

---

```
% Name: Eric Zounes
% Date: 10/26/12
% Lab 3

% 1.

syms x

bisection((x^5 - x^4 + x - 1), 0, 3, 10^-6, 100)

bisection((x^5 - x^4 + x - 1), 0.5, 2, 10^-6, 100)

bisection((x^5 - x^4 + x - 1), 0.9, 1.2, 10^-6, 100)

% a. The second interval is half the distance of the first so the bisection i
% algorithm would take one less iteration due to bisection halving the interval
% at each step. As the interval increases by twice the amount, it will take one
% additional iteration due to logarithmic run time.

% b. Analytically we know that the algorithm will choose either the left or
% right side of the interval. This decision is completely agnostic to the
% location of the root since the number of iterations is dependent on the
% length of the interval and its error tolerance.

% 2.

newton((x^5 - x^4 + x - 1), (5*x^4 - 4*x^3 + 1), -100, 10^-6, 100)

newton((x^5 - x^4 + x - 1), (5*x^4 - 4*x^3 + 1), 0, 10^-6, 100)

newton((x^5 - x^4 + x - 1), (5*x^4 - 4*x^3 + 1), .9, 10^-6, 100)

newton((x^5 - x^4 + x - 1), (5*x^4 - 4*x^3 + 1), .99, 10^-6, 100)

newton((x^5 - x^4 + x - 1), (5*x^4 - 4*x^3 + 1), 1.1, 10^-6, 100)

newton((x^5 - x^4 + x - 1), (5*x^4 - 4*x^3 + 1), 1.4, 10^-6, 100)

newton((x^5 - x^4 + x - 1), (5*x^4 - 4*x^3 + 1), 1000000, 10^-6, 100)

% a. Newton is much better in most situations. It's most effective when x0 is
% near the root.

% b. For guesses near the actual root, it makes more sense to use an error
% tolerance that is twice the magnitude as bisection. Newton tends to compute
% more accurate approximations of the roots in that it converges at a quadratic
% rate.

% 3.
```

---

---

```

secant((x^5 - x^4 + x -1), 0, 3, 10^-6, 100)

secant((x^5 - x^4 + x -1), 0.5, 2, 10^-6, 100)

secant((x^5 - x^4 + x -1), 0.9, 1.2, 10^-6, 100)

% a. When the interval begins closer to the actual root, the secant method
% is more effective than bisection. It takes roughly 11 less iterations,
% however, it takes 4 iterations more than Newton's method.

% b. The size of the interval affects bisection significantly more than the
% secant method.

% 4. The error in the roots makes these algorithms unstable in that
% approximating roots when they are very large can introduce too much error.

```

```
iteration =
```

```
1.0000e+00      0  3.0000e+00  1.5000e+00  3.0312e+00  1.5000e+00
```

```
iteration =
```

```
2.0000e+00      0  1.5000e+00  7.5000e-01 -3.2910e-01  7.5000e-01
```

```
iteration =
```

```
3.0000e+00  7.5000e-01  1.5000e+00  1.1250e+00  3.2523e-01  3.7500e-01
```

```
iteration =
```

```
4.0000e+00  7.5000e-01  1.1250e+00  9.3750e-01 -1.1078e-01  1.8750e-01
```

```
iteration =
```

```
5.0000e+00  9.3750e-01  1.1250e+00  1.0312e+00  6.6593e-02  9.3750e-02
```

```
iteration =
```

```
6.0000e+00  9.3750e-01  1.0312e+00  9.8438e-01 -3.0296e-02  4.6875e-02
```

```
iteration =
```

```
7.0000e+00  9.8438e-01  1.0312e+00  1.0078e+00  1.5872e-02  2.3438e-02
```

```
iteration =
```

