Numerical Root Finding Methods (Made by RC)

MAX_ITERATIONS = 100
TOLERANCE = 1E-5

Function 1: f(x) = x - sqrt(3)

First Initial Approximation = 1
Second Initial Approximation = 2

1. Binary Bisection Method
Bisection Iteration 1 -> Root: 1.5, Root Value: -.2320508075688773
Bisection Iteration 5 -> Root: 1.71875, Root Value: -.0133008075688773
Bisection Iteration 10 -> Root: 1.7314453125, Root Value: -6.054950688772936D-04
Bisection Iteration 13 -> Root: 1.7320556640625, Root Value: 4.856493622706426D-06
Bisection -> Root Found at iteration 13
Bisection Root: 1.7320556640625

2. Regular Falsi (Chord) Method
Chord Iteration 1 -> Root: 1.732050807568877, Root Value: -1.003971211721577D-16
Chord -> Root found at iteration 1
Chord Root: 1.732050807568877

3. Secant Method
Secant Iteration 1 -> Root: 1.732050807568877, Root Value: -1.003971211721577D-16
Secant -> Root Found at iteration 1
Secant Root: 1.732050807568877

4. Newton-Raphson Method
Raphson Iteration 0 -> Root: 1, Root Value: -.7320508075688773
Raphson Iteration 1 -> Root: 1.732050807141457, Root Value: -4.274204217554617D-10
Raphson -> Root Found at iteration 1
Raphson Root: 1.732050807141457

Function 2: f(x) = x^3 - x^2 - 1

First Initial Approximation = -1
Second Initial Approximation = 0

1. Binary Bisection Method
Bisection Iteration 1 -> Root: -.5, Root Value: .625
Bisection Iteration 5 -> Root: -.78125, Root Value: -.087188720703125
Bisection Iteration 10 -> Root: -.7548828125, Root Value: -1.656729727983475D-05
Bisection Iteration 17 -> Root: -.7548751831054688, Root Value: 7.993897327640553D-06
Bisection -> Root Found at iteration 17
Bisection Root: -.7548751831054688

2. Regular Falsi (Chord) Method
Chord Iteration 1 -> Root: -.5, Root Value: .625
Chord Iteration 5 -> Root: -.78125, Root Value: -.087188720703125
Chord Iteration 10 -> Root: -.7548828125, Root Value: -1.656729727983475D-05
Chord Iteration 17 -> Root: -.7548751831054688, Root Value: 7.993897327640553D-06
Chord -> Root found at iteration 17
Chord Root: -.7548751831054688

3. Secant Method
Secant Iteration 1 -> Root: -.5, Root Value: .625
Secant Iteration 20 -> Root: -.3333330154418945, Root Value: .8518521697430885
Secant Iteration 40 -> Root: -.3333333333330302, Root Value: .851851851852155
Secant Iteration 60 -> Root: -.3333333333333334, Root Value: .851851851851852
Secant Iteration 80 -> Root: -.3333333333333334, Root Value: .851851851851852
Secant Iteration 100 -> Root: -.3333333333333334, Root Value: .851851851851852
Secant Root: -.3333333333333334

4. Newton-Raphson Method
Raphson Iteration 0 -> Root: -1, Root Value: -1
Raphson Iteration 1 -> Root: -.7999999838631071, Root Value: -.1519999431981378
Raphson Iteration 2 -> Root: -.7568181762658437, Root Value: -6.25933827220826D-03
Raphson Iteration 3 -> Root: -.7548814742196708, Root Value: -1.225896413870053D-05
Raphson Iteration 4 -> Root: -.754877666261008, Root Value: -4.608446957377055D-11
Raphson -> Root Found at iteration 4
Raphson Root: -.754877666261008

Function 3: f(x) = x * exp(x) - 1

First Initial Approximation = 0

Second Initial Approximation = 1

1. Binary Bisection Method
Bisection Iteration 1 -> Root: .5, Root Value: -.175639364649936
Bisection Iteration 5 -> Root: .59375, Root Value: 7.514235532088613D-02
Bisection Iteration 10 -> Root: .5673828125, Root Value: 6.61982766399333D-04
Bisection Iteration 17 -> Root: .5671463012695312, Root Value: 8.31969692175231D-06
Bisection -> Root Found at iteration 17
Bisection Root: .5671463012695312

