AD3.

(1) Solve the problem f(x)=0 using Newton's method

Enter guess at root: -1

Enter tolerance: 1e-6

Enter maxIteration: 100

Monitor iterations? (1/0): 1

Guess: x=-1, error=0.333333

Iter 1: x= -0.8125, dx= 0.1875, error = 0.145833, r\_l = 0, r\_q = 0

Iter 2: x= -0.742095241075, dx= 0.0704047589251, error = 0.0754282410749, r\_l = 0.517223406738, r\_q = 0

Iter 3: x= -0.705509120304, dx= 0.0365861207712, error = 0.0388421203037, r\_l = 0.514954607852, r\_q = 6.8270796258

Iter 4: x= -0.686450374126, dx= 0.0190587461775, error = 0.0197833741261, r\_l = 0.509327862935, r\_q = 13.1127718815

Iter 5: x= -0.676661366785, dx= 0.00978900734098, error = 0.00999436678516, r\_l = 0.505190202714, r\_q = 25.5360991251

Iter 6: x= -0.671691446315, dx= 0.00496992046977, error = 0.0050244463154, r\_l = 0.502727828926, r\_q = 50.3011185933

Iter 7: x= -0.669186142818, dx= 0.00250530349722, error = 0.00251914281818, r\_l = 0.50137719861, r\_q = 99.7875521275

Iter 8: x= -0.667928205914, dx= 0.00125793690446, error = 0.00126120591372, r\_l = 0.500648833651, r\_q = 198.737773039

Iter 9: x= -0.667297890346, dx= 0.000630315568191, error = 0.000630890345531, r\_l = 0.500227868159, r\_q = 396.626643371

Iter 10: x= -0.666982392494, dx= 0.000315497851186, error = 0.000315392494345, r\_l = 0.499916501464, r\_q = 792.398401728

Iter 11: x= -0.666824558137, dx= 0.00015783435723, error = 0.000157558137115, r\_l = 0.499562101001, r\_q = 1583.93782337

Iter 12: x= -0.666745619549, dx= 7.89385886084e-05, error = 7.86195485065e-05, r\_l = 0.498987548001, r\_q = 3167.00588835

Iter 13: x= -0.666706144895, dx= 3.94746533701e-05, error = 3.91448951365e-05, r\_l = 0.497902822899, r\_q = 6333.06642378

Iter 14: x= -0.666686406228, dx= 1.97386671228e-05, error = 1.94062280137e-05, r\_l = 0.495753736113, r\_q = 12664.5820454

Iter 15: x= -0.666676536559, dx= 9.86966950523e-06, error = 9.53655850844e-06, r\_l = 0.491417420311, r\_q = 25322.6654848

Iter 16: x= -0.66667160164, dx= 4.93491835497e-06, error = 4.60164015348e-06, r\_l = 0.482526285495, r\_q = 50597.5279308

Iter 17: x= -0.666669134163, dx= 2.46747692694e-06, error = 2.13416322659e-06, r\_l = 0.463783163265, r\_q = 100786.490859

Iter 18: x= -0.666667900418, dx= 1.23374501513e-06, error = 9.00418211436e-07, r\_l = 0.421906909565, r\_q = 197691.959223

The root is -0.666667

The number of iterations is 19

errors = [3.33333000e-01 1.45833000e-01 7.54282411e-02 3.88421203e-02

1.97833741e-02 9.99436679e-03 5.02444632e-03 2.51914282e-03

1.26120591e-03 6.30890346e-04 3.15392494e-04 1.57558137e-04

7.86195485e-05 3.91448951e-05 1.94062280e-05 9.53655851e-06

4.60164015e-06 2.13416323e-06 9.00418211e-07 2.83551003e-07]

Linear error ratios r\_l: [0. 0.51722341 0.51495461 0.50932786 0.5051902 0.50272783

0.5013772 0.50064883 0.50022787 0.4999165 0.4995621 0.49898755

0.49790282 0.49575374 0.49141742 0.48252629 0.46378316 0.42190691]

Quadratic error ratios r\_q: [0.00000000e+00 6.82707963e+00 1.31127719e+01 2.55360991e+01

5.03011186e+01 9.97875521e+01 1.98737773e+02 3.96626643e+02

7.92398402e+02 1.58393782e+03 3.16700589e+03 6.33306642e+03

1.26645820e+04 2.53226655e+04 5.05975279e+04 1.00786491e+05

1.97691959e+05]

