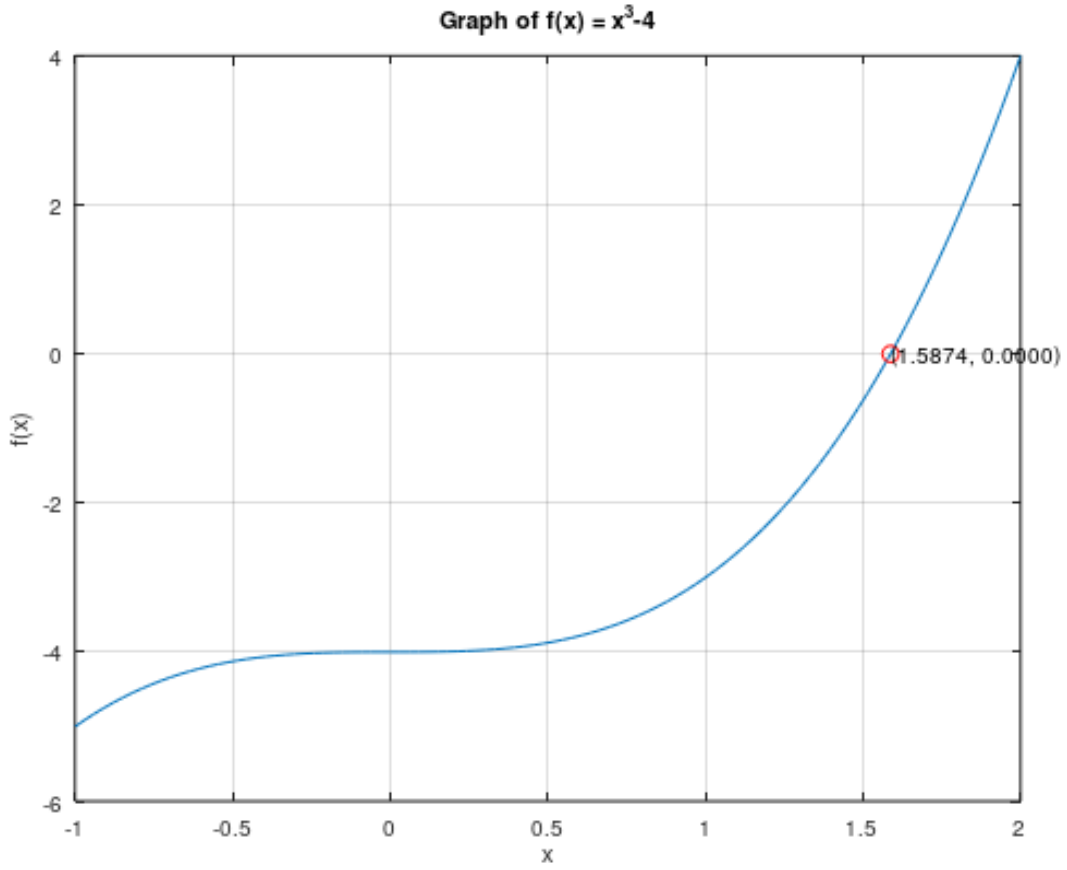
**Program Output #2 -** $x^3 - 4$

**Command Window:**

```
Iteration 1:
  xl = 1.000000
  xu = 2.000000
  xm = 1.500000
  f(xl) = -3.000000
  f(xu) = 4.000000
  f(xm) = -0.625000
  Approximate relative error = 33.333333%

Iteration 2:
  xl = 1.500000
  xu = 2.000000
  xm = 1.750000
  f(xl) = -0.625000
  f(xu) = 4.000000
  f(xm) = 1.359375
  Approximate relative error = 14.285714%

Iteration 3:
  xl = 1.500000
  xu = 1.750000
  xm = 1.625000
  f(xl) = -0.625000
  f(xu) = 1.359375
  f(xm) = 0.291016
  Approximate relative error = 7.692308%

Iteration 4:
  xl = 1.500000
  xu = 1.625000
  xm = 1.562500
  f(xl) = -0.625000
  f(xu) = 0.291016
  f(xm) = -0.185303
  Approximate relative error = 4.000000%

Iteration 5:
  xl = 1.562500
  xu = 1.625000
  xm = 1.593750
  f(xl) = -0.185303
  f(xu) = 0.291016
  f(xm) = 0.048187
  Approximate relative error = 1.960784%

Iteration 6:
  xl = 1.562500
  xu = 1.593750
  xm = 1.578125
  f(xl) = -0.185303
  f(xu) = 0.048187
  f(xm) = -0.069714
  Approximate relative error = 0.990099%

Iteration 7:
  xl = 1.578125
  xu = 1.593750
  xm = 1.585938
  f(xl) = -0.069714
  f(xu) = 0.048187
  f(xm) = -0.011054
  Approximate relative error = 0.492611%

Iteration 8:
  xl = 1.585938
  xu = 1.593750
  xm = 1.589844
  f(xl) = -0.011054
  f(xu) = 0.048187
  f(xm) = 0.018494
  Approximate relative error = 0.245700%

Iteration 9:
  xl = 1.585938
  xu = 1.589844
  xm = 1.587891
  f(xl) = -0.011054
  f(xu) = 0.018494
  f(xm) = 0.003702
  Approximate relative error = 0.123001%

Iteration 10:
  xl = 1.585938
  xu = 1.587891
  xm = 1.586914
  f(xl) = -0.011054
  f(xu) = 0.003702
  f(xm) = -0.003680
  Approximate relative error = 0.061538%
```

```
Iteration 11:
  xl = 1.586914
  xu = 1.587891
  xm = 1.587402
  f(xl) = -0.003680
  f(xu) = 0.003702
  f(xm) = 0.000010
  Approximate relative error = 0.030760%

Iteration 12:
  xl = 1.586914
  xu = 1.587402
  xm = 1.587158
  f(xl) = -0.003680
  f(xu) = 0.000010
  f(xm) = -0.001836
  Approximate relative error = 0.015382%

