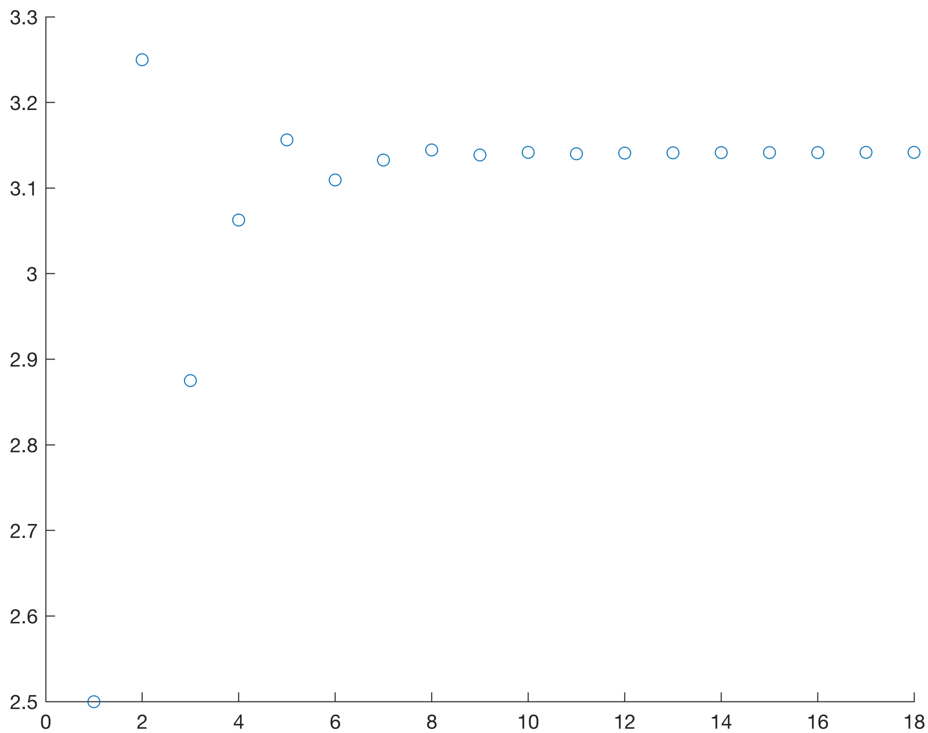
```
%Number 1A
f = @(x) sin(x);
a = 1;
b = 4;
tol = 0.00002;
maxits = 30;

assert(sign(f(a)) ~= sign(f(b)));
assert(a<b);
assert(~isinf(a) && ~isinf(b));

bisection(f,a,b,tol,maxits)
```

```
We are at interation 1
We are at interation 2
We are at interation 3
We are at interation 4
We are at interation 5
We are at interation 6
We are at interation 7
We are at interation 8
We are at interation 9
We are at interation 10
We are at interation 11
We are at interation 12
We are at interation 13
We are at interation 14
We are at interation 15
We are at interation 16
We are at interation 17
We are at interation 18
result = 3.1416
```



```
ans = 3.1416
```

```
% 3.14159
% The tolerance has to be relatively low
% tol < 0.00002 to get an accurate reading
% Takes about 17 iterations to get the
% first 6 desired digits
```

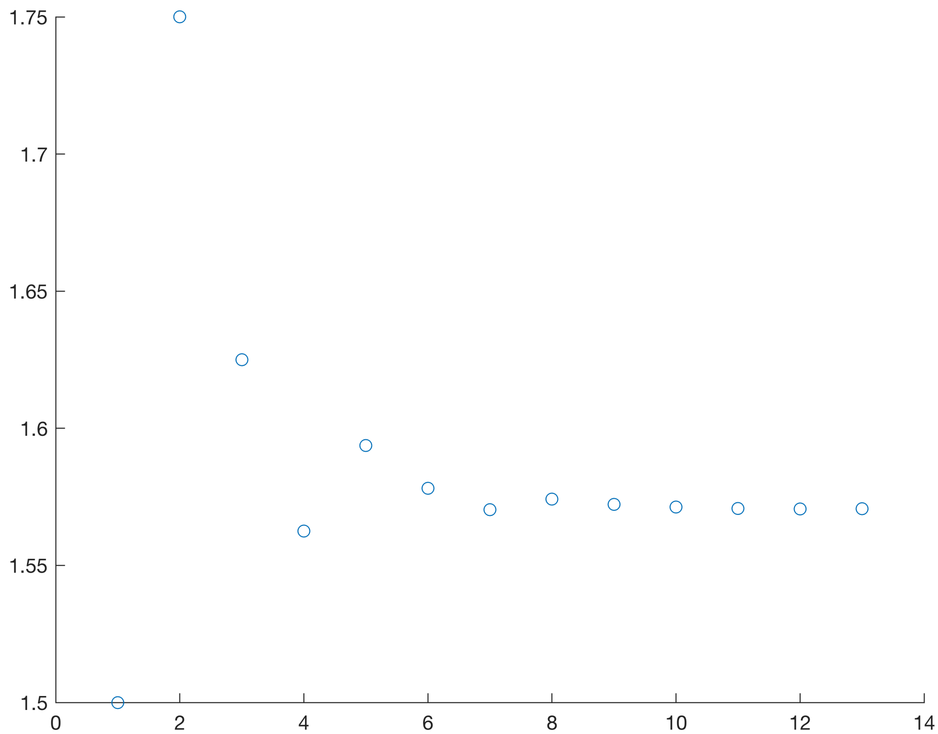
```
%Number 1B
f = @(x) tan(x);
a = 1;
b = 2;
tol = 0.0002;
maxits = 20;

assert(sign(f(a)) ~= sign(f(b)));
assert(a<b);
assert(~isinf(a) && ~isinf(b));

bisection(f,a,b,tol,maxits)
```

```
We are at interation 1
We are at interation 2
We are at interation 3
We are at interation 4
We are at interation 5
We are at interation 6
We are at interation 7
We are at interation 8
```

```
We are at interation 9
We are at interation 10
We are at interation 11
We are at interation 12
We are at interation 13
result = 1.5707
```




```
ans = 1.5707
```

```
%1.570
% Similar to number 1, the tol
% has to be fairly low to get
% an accurate reading. 1.570 is
% about the root. Takes about 10
% iterations
```

```
% Number 2A
fzero(@sin,[1,4])
```

```
ans = 3.1416
```

```
% 3.141592653589793
% This has all the digits correct
```

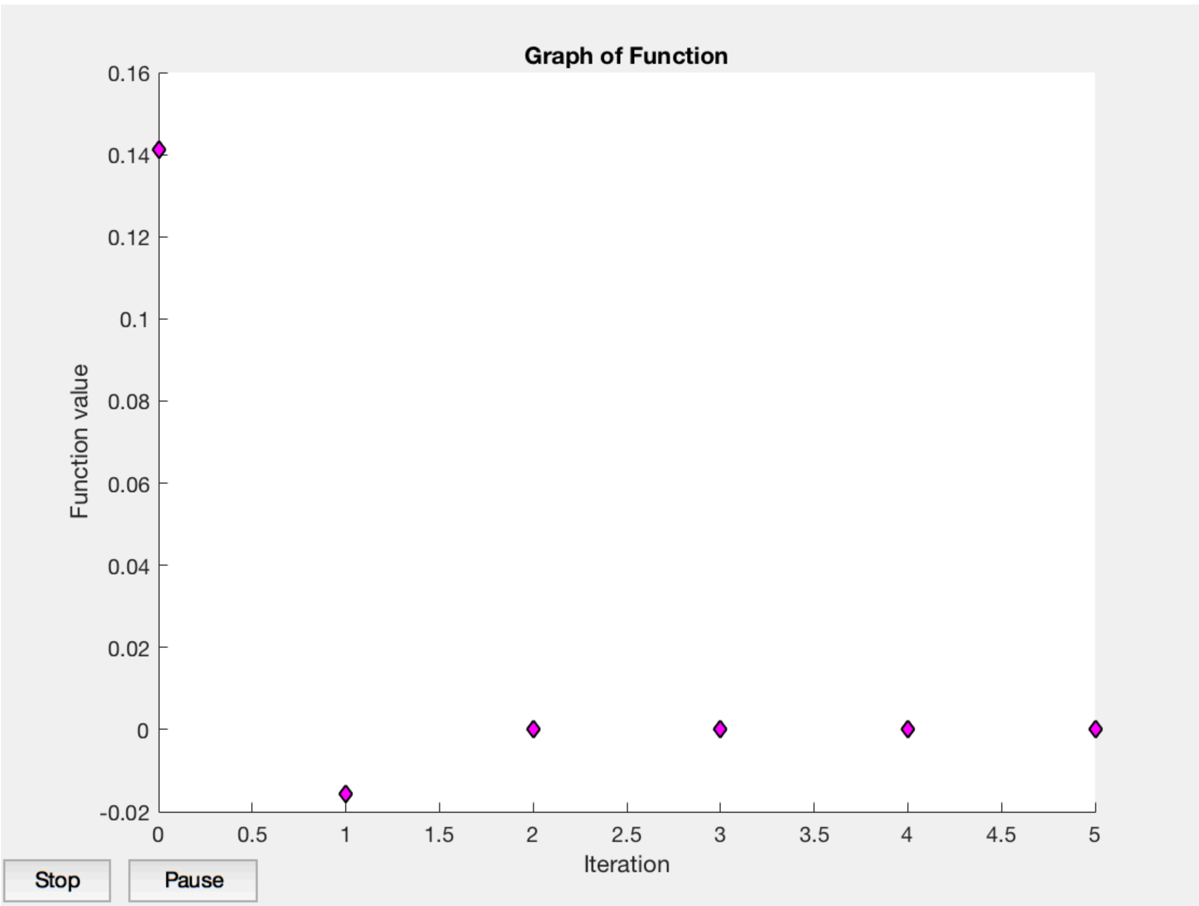
```
%Number 2B
fzero(@tan, [1 2]);
fzero(@tan, [1 2], optimset('Display','iter'));
```

```
Func-count    x          f(x)             Procedure