Process finished with exit code 0

(2) Solve the problem f(x)=0 using Newton's method

Enter guess at root: 0.8

Enter tolerance: 1e-6

Enter maxIteration: 100

Monitor iterations? (1/0): 1

Guess: x=0.8, error=0.3

Iter 1: x= 0.560642092747, dx= -0.239357907253, error = 0.0606420927467, r\_l = 0, r\_q = 0

Iter 2: x= 0.510196211467, dx= -0.05044588128, error = 0.0101962114667, r\_l = 0.168137526344, r\_q = 0

Iter 3: x= 0.500400032866, dx= -0.00979617860073, error = 0.000400032866017, r\_l = 0.0392334807219, r\_q = 3.84784886523

Iter 4: x= 0.500000663416, dx= -0.000399369449636, error = 6.63416381053e-07, r\_l = 0.00165840468974, r\_q = 4.1456710951

The root is 0.500000

The number of iterations is 5

errors = [3.00000000e-01 6.06420927e-02 1.01962115e-02 4.00032866e-04

6.63416381e-07 1.83042470e-12]

Linear error ratios r\_l: [0. 0.16813753 0.03923348 0.0016584 ]

Quadratic error ratios r\_q: [0. 3.84784887 4.1456711 ]

Process finished with exit code 0

(3)Solve the problem f(x)=0 using Newton's method

Enter guess at root: -1.5

Enter tolerance: 1e-6

Enter maxIteration: 100

Monitor iterations? (1/0): 1

Guess: x=-1.5, error=0.118702

Iter 1: x= -1.41859737007, dx= 0.0814026299311, error = 0.0372993700689, r\_l = 0, r\_q = 0

Iter 2: x= -1.38633173912, dx= 0.0322656309525, error = 0.00503373911639, r\_l = 0.134955070477, r\_q = 0

Iter 3: x= -1.3814057834, dx= 0.00492595571655, error = 0.000107783399846, r\_l = 0.0214121942662, r\_q = 4.25373539849

Iter 4: x= -1.38129853212, dx= 0.000107251283316, error = 5.32116529284e-07, r\_l = 0.00493690614739, r\_q = 45.803956402

The root is -1.381298

The number of iterations is 5

errors = [1.18702000e-01 3.72993701e-02 5.03373912e-03 1.07783400e-04

5.32116529e-07 4.82044006e-07]

Linear error ratios r\_l: [0. 0.13495507 0.02141219 0.00493691]

Quadratic error ratios r\_q: [ 0. 4.2537354 45.8039564]

Process finished with exit code 0

(4) Solve the problem f(x)=0 using Newton's method

Enter guess at root: 0

Enter tolerance: 1e-6

Enter maxIteration: 100

Monitor iterations? (1/0): 1

Guess: x=0, error=0.205183

Iter 1: x= 0.25, dx= 0.25, error = 0.044817, r\_l = 0, r\_q = 0

Iter 2: x= 0.200069832402, dx= -0.0499301675978, error = 0.00511316759777, r\_l = 0.11408991226, r\_q = 0

Iter 3: x= 0.205146099616, dx= 0.00507626721413, error = 3.69003836334e-05, r\_l = 0.00721673657822, r\_q = 1.41140231378

Iter 4: x= 0.205182922659, dx= 3.68230427352e-05, error = 7.73408981858e-08, r\_l = 0.00209593750987, r\_q = 56.7998839983

The root is 0.205183

The number of iterations is 5

errors = [2.05183000e-01 4.48170000e-02 5.11316760e-03 3.69003836e-05

7.73408982e-08 7.53109524e-08]

Linear error ratios r\_l: [0. 0.11408991 0.00721674 0.00209594]

Quadratic error ratios r\_q: [ 0. 1.41140231 56.799884 ]

Process finished with exit code 0

(5) Solve the problem f(x)=0 using Newton's method

Enter guess at root: 2

Enter tolerance: 1e-6

Enter maxIteration: 100

Monitor iterations? (1/0): 1

Guess: x=2, error=0.823884

Iter 1: x= 1.71291866029, dx= -0.287081339713, error = 0.536802660287, r\_l = 0, r\_q = 0

Iter 2: x= 1.49139793671, dx= -0.221520723581, error = 0.315281936706, r\_l = 0.587333036944, r\_q = 0

Iter 3: x= 1.33095570355, dx= -0.160442233152, error = 0.154839703554, r\_l = 0.491115048238, r\_q = 1.55770119078

Iter 4: x= 1.23014796089, dx= -0.100807742664, error = 0.0540319608897, r\_l = 0.348954174217, r\_q = 2.25364790947