Iteration 13:
  xl = 1.587158
  xu = 1.587402
  xm = 1.587280
  f(xl) = -0.001836
  f(xu) = 0.000010
  f(xm) = -0.000913
  Approximate relative error = 0.007691%

Iteration 14:
  xl = 1.587280
  xu = 1.587402
  xm = 1.587341
  f(xl) = -0.000913
  f(xu) = 0.000010
  f(xm) = -0.000452
  Approximate relative error = 0.003845%

Iteration 15:
  xl = 1.587341
  xu = 1.587402
  xm = 1.587372
  f(xl) = -0.000452
  f(xu) = 0.000010
  f(xm) = -0.000221
  Approximate relative error = 0.001923%

Iteration 16:
  xl = 1.587372
  xu = 1.587402
  xm = 1.587387
  f(xl) = -0.000221
  f(xu) = 0.000010
  f(xm) = -0.000106
  Approximate relative error = 0.000961%

Iteration 17:
  xl = 1.587387
  xu = 1.587402
  xm = 1.587395
  f(xl) = -0.000106
  f(xu) = 0.000010
  f(xm) = -0.000048
  Approximate relative error = 0.000481%

Iteration 18:
  xl = 1.587395
  xu = 1.587402
  xm = 1.587399
  f(xl) = -0.000048
  f(xu) = 0.000010
  f(xm) = -0.000019
  Approximate relative error = 0.000240%

Iteration 19:
  xl = 1.587399
  xu = 1.587402
  xm = 1.587400
  f(xl) = -0.000019
  f(xu) = 0.000010
  f(xm) = -0.000005
  Approximate relative error = 0.000120%

Iteration 20:
  xl = 1.587400
  xu = 1.587402
  xm = 1.587401
  f(xl) = -0.000005
  f(xu) = 0.000010
  f(xm) = 0.000003
  Approximate relative error = 0.000060%

Estimated root: 1.587401
Function value at root: 0.000003
Approximate relative error: 0.000060%
Number of iterations: 20
```

**Graph:**



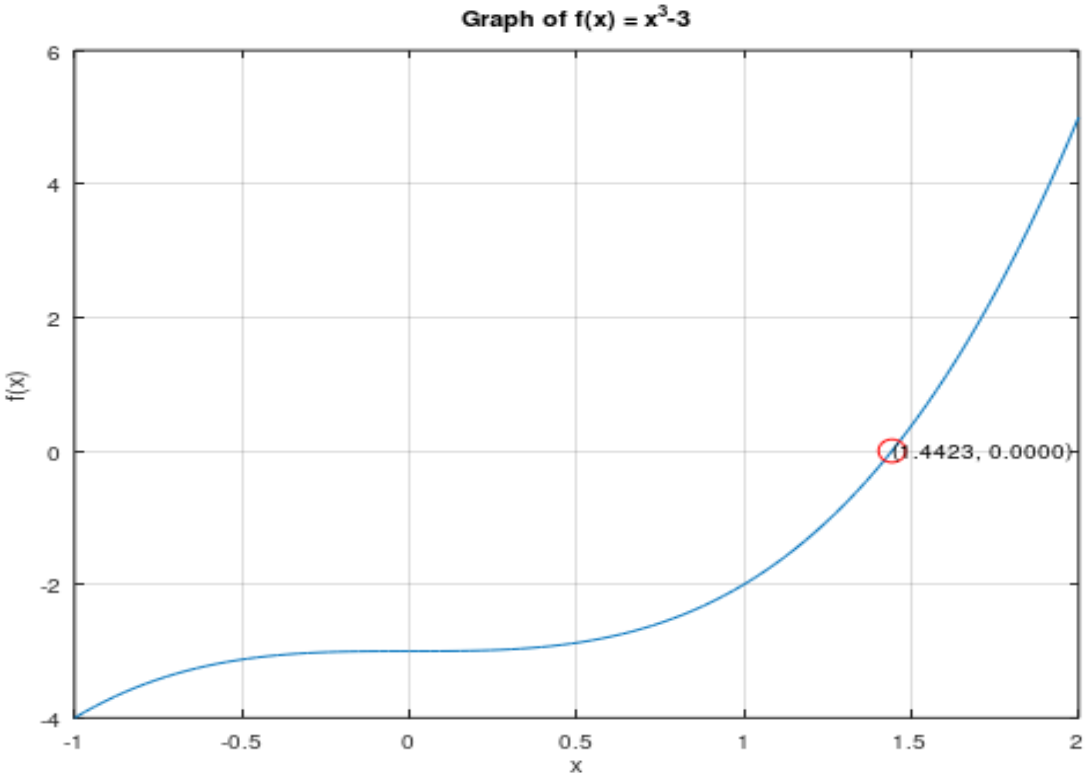
**Program Output #3 -** $x^3 - 3$

**Command Window:**

```
Iteration 1:
  xl = 1.000000
  xu = 2.000000
  xm = 1.500000
  f(xl) = -2.000000
  f(xu) = 5.000000
  f(xm) = 0.375000
  Approximate relative error = 33.333333%

Iteration 2:
  xl = 1.000000
  xu = 1.500000
  xm = 1.250000
  f(xl) = -2.000000
  f(xu) = 0.375000
  f(xm) = -1.046875
  Approximate relative error = 20.000000%

Iteration 3:
  xl = 1.250000
  xu = 1.500000
  xm = 1.375000
  f(xl) = -1.046875
  f(xu) = 0.375000
  f(xm) = -0.400391
  Approximate relative error = 9.090909%

Iteration 4:
