejercicio 1:



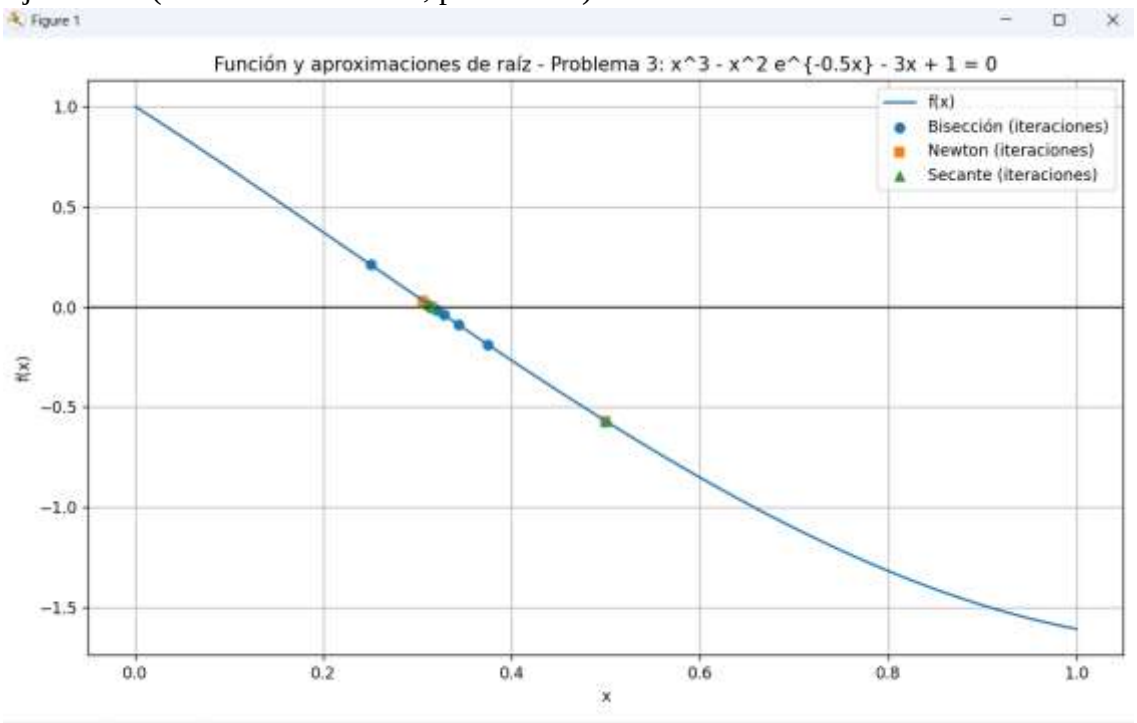

```
================================================================
  Problema 1: x^3 - e^(0.8x) - 20 = 0
================================================================

--- Método de Bisección ---
 k          a          b          c          f(c)         error
 1   0.000000   5.000000   2.500000 -1.176406e+01  2.500000e+00
 2   2.500000   5.000000   3.750000  1.264884e+01  1.250000e+00
 3   2.500000   3.750000   3.125000 -1.664916e+00  6.250000e-01
 4   3.125000   3.750000   3.437500  4.976265e+00  3.125000e-01
 5   3.125000   3.437500   3.281250  1.523337e+00  1.562500e-01
 6   3.125000   3.281250   3.203125 -1.041035e-01  7.812500e-02
 7   3.203125   3.281250   3.242188  7.013089e-01  3.906250e-02
 8   3.203125   3.242188   3.222656  2.965227e-01  1.953125e-02
 9   3.203125   3.222656   3.212891  9.568921e-02  9.765625e-03
10   3.203125   3.212891   3.208008 -4.337292e-03  4.882812e-03
11   3.208008   3.212891   3.210449  4.564343e-02  2.441406e-03
12   3.208008   3.210449   3.209229  2.064494e-02  1.220703e-03
13   3.208008   3.209229   3.208618  8.151789e-03  6.103516e-04
14   3.208008   3.208618   3.208313  1.906740e-03  3.051758e-04

--- Método de Newton-Raphson ---
 k           x          f(x)         error
 1  3.00000000 -4.02317638e+00  2.212791e-01
 2  3.22127907  2.68137538e-01  1.381412e-02
 3  3.20826495  9.23875870e-04  4.515172e-05

--- Método de la Secante ---
 k          x0          x1         f(x0)         f(x1)          x2         error
 1   3.000000   3.100000 -4.023176e+00 -2.150264e+00   3.214809  1.148086e-01
 2   3.100000   3.214809 -2.150264e+00  1.350514e-01   3.208024  6.784648e-03
 3   3.214809   3.208024  1.350514e-01 -4.006634e-03   3.208219  1.954839e-04

=== COMPARACIÓN DE MÉTODOS ===
Método          Iter     Raíz aprox       f(raíz)    Error aprox
Bisección         14     3.20831299      1.907e-03      3.052e-04
Newton             3     3.20821980      1.113e-08      4.515e-05
Secante            3     3.20821946     -7.029e-06      1.955e-04
```