Iter 5: x= 1.18528473347, dx= -0.0448632274172, error = 0.00916873347247, r\_l = 0.169690925917, r\_q = 3.14056575261

Iter 6: x= 1.17643597213, dx= -0.00884876134134, error = 0.000319972131135, r\_l = 0.0348981821858, r\_q = 3.80621623374

Iter 7: x= 1.17611596586, dx= -0.000320006274499, error = 3.41433639139e-08, r\_l = 0.000106707305392, r\_q = 0.333489373007

The root is 1.176116

The number of iterations is 8

errors = [8.23884000e-01 5.36802660e-01 3.15281937e-01 1.54839704e-01

5.40319609e-02 9.16873347e-03 3.19972131e-04 3.41433639e-08

4.42644388e-07]

Linear error ratios r\_l: [0.00000000e+00 5.87333037e-01 4.91115048e-01 3.48954174e-01

1.69690926e-01 3.48981822e-02 1.06707305e-04]

Quadratic error ratios r\_q: [0. 1.55770119 2.25364791 3.14056575 3.80621623 0.33348937]

Process finished with exit code 0

(6) **Modified root 1:**

Solve the problem f(x)=0 using Newton's method

Enter guess at root: -1

Enter tolerance: 1e-6

Enter maxIteration: 100

Monitor iterations? (1/0): 1

Guess: x=-1, error=0.333333

Iter 1: x= -0.625, dx= 0.375, error = 0.041667, r\_l = 0, r\_q = 0

Iter 2: x= -0.66785079929, dx= -0.0428507992895, error = 0.00118379928952, r\_l = 0.0284109556608, r\_q = 0

Iter 3: x= -0.666667467024, dx= 0.00118333226588, error = 4.67023645312e-07, r\_l = 0.000394512523741, r\_q = 0.333259638888

The root is -0.666667

The number of iterations is 4

errors = [3.33333000e-01 4.16670000e-02 1.18379929e-03 4.67023645e-07

3.33390747e-07]

Linear error ratios r\_l: [0. 0.02841096 0.00039451]

Quadratic error ratios r\_q: [0. 0.33325964]

Process finished with exit code 0

AD4.

(1) Solve the problem f(x)=0 on interval [a,b] using Newton-Bisection method

Enter a: -1.5

Enter b: 0.2

Enter tolerance: 5e-7

Enter maxIteration: 100

Monitor iterations? (1/0): 1

Interval = [-1.500000,0.200000], guess x = -0.650000, error = 0.016667

Iter 1: x= -0.658418860924, dx= -0.00841886092367, error = 0.00824780574299, interval = [-1.5,-0.658418860924], Newton? 1

Iter 2: x= -0.662562979968, dx= -0.00414411904445, error = 0.00410368669855, interval = [-1.5,-0.662562979968], Newton? 1

Iter 3: x= -0.664619740282, dx= -0.00205676031347, error = 0.00204692638508, interval = [-1.5,-0.664619740282], Newton? 1

Iter 4: x= -0.665644416077, dx= -0.00102467579499, error = 0.00102225059009, interval = [-1.5,-0.665644416077], Newton? 1

Iter 5: x= -0.666155842472, dx= -0.000511426395616, error = 0.000510824194478, interval = [-1.5,-0.666155842472], Newton? 1

Iter 6: x= -0.66641132959, dx= -0.000255487117927, error = 0.000255337076551, interval = [-1.5,-0.66641132959], Newton? 1

Iter 7: x= -0.666539016852, dx= -0.000127687261714, error = 0.000127649814837, interval = [-1.5,-0.666539016852], Newton? 1

Iter 8: x= -0.666602846436, dx= -6.38295841522e-05, error = 6.38202306846e-05, interval = [-1.5,-0.666602846436], Newton? 1

Iter 9: x= -0.66663475772, dx= -3.19112841313e-05, error = 3.19089465534e-05, interval = [-1.5,-0.66663475772], Newton? 1

Iter 10: x= -0.666650712485, dx= -1.59547644749e-05, error = 1.59541820784e-05, interval = [-1.5,-0.666650712485], Newton? 1

Iter 11: x= -0.66665868965, dx= -7.97716558743e-06, error = 7.97701649102e-06, interval = [-1.5,-0.66665868965], Newton? 1

Iter 12: x= -0.666662678174, dx= -3.98852412398e-06, error = 3.98849236705e-06, interval = [-1.5,-0.666662678174], Newton? 1

Iter 13: x= -0.666664672421, dx= -1.99424630465e-06, error = 1.9942460624e-06, interval = [-1.5,-0.666664672421], Newton? 1

Iter 14: x= -0.666665669551, dx= -9.97130565339e-07, error = 9.97115497059e-07, interval = [-1.5,-0.666665669551], Newton? 1

Iter 15: x= -0.666666168129, dx= -4.98577429897e-07, error = 4.98538067162e-07, interval = [-1.5,-0.666666168129], Newton? 1

The root is -0.666666.