  xl = 1.375000
  xu = 1.500000
  xm = 1.437500
  f(xl) = -0.400391
  f(xu) = 0.375000
  f(xm) = -0.029541
  Approximate relative error = 4.347826%

Iteration 5:
  xl = 1.437500
  xu = 1.500000
  xm = 1.468750
  f(xl) = -0.029541
  f(xu) = 0.375000
  f(xm) = 0.168427
  Approximate relative error = 2.127660%

Iteration 6:
  xl = 1.437500
  xu = 1.468750
  xm = 1.453125
  f(xl) = -0.029541
  f(xu) = 0.168427
  f(xm) = 0.068378
  Approximate relative error = 1.075269%

Iteration 7:
  xl = 1.437500
  xu = 1.453125
  xm = 1.445312
  f(xl) = -0.029541
  f(xu) = 0.068378
  f(xm) = 0.019154
  Approximate relative error = 0.540541%

Iteration 8:
  xl = 1.437500
  xu = 1.445312
  xm = 1.441406
  f(xl) = -0.029541
  f(xu) = 0.019154
  f(xm) = -0.005259
  Approximate relative error = 0.271003%

Iteration 9:
  xl = 1.441406
  xu = 1.445312
  xm = 1.443359
  f(xl) = -0.005259
  f(xu) = 0.019154
  f(xm) = 0.006931
  Approximate relative error = 0.135318%

Iteration 10:
  xl = 1.441406
  xu = 1.443359
  xm = 1.442383
  f(xl) = -0.005259
  f(xu) = 0.006931
  f(xm) = 0.000832
  Approximate relative error = 0.067705%
```

```
Iteration 11:
  xl = 1.441406
  xu = 1.442383
  xm = 1.441895
  f(xl) = -0.005259
  f(xu) = 0.000832
  f(xm) = -0.002215
  Approximate relative error = 0.033864%

Iteration 12:
  xl = 1.441895
  xu = 1.442383
  xm = 1.442139
  f(xl) = -0.002215
  f(xu) = 0.000832
  f(xm) = -0.000692
  Approximate relative error = 0.016929%

Iteration 13:
  xl = 1.442139
  xu = 1.442383
  xm = 1.442261
  f(xl) = -0.000692
  f(xu) = 0.000832
  f(xm) = 0.000070
  Approximate relative error = 0.008464%

Iteration 14:
  xl = 1.442139
  xu = 1.442261
  xm = 1.442200
  f(xl) = -0.000692
  f(xu) = 0.000070
  f(xm) = -0.000311
  Approximate relative error = 0.004232%

Iteration 15:
  xl = 1.442200
  xu = 1.442261
  xm = 1.442230
  f(xl) = -0.000311
  f(xu) = 0.000070
  f(xm) = -0.000121
  Approximate relative error = 0.002116%

Iteration 16:
  xl = 1.442230
  xu = 1.442261
  xm = 1.442245
  f(xl) = -0.000121
  f(xu) = 0.000070