❖ Ejercicio 2:



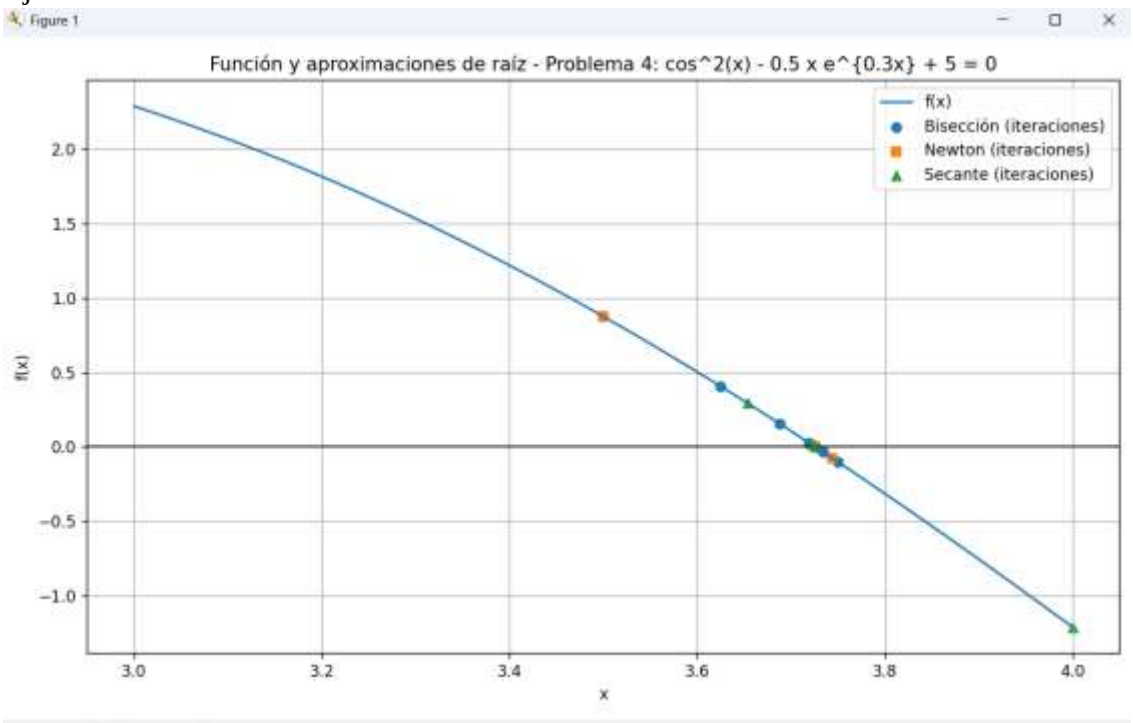

```
================================================================
   Problema 2: 3 sin(0.5x) - 0.5x + 2 = 0
================================================================

--- Método de Bisección ---
  k           a           b           c          f(c)         error
  1    4.000000    6.000000    5.000000  1.295416e+00  1.000000e+00
  2    5.000000    6.000000    5.500000  3.949830e-01  5.000000e-01
  3    5.500000    6.000000    5.750000 -8.466202e-02  2.500000e-01
  4    5.500000    5.750000    5.625000  1.570535e-01  1.250000e-01
  5    5.625000    5.750000    5.687500  3.662559e-02  6.250000e-02
  6    5.687500    5.750000    5.718750 -2.391623e-02  3.125000e-02
  7    5.687500    5.718750    5.703125  6.380858e-03  1.562500e-02
  8    5.703125    5.718750    5.710938 -8.761228e-03  7.812500e-03
  9    5.703125    5.710938    5.707031 -1.188559e-03  3.906250e-03
 10    5.703125    5.707031    5.705078  2.596557e-03  1.953125e-03
 11    5.705078    5.707031    5.706055  7.041009e-04  9.765625e-04
 12    5.706055    5.707031    5.706543 -2.422037e-04  4.882812e-04

--- Método de Newton-Raphson ---
  k           x           f(x)         error
  1    5.00000000  1.29541643e+00  7.612415e-01
  2    5.76124152 -1.06561781e-01  5.466923e-02
  3    5.70657229 -2.99028940e-04  1.542905e-04

--- Método de la Secante ---
  k          x0          x1          f(x0)          f(x1)          x2         error
  1    4.800000    5.000000  1.626390e+00  1.295416e+00    5.782793  7.827926e-01
  2    5.000000    5.782793  1.295416e+00 -1.486136e-01    5.702231  8.056177e-02
  3    5.782793    5.702231 -1.486136e-01  8.113189e-03    5.706401  4.170397e-03
  4    5.702231    5.706401  8.113189e-03  3.259568e-05    5.706418  1.682264e-05

=== COMPARACIÓN DE MÉTODOS ===
Método          Iter     Raiz aprox       f(raiz)    Error aprox
Bisección         12     5.70654297     -2.422e-04      4.883e-04
Newton             3     5.70641800     -2.538e-09      1.543e-04
Secante            4     5.70641800     -7.530e-09      1.682e-05
```