2. Regular Falsi (Chord) Method
Chord Iteration 1 -> Root: .3678794411714423, Root Value: -.4685363946133844
Chord Iteration 8 -> Root: .5683200658560884, Root Value: 3.254828605051845D-03
Chord Iteration 14 -> Root: .567114094996751, Root Value: -8.067150286898982D-05
Chord Iteration 18 -> Root: .5671439486026767, Root Value: 1.818734611323271D-06
Chord -> Root found at iteration 18
Chord Root: .5671439486026767

3. Secant Method
Secant Iteration 1 -> Root: .3678794411714423, Root Value: -.4685363946133844
Secant Iteration 20 -> Root: .6127400201161555, Root Value: .1308001464749861
Secant Iteration 40 -> Root: .6126998409493997, Root Value: .1306805658651226
Secant Iteration 60 -> Root: .6126998367807126, Root Value: .130680553458745
Secant Iteration 80 -> Root: .6126998367802793, Root Value: .1306805534574554
Secant Iteration 100 -> Root: .6126998367802791, Root Value: .1306805534574547
Secant Root: .6126998367802791

4. Newton-Raphson Method
Raphson Iteration 0 -> Root: 0, Root Value: -1
Raphson Iteration 1 -> Root: .9999998994960707, Root Value: 1.718281282063077
Raphson Iteration 2 -> Root: .6839396964530868, Root Value: .3553424704638545
Raphson Iteration 3 -> Root: .5774544814962747, Root Value: 2.873389903076463D-02
Raphson Iteration 4 -> Root: .567229738632651, Root Value: 2.388926178250421D-04
Raphson Iteration 5 -> Root: .5671432965374582, Root Value: 1.693212972901561D-08
Raphson -> Root Found at iteration 5
Raphson Root: .5671432965374582

Function 4: f(x) = x ^ 3 - sin(x) + 4
First Initial Approximation = -2
Second Initial Approximation = 0

1. Binary Bisection Method
Bisection Iteration 1 -> Root: -1, Root Value: 3.841470984807897
Bisection Iteration 8 -> Root: -1.7109375, Root Value: -1.824325426651896D-02
Bisection Iteration 13 -> Root: -1.708740234375, Root Value: 1.332719107556724D-03
Bisection Iteration 19 -> Root: -1.70888900756836, Root Value: 8.976479362488021D-06
Bisection -> Root Found at iteration 19
Bisection Root: -1.70888900756836

2. Regular Falsi (Chord) Method
Chord Iteration 1 -> Root: -1.12823798734215, Root Value: 3.467501228291467
Chord Iteration 8 -> Root: -1.712314572500828, Root Value: -3.053962511897801D-02
Chord Iteration 13 -> Root: -1.708978911783463, Root Value: -7.910869355649552D-04
Chord Iteration 18 -> Root: -1.708891004036351, Root Value: -8.789231507932982D-06
Chord -> Root found at iteration 18
Chord Root: -1.708891004036351

3. Secant Method
Secant Iteration 1 -> Root: -1.12823798734215, Root Value: 3.467501228291467
Secant Iteration 20 -> Root: -.721317223547957, Root Value: 4.28507409973774
Secant Iteration 40 -> Root: -.7213249067234366, Root Value: 4.285067876532681
Secant Iteration 60 -> Root: -.7213249068052746, Root Value: 4.285067876466393
Secant Iteration 80 -> Root: -.7213249068052756, Root Value: 4.285067876466392
Secant Iteration 100 -> Root: -.7213249068052756, Root Value: 4.285067876466392
Secant Root: -.7213249068052756

4. Newton-Raphson Method
Raphson Iteration 0 -> Root: -2, Root Value: -3.090702573174318
Raphson Iteration 1 -> Root: -1.751073922166887, Root Value: -.3854537589175173
Raphson Iteration 2 -> Root: -1.70997236545785, Root Value: -9.637947227435717D-03
Raphson Iteration 3 -> Root: -1.708890755637567, Root Value: -6.578835010984108D-06
Raphson -> Root Found at iteration 3
Raphson Root: -1.708890755637567