  f(xm) = -0.000026
  Approximate relative error = 0.001058%

Iteration 17:
  xl = 1.442245
  xu = 1.442261
  xm = 1.442253
  f(xl) = -0.000026
  f(xu) = 0.000070
  f(xm) = 0.000022
  Approximate relative error = 0.000529%

Iteration 18:
  xl = 1.442245
  xu = 1.442253
  xm = 1.442249
  f(xl) = -0.000026
  f(xu) = 0.000022
  f(xm) = -0.000002
  Approximate relative error = 0.000264%

Iteration 19:
  xl = 1.442249
  xu = 1.442253
  xm = 1.442251
  f(xl) = -0.000002
  f(xu) = 0.000022
  f(xm) = 0.000010
  Approximate relative error = 0.000132%

Iteration 20:
  xl = 1.442249
  xu = 1.442251
  xm = 1.442250
  f(xl) = -0.000002
  f(xu) = 0.000010
  f(xm) = 0.000004
  Approximate relative error = 0.000066%

  Estimated root: 1.442250
  Function value at root: 0.000004
  Approximate relative error: 0.000066%
  Number of iterations: 20
  >>
```

**Graph:**



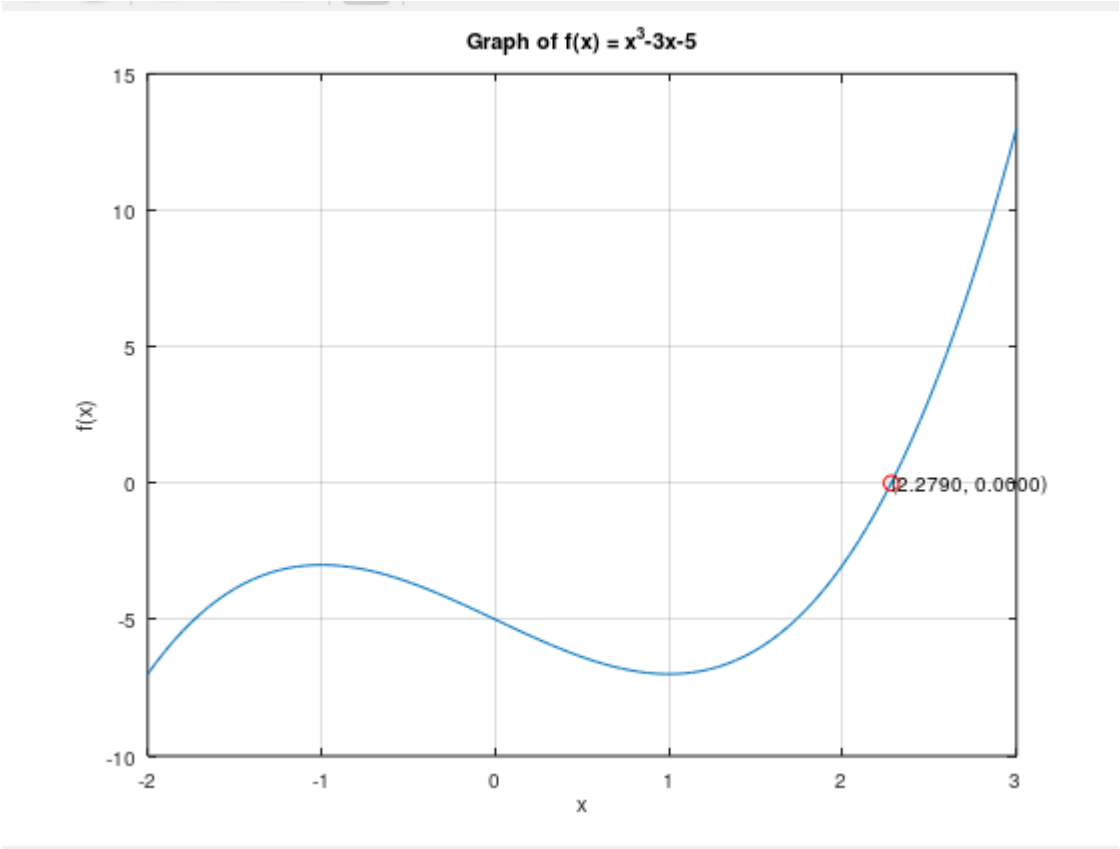
**Program Output #4 -** $x^3 - 3x - 5$

**Command Window:**

```
Iteration 1:
  xl = 2.000000
  xu = 3.000000
  xm = 2.500000
  f(xl) = -3.000000
  f(xu) = 13.000000
  f(xm) = 3.125000
  Approximate relative error = 20.000000%

Iteration 2:
  xl = 2.000000
  xu = 2.500000
  xm = 2.250000
  f(xl) = -3.000000
  f(xu) = 3.125000
  f(xm) = -0.359375
  Approximate relative error = 11.111111%

Iteration 3:
  xl = 2.250000
  xu = 2.500000
  xm = 2.375000
  f(xl) = -0.359375
  f(xu) = 3.125000
  f(xm) = 1.271484
  Approximate relative error = 5.263158%

Iteration 4:
  xl = 2.250000
  xu = 2.375000
  xm = 2.312500
  f(xl) = -0.359375
  f(xu) = 1.271484
  f(xm) = 0.428955
  Approximate relative error = 2.702703%

Iteration 5:
  xl = 2.250000
  xu = 2.312500
  xm = 2.281250
  f(xl) = -0.359375
  f(xu) = 0.428955
  f(xm) = 0.028107
  Approximate relative error = 1.369863%

Iteration 6:
  xl = 2.250000
  xu = 2.281250
  xm = 2.265625
  f(xl) = -0.359375
  f(xu) = 0.028107
  f(xm) = -0.167294
  Approximate relative error = 0.689655%

Iteration 7:
  xl = 2.265625
  xu = 2.281250
  xm = 2.273438
  f(xl) = -0.167294
  f(xu) = 0.028107
