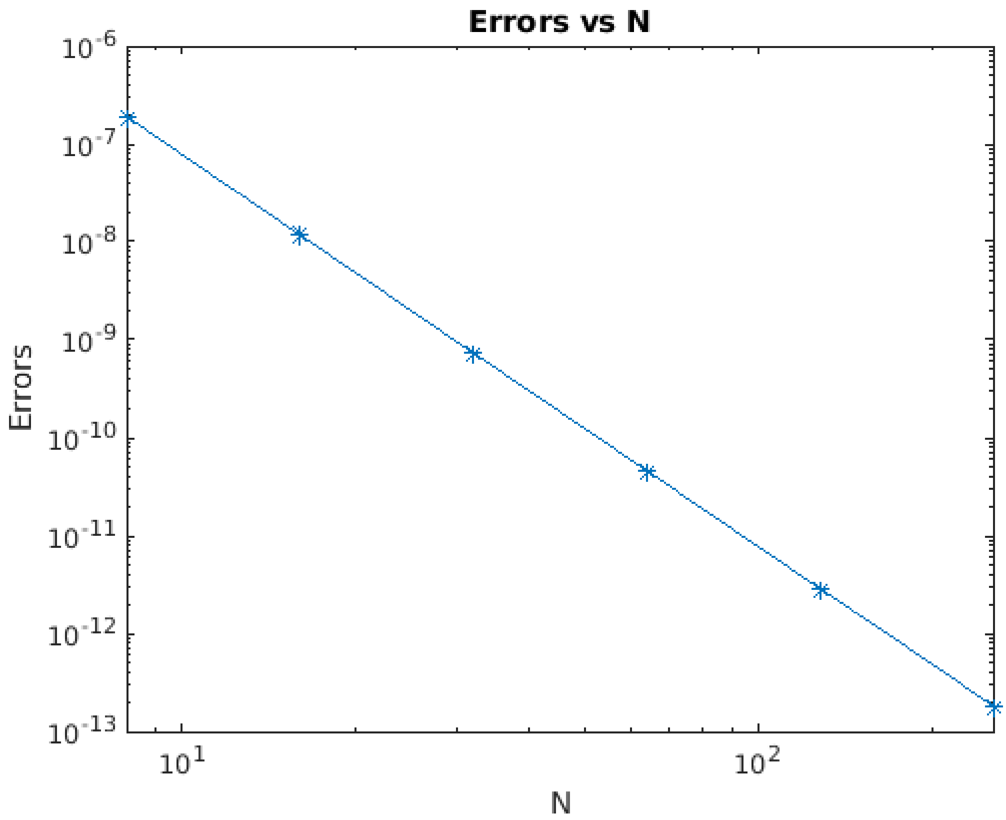
```
% The program uses Simpson's rule to evaluate the arc length along an
% ellipse. at t=b=1

clear all
close all

a = 0; b = 1;
A = 1; B = 0.5;
k = sqrt(1 - (B/A)^2);
f = @(x) A*(sqrt(1 - k^2*(sin(x)).^2));

%exact solution
Tex =  0.8866251235367069482;

n = [8,16,32,64,128,256];
c = length(n);
Error = [];

for i = 1:c

    S= simpson(a,b,f,n(i));
    error = abs(S-Tex);
    Error = [Error,error];

end

%Table of errors
Table = table(n(:),Error(:),'VariableNames',{'N','Error'})

%loglog plot
loglog(n,Error,'-*'); xlim('auto');
title('Errors vs N');
xlabel('N'); ylabel('Errors');

%order of convergence
p = polyfit(log(n),log(Error),1); p(1)

fprintf('Hence order of convergence is 4\n');

function [S] = simpson(a,b,f,n)
    h = (b-a)/n;
    xe = linspace(a,b,n+1); %Nodes at edges
    xc = xe(1:end-1) + h/2; %Nodes at centers

    fe = f(xe);
    fc = f(xc);

    M = h*sum(fc);

    T = (h/2)*(fe(1) + 2*sum(fe(2:end-1)) + fe(end));

    S = (T + 2*M)/3;
end
```

```
Table =

  6×2 table

     N       Error
    ___    __________

      8    1.8594e-07
```

```
     16    1.1632e-08
     32    7.2718e-10
     64    4.5451e-11
    128    2.8406e-12
    256    1.7719e-13


ans =

   -4.0001
```

Hence order of convergence is 4



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