The number of iterations is 15

errors = [1.66666667e-02 8.24780574e-03 4.10368670e-03 2.04692639e-03

1.02225059e-03 5.10824194e-04 2.55337077e-04 1.27649815e-04

6.38202307e-05 3.19089466e-05 1.59541821e-05 7.97701649e-06

3.98849237e-06 1.99424606e-06 9.97115497e-07 4.98538067e-07]

Linear error ratios r\_l: [0.49486834 0.4975489 0.49880182 0.4994076 0.49970545 0.49985314

0.49992667 0.49996336 0.49998169 0.49999087 0.49999533 0.49999801

0.49999997 0.49999622 0.49998026]

Quadratic error ratios r\_q: [2.96921007e+01 6.03250026e+01 1.21549683e+02 2.43979267e+02

4.88828726e+02 9.78522833e+02 1.95790865e+03 3.91667911e+03

7.83421935e+03 1.56693006e+04 3.13394522e+04 6.26798265e+04

1.25360643e+05 2.50719423e+05 5.01426628e+05]

Superlinear error ratios r\_sl: [0.00000000e+00 2.98529342e+01 6.04769115e+01 1.21697302e+02

2.44124780e+02 4.88973196e+02 9.78666784e+02 1.95805235e+03

3.91682265e+03 7.83436332e+03 1.56694401e+04 3.13396204e+04

6.26800722e+04 1.25359704e+05 2.50711420e+05]

Process finished with exit code 0

(2) Solve the problem f(x)=0 on interval [a,b] using Newton-Bisection method

Enter a: 0.3

Enter b: 1

Enter tolerance: 5e-7

Enter maxIteration: 100

Monitor iterations? (1/0): 1

Interval = [0.300000,1.000000], guess x = 0.650000, error = 0.150000

Iter 1: x= 0.539200874286, dx= -0.110799125714, error = 0.0392008742858, interval = [0.3,0.539200874286], Newton? 1

Iter 2: x= 0.504851571098, dx= -0.0343493031873, error = 0.00485157109849, interval = [0.3,0.504851571098], Newton? 1

Iter 3: x= 0.500094275397, dx= -0.00475729570174, error = 9.42753967551e-05, interval = [0.3,0.500094275397], Newton? 1

Iter 4: x= 0.500000036935, dx= -9.42384619975e-05, error = 3.69347575857e-08, interval = [0.3,0.500000036935], Newton? 1

Iter 5: x= 0.5, dx= -3.69347518125e-08, error = 5.77315972805e-15, interval = [0.3,0.5], Newton? 1

The root is 0.500000.

The number of iterations is 5

errors = [1.50000000e-01 3.92008743e-02 4.85157110e-03 9.42753968e-05

3.69347576e-08 5.77315973e-15]

Linear error ratios r\_l: [2.61339162e-01 1.23761809e-01 1.94319314e-02 3.91775149e-04

1.56306961e-07]

Quadratic error ratios r\_q: [1.74226108 3.15711858 4.00528633 4.15564572 4.23197475]

Superlinear error ratios r\_sl: [0. 0.82507872 0.49570148 0.08075222 0.00165798]

Process finished with exit code 0

(3) Solve the problem f(x)=0 on interval [a,b] using Newton-Bisection method

Enter a: -2

Enter b: -1

Enter tolerance: 5e-7

Enter maxIteration: 100

Monitor iterations? (1/0): 1

Interval = [-2.000000,-1.000000], guess x = -1.500000, error = 0.118702

Iter 1: x= -1.41859737007, dx= 0.0814026299311, error = 0.0372993700689, interval = [-1.41859737007,-1], Newton? 1

Iter 2: x= -1.38633173912, dx= 0.0322656309525, error = 0.00503373911639, interval = [-1.38633173912,-1], Newton? 1

Iter 3: x= -1.3814057834, dx= 0.00492595571655, error = 0.000107783399846, interval = [-1.3814057834,-1], Newton? 1

Iter 4: x= -1.38129853212, dx= 0.000107251283316, error = 5.32116529284e-07, interval = [-1.38129853212,-1], Newton? 1

Iter 5: x= -1.38129848204, dx= 5.00725236829e-08, error = 4.82044005601e-07, interval = [-1.38129848204,-1], Newton? 1

The root is -1.381298.