  f(xm) = -0.070010
  Approximate relative error = 0.343643%

Iteration 8:
  xl = 2.273438
  xu = 2.281250
  xm = 2.277344
  f(xl) = -0.070010
  f(xu) = 0.028107
  f(xm) = -0.021056
  Approximate relative error = 0.171527%

Iteration 9:
  xl = 2.277344
  xu = 2.281250
  xm = 2.279297
  f(xl) = -0.021056
  f(xu) = 0.028107
  f(xm) = 0.003499
  Approximate relative error = 0.085690%

Iteration 10:
  xl = 2.277344
  xu = 2.279297
  xm = 2.278320
  f(xl) = -0.021056
  f(xu) = 0.003499
  f(xm) = -0.008785
  Approximate relative error = 0.042863%
```

```
Iteration 11:
  xl = 2.278320
  xu = 2.279297
  xm = 2.278809
  f(xl) = -0.008785
  f(xu) = 0.003499
  f(xm) = -0.002644
  Approximate relative error = 0.021427%

Iteration 12:
  xl = 2.278809
  xu = 2.279297
  xm = 2.279053
  f(xl) = -0.002644
  f(xu) = 0.003499
  f(xm) = 0.000427
  Approximate relative error = 0.010712%

Iteration 13:
  xl = 2.278809
  xu = 2.279053
  xm = 2.278931
  f(xl) = -0.002644
  f(xu) = 0.000427
  f(xm) = -0.001109
  Approximate relative error = 0.005356%

Iteration 14:
  xl = 2.278931
  xu = 2.279053
  xm = 2.278992
  f(xl) = -0.001109
  f(xu) = 0.000427
  f(xm) = -0.000341
  Approximate relative error = 0.002678%

Iteration 15:
  xl = 2.278992
  xu = 2.279053
  xm = 2.279022
  f(xl) = -0.000341
  f(xu) = 0.000427
  f(xm) = 0.000043
  Approximate relative error = 0.001339%

Iteration 16:
  xl = 2.278992
  xu = 2.279022
  xm = 2.279007
  f(xl) = -0.000341
  f(xu) = 0.000043
  f(xm) = -0.000149
  Approximate relative error = 0.000670%

Iteration 17:
  xl = 2.279007
  xu = 2.279022
  xm = 2.279015
  f(xl) = -0.000149
  f(xu) = 0.000043
  f(xm) = -0.000053
  Approximate relative error = 0.000335%

Iteration 18:
  xl = 2.279015
  xu = 2.279022
  xm = 2.279018
  f(xl) = -0.000053
  f(xu) = 0.000043
  f(xm) = -0.000005
  Approximate relative error = 0.000167%

Iteration 19:
  xl = 2.279018
  xu = 2.279022
  xm = 2.279020
  f(xl) = -0.000005
  f(xu) = 0.000043
  f(xm) = 0.000019
  Approximate relative error = 0.000084%

Estimated root: 2.279020
