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

% 1.

syms x

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

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

bisect((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
% 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.

% 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 i
% 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

% 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   1.5000


        iteration =

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


        iteration =

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


        iteration =

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


        iteration =

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


        iteration =

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


        iteration =

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


        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
```

6

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 =
```

8

```
         2


ans =

         5


ans =

         3


ans =

         4


ans =

         6


ans =

        67


ans =

         6


ans =

        10


ans =

         6
```

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