❖ Ejercicio 3 (Otra raíz encontrada, pero válida):




```
======================================================================
   Problema 3: x^3 - x^2 e^{-0.5x} - 3x + 1 = 0
======================================================================

--- Método de Bisección ---
 k           a           b           c          f(c)         error
 1    0.000000    1.000000    0.500000 -5.697002e-01  5.000000e-01
 2    0.000000    0.500000    0.250000  2.104689e-01  2.500000e-01
 3    0.250000    0.500000    0.375000 -1.888478e-01  1.250000e-01
 4    0.250000    0.375000    0.312500  9.487761e-03  6.250000e-02
 5    0.312500    0.375000    0.343750 -9.013522e-02  3.125000e-02
 6    0.312500    0.343750    0.328125 -4.042205e-02  1.562500e-02
 7    0.312500    0.328125    0.320312 -1.548978e-02  7.812500e-03
 8    0.312500    0.320312    0.316406 -3.006427e-03  3.906250e-03
 9    0.312500    0.316406    0.314453  3.239343e-03  1.953125e-03
10    0.314453    0.316406    0.315430  1.161234e-04  9.765625e-04

--- Método de Newton-Raphson ---
 k           x           f(x)         error
 1    0.50000000 -5.69700196e-01  1.943407e-01
 2    0.30565929  3.13924708e-02  9.796971e-03
 3    0.31545626  3.11346239e-05  9.736212e-06

--- Método de la Secante ---
 k          x0          x1          f(x0)          f(x1)          x2          error
 1    0.400000    0.500000 -2.669969e-01 -5.697002e-01    0.311796  1.882042e-01
 2    0.500000    0.311796 -5.697002e-01  1.174118e-02    0.315596  3.800451e-03
 3    0.311796    0.315596  1.174118e-02 -4.165954e-04    0.315466  1.302253e-04

=== COMPARACIÓN DE MÉTODOS ===
Método          Iter     Raíz aprox       f(raíz)    Error aprox
Bisección         10     0.31542969      1.161e-04      9.766e-04
Newton             3     0.31546600      3.328e-11      9.736e-06
Secante            3     0.31546605     -1.655e-07      1.302e-04
```

❖ Ejercicio 4:




```
======================================================================
   Problema 4: cos^2(x) - 0.5 x e^{0.3x} + 5 = 0
======================================================================

--- Método de Bisección ---
  k           a           b           c          f(c)         error
  1    3.000000    4.000000    3.500000   8.760617e-01  5.000000e-01
  2    3.500000    4.000000    3.750000  -1.020889e-01  2.500000e-01
  3    3.500000    3.750000    3.625000   4.065507e-01  1.250000e-01
  4    3.625000    3.750000    3.687500   1.567800e-01  6.250000e-02
  5    3.687500    3.750000    3.718750   2.843680e-02  3.125000e-02
  6    3.718750    3.750000    3.734375  -3.655917e-02  1.562500e-02
  7    3.718750    3.734375    3.726562  -3.993709e-03  7.812500e-03
  8    3.718750    3.726562    3.722656   1.223851e-02  3.906250e-03
  9    3.722656    3.726562    3.724609   4.126629e-03  1.953125e-03
 10    3.724609    3.726562    3.725586   6.751566e-05  9.765625e-04

--- Método de Newton-Raphson ---
  k           x          f(x)         error
  1    3.50000000  8.76061671e-01  2.442951e-01
  2    3.74429514 -7.81021811e-02  1.860246e-02
  3    3.72569268 -3.76291752e-04  9.050153e-05

--- Método de la Secante ---
  k          x0          x1          f(x0)          f(x1)          x2          error
  1    3.000000    4.000000   2.290680e+00  -1.212984e+00    3.653796   3.462044e-01
  2    4.000000    3.653796  -1.212984e+00   2.926501e-01    3.721087   6.729174e-02
  3    3.653796    3.721087   2.926501e-01   1.874832e-02    3.725693   4.606057e-03
  4    3.721087    3.725693   1.874832e-02  -3.794474e-04    3.725602   9.137274e-05

=== COMPARACIÓN DE MÉTODOS ===
Método          Iter     Raíz aprox       f(raíz)    Error aprox
Bisección         10     3.72558594      6.752e-05      9.766e-04
Newton             3     3.72560218     -9.066e-09      9.050e-05
Secante            4     3.72560207      4.576e-07      9.137e-05
```