Function value at root: 0.000019
Approximate relative error: 0.000084%
Number of iterations: 19
>>
```

**Graph:**



**Program Output #5 -** $x^4 - x^3 - x^2 - 4$

**Command Window:**

```
Iteration 1:
  xl = 1.000000
  xu = 9.000000
  xm = 5.000000
  f(xl) = -5.000000
  f(xu) = 5747.000000
  f(xm) = 471.000000
  Approximate relative error = 80.000000%

Iteration 2:
  xl = 1.000000
  xu = 5.000000
  xm = 3.000000
  f(xl) = -5.000000
  f(xu) = 471.000000
  f(xm) = 41.000000
  Approximate relative error = 66.666667%

Iteration 3:
  xl = 1.000000
  xu = 3.000000
  xm = 2.000000
  f(xl) = -5.000000
  f(xu) = 41.000000
  f(xm) = 0.000000
  Approximate relative error = 50.000000%

Iteration 4:
  xl = 1.000000
  xu = 2.000000
  xm = 1.500000
  f(xl) = -5.000000
  f(xu) = 0.000000
  f(xm) = -4.562500
  Approximate relative error = 33.333333%

Iteration 5:
  xl = 1.500000
  xu = 2.000000
  xm = 1.750000
  f(xl) = -4.562500
  f(xu) = 0.000000
  f(xm) = -3.042969
  Approximate relative error = 14.285714%

Iteration 5:
  xl = 1.500000
  xu = 2.000000
  xm = 1.750000
  f(xl) = -4.562500
  f(xu) = 0.000000
  f(xm) = -3.042969
  Approximate relative error = 14.285714%

Iteration 6:
  xl = 1.750000
  xu = 2.000000
  xm = 1.875000
  f(xl) = -3.042969
  f(xu) = 0.000000
  f(xm) = -1.747803
  Approximate relative error = 6.666667%

Iteration 7:
  xl = 1.875000
  xu = 2.000000
  xm = 1.937500
  f(xl) = -1.747803
  f(xu) = 0.000000
  f(xm) = -0.935287
  Approximate relative error = 3.225806%

Iteration 8:
  xl = 1.937500
  xu = 2.000000
  xm = 1.968750
  f(xl) = -0.935287
  f(xu) = 0.000000
  f(xm) = -0.483611
  Approximate relative error = 1.587302%

Iteration 9:
  xl = 1.968750
  xu = 2.000000
  xm = 1.984375
  f(xl) = -0.483611
  f(xu) = 0.000000
  f(xm) = -0.245876
  Approximate relative error = 0.787402%

Iteration 10:
  xl = 1.984375
  xu = 2.000000
  xm = 1.992188
  f(xl) = -0.245876
  f(xu) = 0.000000
  f(xm) = -0.123966
  Approximate relative error = 0.392157%
```

```
Iteration 11:
  xl = 1.992188
  xu = 2.000000
  xm = 1.996094