---

8.0000e+00	9.8438e-01	1.0078e+00	9.9609e-01	-7.7518e-03	1.1719
iteration =					
9.0000e+00	9.9609e-01	1.0078e+00	1.0020e+00	3.9216e-03	5.8594
iteration =					
1.0000e+01	9.9609e-01	1.0020e+00	9.9902e-01	-1.9493e-03	2.9297
iteration =					
1.1000e+01	9.9902e-01	1.0020e+00	1.0005e+00	9.7752e-04	1.4648
iteration =					
1.2000e+01	9.9902e-01	1.0005e+00	9.9976e-01	-4.8804e-04	7.3242
iteration =					
1.3000e+01	9.9976e-01	1.0005e+00	1.0001e+00	2.4420e-04	3.6621
iteration =					
1.4000e+01	9.9976e-01	1.0001e+00	9.9994e-01	-1.2206e-04	1.8311
iteration =					
1.5000e+01	9.9994e-01	1.0001e+00	1.0000e+00	6.1039e-05	9.1553
iteration =					
1.6000e+01	9.9994e-01	1.0000e+00	9.9998e-01	-3.0517e-05	4.5776
iteration =					
1.7000e+01	9.9998e-01	1.0000e+00	1.0000e+00	1.5259e-05	2.2888
iteration =					
1.8000e+01	9.9998e-01	1.0000e+00	1.0000e+00	-7.6293e-06	1.1444

---

---

iteration =

1.9000e+01	1.0000e+00	1.0000e+00	1.0000e+00	3.8147e-06	5.7220
------------	------------	------------	------------	------------	--------

iteration =

2.0000e+01	1.0000e+00	1.0000e+00	1.0000e+00	-1.9073e-06	2.8610
------------	------------	------------	------------	-------------	--------

iteration =

2.1000e+01	1.0000e+00	1.0000e+00	1.0000e+00	9.5368e-07	1.4305
------------	------------	------------	------------	------------	--------

root =

0.999999761581421

error\_bound =

7.1526e-07

it\_count =

21

ans =

21

iteration =

1.0000e+00	5.0000e-01	2.0000e+00	1.2500e+00	8.6035e-01	7.5000
------------	------------	------------	------------	------------	--------

iteration =

2.0000e+00	5.0000e-01	1.2500e+00	8.7500e-01	-1.9827e-01	3.7500
------------	------------	------------	------------	-------------	--------

iteration =

3.0000e+00	8.7500e-01	1.2500e+00	1.0625e+00	1.4215e-01	1.8750
------------	------------	------------	------------	------------	--------

iteration =

4.0000e+00	8.7500e-01	1.0625e+00	9.6875e-01	-5.8773e-02	9.3750
------------	------------	------------	------------	-------------	--------

---

*iteration =*

5.0000e+00	9.6875e-01	1.0625e+00	1.0156e+00	3.2250e-02	4.6875
------------	------------	------------	------------	------------	--------

*iteration =*

6.0000e+00	9.6875e-01	1.0156e+00	9.9219e-01	-1.5384e-02	2.3438
------------	------------	------------	------------	-------------	--------

*iteration =*

7.0000e+00	9.9219e-01	1.0156e+00	1.0039e+00	7.8739e-03	1.1719
------------	------------	------------	------------	------------	--------

*iteration =*

8.0000e+00	9.9219e-01	1.0039e+00	9.9805e-01	-3.8910e-03	5.8594
------------	------------	------------	------------	-------------	--------

*iteration =*

9.0000e+00	9.9805e-01	1.0039e+00	1.0010e+00	1.9569e-03	2.9297
------------	------------	------------	------------	------------	--------

*iteration =*

1.0000e+01	9.9805e-01	1.0010e+00	9.9951e-01	-9.7561e-04	1.4648
------------	------------	------------	------------	-------------	--------

*iteration =*

1.1000e+01	9.9951e-01	1.0010e+00	1.0002e+00	4.8852e-04	7.3242
------------	------------	------------	------------	------------	--------

*iteration =*

1.2000e+01	9.9951e-01	1.0002e+00	9.9988e-01	-2.4408e-04	3.6621
------------	------------	------------	------------	-------------	--------