    2              1       1.55741        initial
    3              2      -2.18504        interpolation
    4        1.85165      -3.46644        interpolation
    5        1.41615        6.4146        bisection
    6        1.47895       10.8572        interpolation
    7         1.6339      -15.8261        bisection
    8        1.61954      -20.4982        interpolation
    9        1.58798      -58.1765        bisection
   10        1.55642       69.5775        bisection
   11        1.55783       77.1347        interpolation
   12        1.56502       173.074        bisection
   13        1.56861       457.679        bisection
   14         1.5722      -710.251        bisection
   15        1.57182       -980.91        interpolation
   16        1.57041       2574.06        bisection
   17        1.57111      -3169.73        interpolation
   18        1.57104      -4124.11        interpolation
   19        1.57088      -11801.6        bisection
   20        1.57072       13697.2        bisection
   21        1.57073       14893.3        interpolation
   22        1.57077       32636.8        bisection
   23        1.57078       80720.7        bisection
   24         1.5708       -170547        bisection
   25        1.57079        306518        interpolation
   26         1.5708       -384460        interpolation
   27         1.5708       -515558        interpolation
   28         1.5708   1.51194e+06        bisection
   29         1.5708  -1.56465e+06        interpolation
   30         1.5708  -1.62117e+06        interpolation
   31         1.5708  -3.36385e+06        bisection
   32         1.5708  -7.27282e+06        bisection
   33         1.5708  -1.73587e+07        bisection
   34         1.5708   4.48791e+07        bisection
   35         1.5708  -5.66155e+07        interpolation
   36         1.5708  -7.66641e+07        interpolation