  f(xl) = -0.123966
  f(xu) = 0.000000
  f(xm) = -0.062241
  Approximate relative error = 0.195695%

Iteration 12:
  xl = 1.996094
  xu = 2.000000
  xm = 1.998047
  f(xl) = -0.062241
  f(xu) = 0.000000
  f(xm) = -0.031185
  Approximate relative error = 0.097752%

Iteration 13:
  xl = 1.998047
  xu = 2.000000
  xm = 1.999023
  f(xl) = -0.031185
  f(xu) = 0.000000
  f(xm) = -0.015609
  Approximate relative error = 0.048852%

Iteration 14:
  xl = 1.999023
  xu = 2.000000
  xm = 1.999512
  f(xl) = -0.015609
  f(xu) = 0.000000
  f(xm) = -0.007808
  Approximate relative error = 0.024420%

Iteration 15:
  xl = 1.999512
  xu = 2.000000
  xm = 1.999756
  f(xl) = -0.007808
  f(xu) = 0.000000
  f(xm) = -0.003905
  Approximate relative error = 0.012209%

Iteration 16:
  xl = 1.999756
  xu = 2.000000
  xm = 1.999878
  f(xl) = -0.003905
  f(xu) = 0.000000
  f(xm) = -0.001953
  Approximate relative error = 0.006104%

Iteration 17:
  xl = 1.999878
  xu = 2.000000
  xm = 1.999939
  f(xl) = -0.001953
  f(xu) = 0.000000
  f(xm) = -0.000976
  Approximate relative error = 0.003052%

Iteration 18:
  xl = 1.999939
  xu = 2.000000
  xm = 1.999969
  f(xl) = -0.000976
  f(xu) = 0.000000
  f(xm) = -0.000488
  Approximate relative error = 0.001526%

Iteration 19:
  xl = 1.999969
  xu = 2.000000
  xm = 1.999985
  f(xl) = -0.000488
  f(xu) = 0.000000
  f(xm) = -0.000244
  Approximate relative error = 0.000763%

Iteration 20:
  xl = 1.999985
  xu = 2.000000
  xm = 1.999992
  f(xl) = -0.000244
  f(xu) = 0.000000
  f(xm) = -0.000122
  Approximate relative error = 0.000381%
```

```
Iteration 21:
  xl = 1.999992
  xu = 2.000000
  xm = 1.999996
  f(xl) = -0.000122
  f(xu) = 0.000000
  f(xm) = -0.000061
  Approximate relative error = 0.000191%

Iteration 22:
  xl = 1.999996
  xu = 2.000000
  xm = 1.999998
  f(xl) = -0.000061
  f(xu) = 0.000000
  f(xm) = -0.000031
  Approximate relative error = 0.000095%

Estimated root: 1.999998
Function value at root: -0.000031
Approximate relative error: 0.000095%
Number of iterations: 22
>>
```

**Graph:**