The number of iterations is 5

errors = [1.18702000e-01 3.72993701e-02 5.03373912e-03 1.07783400e-04

5.32116529e-07 4.82044006e-07]

Linear error ratios r\_l: [0.31422697 0.13495507 0.02141219 0.00493691 0.90589933]

Quadratic error ratios r\_q: [2.64719190e+00 3.61815951e+00 4.25373540e+00 4.58039564e+01

1.70244538e+06]

Superlinear error ratios r\_sl: [0.00000000e+00 1.13692331e+00 5.74063160e-01 9.80763213e-01

8.40481306e+03]

Process finished with exit code 0

(4) Solve the problem f(x)=0 on interval [a,b] using Newton-Bisection method

Enter a: 0

Enter b: 0.5

Enter tolerance: 5e-7

Enter maxIteration: 100

Monitor iterations? (1/0): 1

Interval = [0.000000,0.500000], guess x = 0.250000, error = 0.044817

Iter 1: x= 0.200069832402, dx= -0.0499301675978, error = 0.00511316759777, interval = [0.200069832402,0.25], Newton? 1

Iter 2: x= 0.205146099616, dx= 0.00507626721413, error = 3.69003836334e-05, interval = [0.205146099616,0.25], Newton? 1

Iter 3: x= 0.205182922659, dx= 3.68230427352e-05, error = 7.73408981858e-08, interval = [0.205182922659,0.25], Newton? 1

Iter 4: x= 0.205182924689, dx= 2.02994576703e-09, error = 7.53109524188e-08, interval = [0.205182924689,0.25], Newton? 1

The root is 0.205183.

The number of iterations is 4

errors = [4.48170000e-02 5.11316760e-03 3.69003836e-05 7.73408982e-08

7.53109524e-08]

Linear error ratios r\_l: [0.11408991 0.00721674 0.00209594 0.97375327]

Quadratic error ratios r\_q: [2.54568383e+00 1.41140231e+00 5.67998840e+01 1.25904055e+07]

Superlinear error ratios r\_sl: [0.00000000e+00 1.61026766e-01 4.09909800e-01 2.63887031e+04]

Process finished with exit code 0

(5) Solve the problem f(x)=0 on interval [a,b] using Newton-Bisection method

Enter a: 1

Enter b: 2

Enter tolerance: 5e-7

Enter maxIteration: 100

Monitor iterations? (1/0): 1

Interval = [1.000000,2.000000], guess x = 1.500000, error = 0.323884

Iter 1: x= 1.33686715707, dx= -0.163132842925, error = 0.160751607075, interval = [1,1.33686715707], Newton? 1

Iter 2: x= 1.23340618877, dx= -0.103460968308, error = 0.0572906387673, interval = [1,1.23340618877], Newton? 1

Iter 3: x= 1.18629406042, dx= -0.0471121283496, error = 0.0101785104176, interval = [1,1.18629406042], Newton? 1

Iter 4: x= 1.17650850608, dx= -0.00978555433473, error = 0.000392956082876, interval = [1,1.17650850608], Newton? 1

Iter 5: x= 1.17611617152, dx= -0.00039233456477, error = 6.21518105648e-07, interval = [1,1.17611617152], Newton? 1

Iter 6: x= 1.17611555736, dx= -6.1416165531e-07, error = 7.35645033778e-09, interval = [1,1.17611555736], Newton? 1

Iter 7: x= 1.17611555735, dx= -1.50301993074e-12, error = 7.35494731785e-09, interval = [1,1.17611555735], Newton? 1

The root is 1.176116.

The number of iterations is 7

errors = [3.23884450e-01 1.60751607e-01 5.72906388e-02 1.01785104e-02

3.92956083e-04 6.21518106e-07 7.35645034e-09 7.35494732e-09]

Linear error ratios r\_l: [0.49632394 0.35639232 0.17766446 0.03860644 0.00158165 0.01183626

0.99979569]

Quadratic error ratios r\_q: [1.53241053e+00 2.21703739e+00 3.10110804e+00 3.79293644e+00

4.02499878e+00 1.90441125e+04 1.35907352e+08]

Superlinear error ratios r\_sl: [0.00000000e+00 1.10036874e+00 1.10521110e+00 6.73870005e-01

1.55390886e-01 3.01210777e+01 1.60863485e+06]

Process finished with exit code 0