   37         1.5708   2.16494e+08        bisection
   38         1.5708  -2.37393e+08        interpolation
   39         1.5708  -2.62758e+08        interpolation
   40         1.5708  -5.88385e+08        bisection
   41         1.5708  -1.54689e+09        bisection
   42         1.5708   2.45914e+09        bisection
   43         1.5708   3.48749e+09        interpolation
   44         1.5708  -8.33979e+09        bisection
   45         1.5708   1.19881e+10        interpolation
   46         1.5708   2.13107e+10        interpolation
   47         1.5708  -2.74039e+10        bisection
   48         1.5708   -3.1975e+10        interpolation
   49         1.5708  -7.67527e+10        bisection
   50         1.5708   1.91689e+11        bisection
   51         1.5708  -2.56007e+11        interpolation
   52         1.5708  -3.85261e+11        interpolation
   53         1.5708   7.63028e+11        bisection
   54         1.5708   1.49707e+12        interpolation
   55         1.5708  -1.55633e+12        bisection
   56         1.5708  -1.58761e+12        interpolation
   57         1.5708  -3.24064e+12        bisection
   58         1.5708  -6.76496e+12        bisection
   59         1.5708  -1.48279e+13        bisection
   60         1.5708  -3.64003e+13        bisection
   61         1.5708   7.86301e+13        bisection
   62         1.5708  -1.33542e+14        interpolation
   63         1.5708   1.93489e+14        interpolation
```

```
   64          1.5708   3.66869e+14        interpolation
   65          1.5708  -4.19946e+14        bisection
   66          1.5708  -5.83048e+14        interpolation
   67          1.5708  -1.20927e+15        bisection

Current point x may be near a singular point. The interval [1, 2]
reduced to the requested tolerance and the function changes sign in the interval,
but f(x) increased in magnitude as the interval reduced.