*iteration =*

1.3000e+01	9.9988e-01	1.0002e+00	1.0001e+00	1.2209e-04	1.8311
------------	------------	------------	------------	------------	--------

*iteration =*

1.4000e+01	9.9988e-01	1.0001e+00	9.9997e-01	-6.1031e-05	9.1553
------------	------------	------------	------------	-------------	--------

*iteration =*

1.5000e+01	9.9997e-01	1.0001e+00	1.0000e+00	3.0519e-05	4.5776
------------	------------	------------	------------	------------	--------

---

*iteration* =

1.6000e+01 9.9997e-01 1.0000e+00 9.9999e-01 -1.5259e-05 2.2888

*iteration* =

1.7000e+01 9.9999e-01 1.0000e+00 1.0000e+00 7.6295e-06 1.1444

*iteration* =

1.8000e+01 9.9999e-01 1.0000e+00 1.0000e+00 -3.8147e-06 5.7220

*iteration* =

1.9000e+01 1.0000e+00 1.0000e+00 1.0000e+00 1.9074e-06 2.8610

*iteration* =

2.0000e+01 1.0000e+00 1.0000e+00 1.0000e+00 -9.5367e-07 1.4305

*root* =

1.000000238418579

*error\_bound* =

7.1526e-07

*it\_count* =

20

*ans* =

20

*iteration* =

1.0000e+00 9.0000e-01 1.2000e+00 1.0500e+00 1.1078e-01 1.5000

*iteration* =

---

2.0000e+00	9.0000e-01	1.0500e+00	9.7500e-01	-4.7592e-02	7.5000
iteration =					
3.0000e+00	9.7500e-01	1.0500e+00	1.0125e+00	2.5637e-02	3.7500
iteration =					
4.0000e+00	9.7500e-01	1.0125e+00	9.9375e-01	-1.2345e-02	1.8750
iteration =					
5.0000e+00	9.9375e-01	1.0125e+00	1.0031e+00	6.2892e-03	9.3750
iteration =					
6.0000e+00	9.9375e-01	1.0031e+00	9.9844e-01	-3.1153e-03	4.6875
iteration =					
7.0000e+00	9.9844e-01	1.0031e+00	1.0008e+00	1.5649e-03	2.3438
iteration =					
8.0000e+00	9.9844e-01	1.0008e+00	9.9961e-01	-7.8064e-04	1.1719
iteration =					
9.0000e+00	9.9961e-01	1.0008e+00	1.0002e+00	3.9078e-04	5.8594
iteration =					
1.0000e+01	9.9961e-01	1.0002e+00	9.9990e-01	-1.9527e-04	2.9297
iteration =					
1.1000e+01	9.9990e-01	1.0002e+00	1.0000e+00	9.7666e-05	1.4648
iteration =					
1.2000e+01	9.9990e-01	1.0000e+00	9.9998e-01	-4.8826e-05	7.3242
iteration =					

---

---

```

1.3000e+01  9.9998e-01  1.0000e+00  1.0000e+00  2.4415e-05  3.6621

iteration =

1.4000e+01  9.9998e-01  1.0000e+00  9.9999e-01  -1.2207e-05  1.8311

iteration =

1.5000e+01  9.9999e-01  1.0000e+00  1.0000e+00  6.1036e-06  9.1553

iteration =

1.6000e+01  9.9999e-01  1.0000e+00  1.0000e+00  -3.0517e-06  4.5776

iteration =

1.7000e+01  1.0000e+00  1.0000e+00  1.0000e+00  1.5259e-06  2.2888

iteration =

1.8000e+01  1.0000e+00  1.0000e+00  1.0000e+00  -7.6294e-07  1.1444

root =

1.000000190734863

error_bound =

5.7220e-07

it_count =

18

ans =

18

ans =

28

```

---



---

`ans =`

2

`ans =`

5

`ans =`

3

`ans =`

4

`ans =`

6

`ans =`

67

`ans =`

6

`ans =`

10

`ans =`

6

*Published with MATLAB® 7.13*