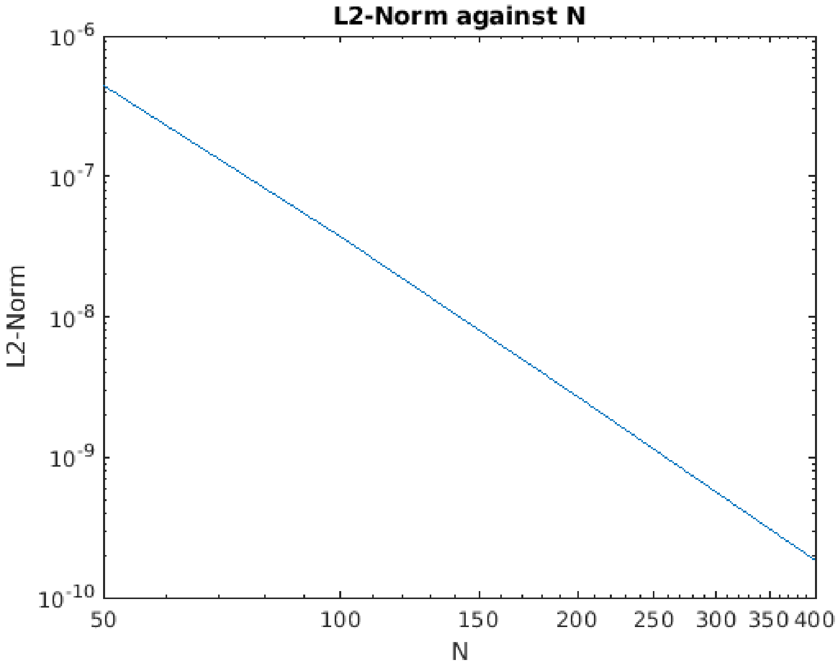
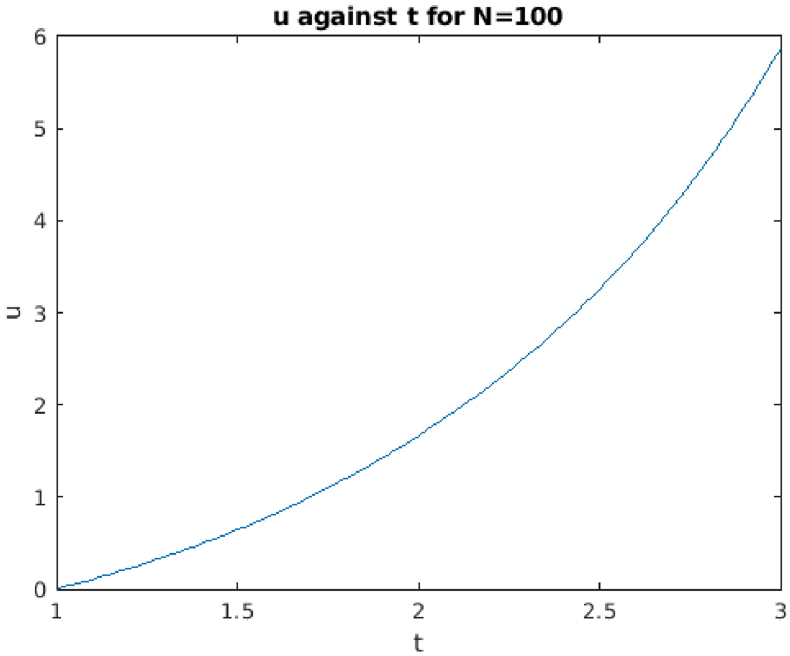
```
%This program uses abm4 to solve the initial value problem

a=1;b=3;
uo = 0;

N = [50; 100; 200; 400];

f = @(t,u) 1 + (u/t) + (u/t)^2;

%exact solution
uexact = @(t) t.*tan(log(t));

L2 = zeros(4,1);
error = zeros(4,1);

for j = 1:4

    [t,u] = abm4(f,a,b,uo,N(j));

    err = u - uexact(t);

    error(j) = err(N(j) +1);

    L2(j) = L2Norm(uexact(t),u);

end

%Table showing timing results of each method and for each value of m.
t1 = [3;3;3;3];
Table4 = table(t1,N,error, 'VariableNames',{'t','N','Error'})

fprintf('Since as N increases the decreases, hence the larger th N the better convergence of the \n the solution\n');

p = polyfit(log(N),log(L2(:)),1);

fprintf('\nThe order of convergence is %.4f\n',p(1))
fprintf('which is approximately -4, and it is  the same as the slope of the lolog plot\n');

figure(1);
loglog(N,L2);
xlabel('N');
ylabel('L2-Norm');
title('L2-Norm against N');

figure(2);
[t,u] = abm4(f,a,b,uo,N(2));
plot(t,u);
xlabel('t');
ylabel('u');
title('u against t for N=100');

%relative two norm of the error
function L2 = L2Norm(uex,uap)
R = (uex - uap).^2;
L2 = sqrt(sum(R)/sum(uap.^2));
end
```

```
Table4 =

  4×3 table

    t     N       Error   
    _    ___    __________

    3     50    3.4945e-06
    3    100    2.9569e-07
    3    200     2.147e-08
    3    400    1.4463e-09

Since as N increases the decreases, hence the larger th N the better convergence of the
 the solution

The order of convergence is -3.7458
which is approximately -4, and it is  the same as the slope of the lolog plot
```




*Published with MATLAB® R2020a*