```

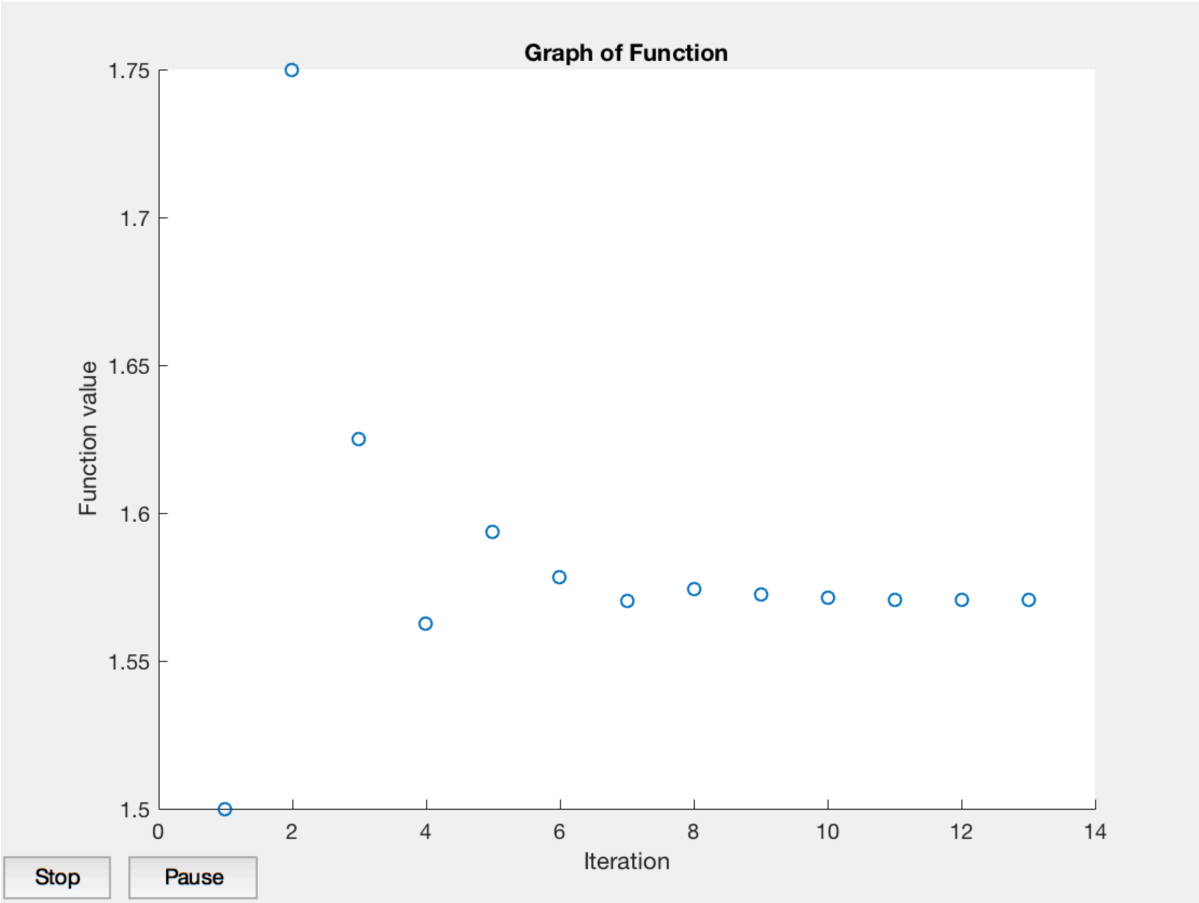
```
%Number 2C
fzero(@sin, [3 4], optimset('PlotFcns',@optimplotfval));
title('Graph of Function');
```




```
%Number 2D
%Update the function
bisection(f,a,b,tol,maxits,'inter');
```

```
We are at interation 1
We are at interation 2
We are at interation 3
We are at interation 4
We are at interation 5
We are at interation 6
We are at interation 7
We are at interation 8
```

```
We are at interation 9
We are at interation 10
We are at interation 11
We are at interation 12
We are at interation 13
result = 1.5707
```




```
function result = bisection(f, a, b, tol, maxits, iter)
% f is function
% a,b is the interval
% tol is the tolerance before we encounter an error (27)
% maxits is the number of ints allowed

    %fzero(f, [a b]);
    %fzero(f, [a b], optimset('Display','iter'))
    %fzero(f, [a b], optimset('PlotFcns', @optimplotfval))

    if (f(a) == 0)
        result = a;
        return;
    elseif f(b) == 0
        result = b;
        return;
    end

    x = 0;
    y = 0;
```

```
    for i=1:maxits
        fprintf("We are at interation "+ i + "\n");
        c = (a+b)/2;
        x(i) = i;
        y(i) = c;
        if f(c) == 0 || (b-a)/2 < tol
           result = c
           break;
        end
        if sign(f(c)) ~= sign(f(a))
            %print(root if left of the subinterval)
            b = c; %a stays unchanged
        else
            a = c; %b stays unchanged
        end

        result = c;
    end
        if ((b-a)/2 > tol)
            fprintf("We're going to need more iterations!");
        end
        title('Graph of Function');
        scatter(x, y);

end
```