Name: Rajan Kumar

Section: 2A

MA202

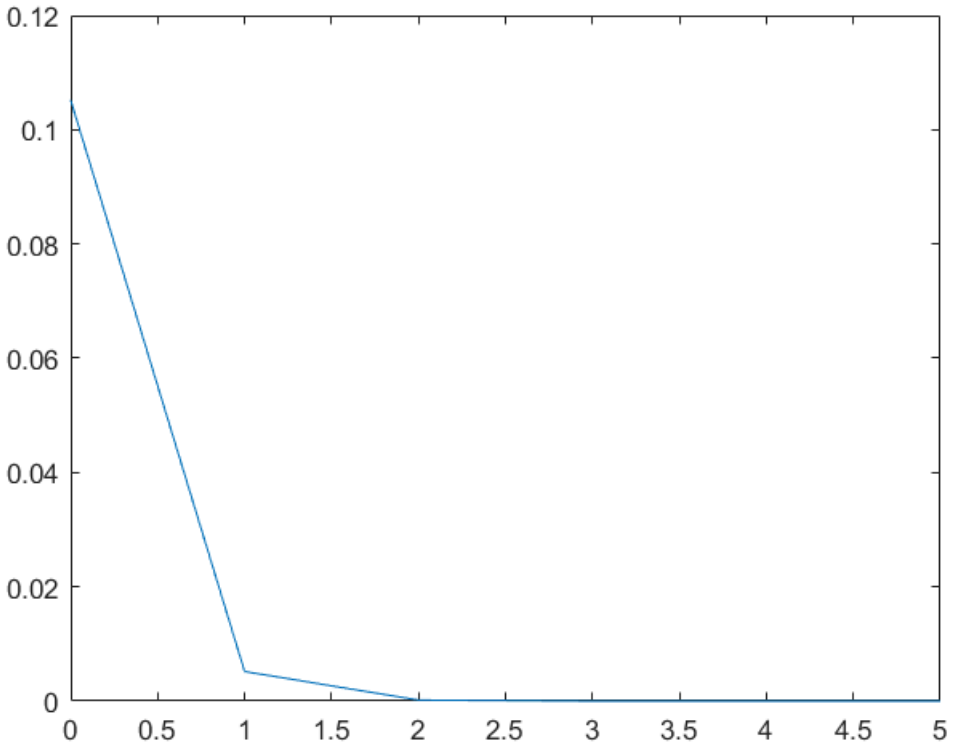
ID: 202051152

Q1.

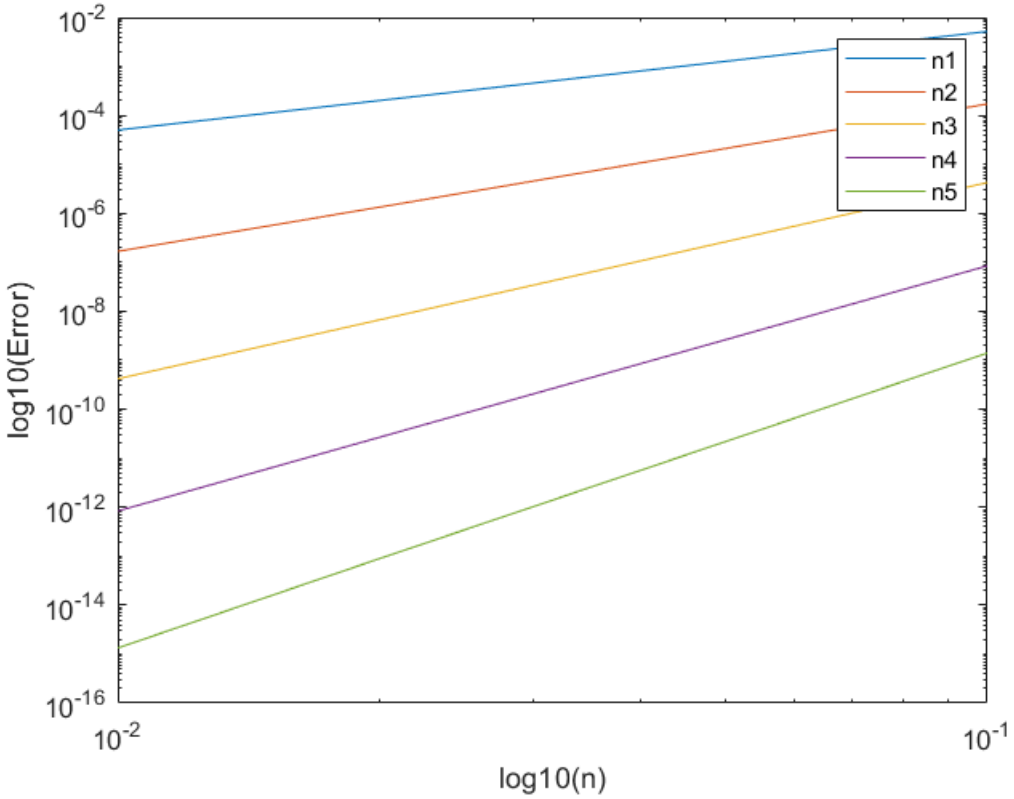
```
% a
a = 0.1;
trueval=exp(a);
expval = 1;
currentterm = 1;
prompt = 'Enter the value of n';
n = input(prompt);
for i = 1 : n %loop to calculate the expected value of exp(a)
currentterm = currentterm*(a/i);
expval(i+1)=expval(i)+currentterm;
end
Error=abs(trueval-expval(n+1)); % error in calculating = trueval-expval
fprintf('Error in calculating e^0.1 for n=%d is %1.20f',n,Error);
```

```
Error in calculating e^0.1 for n=6 is 0.00000000002009237221
```

```
% b.
a = 0.1;
trueval=exp(a);
expval = 1;
currentterm = 1;
for i = 1 : 5
currentterm = currentterm*(a/i);
expval(i+1)=expval(i)+currentterm;
end
Error=abs(trueval-expval); % error in calculating = trueval-expval
n=[0:1:5];
plot(n,Error)
```




```
% c.
aAll=[0.1 0.05 0.02 0.01]; %array of all the step sizes
vec=[1:5]; %array of all the values of n
Error=[];
for i=1:length(aAll) %loop for calculating error of all the step sizes
a=aAll(i); %selecting of individual step sizes as a
terms=a.^vec./cumprod(vec); %makes as array of the value of nth term
expval=1+cumsum(terms); %makes an array of expexted value at each value of n
trueval=exp(a);
Error=[Error;abs(trueval-expval)]; %this makes an matrix of size 4X5 where each column
end
loglog(aAll,Error);
xlabel('log10(n)');
ylabel('log10(Error)');
legend('n1','n2','n3','n4','n5');
```

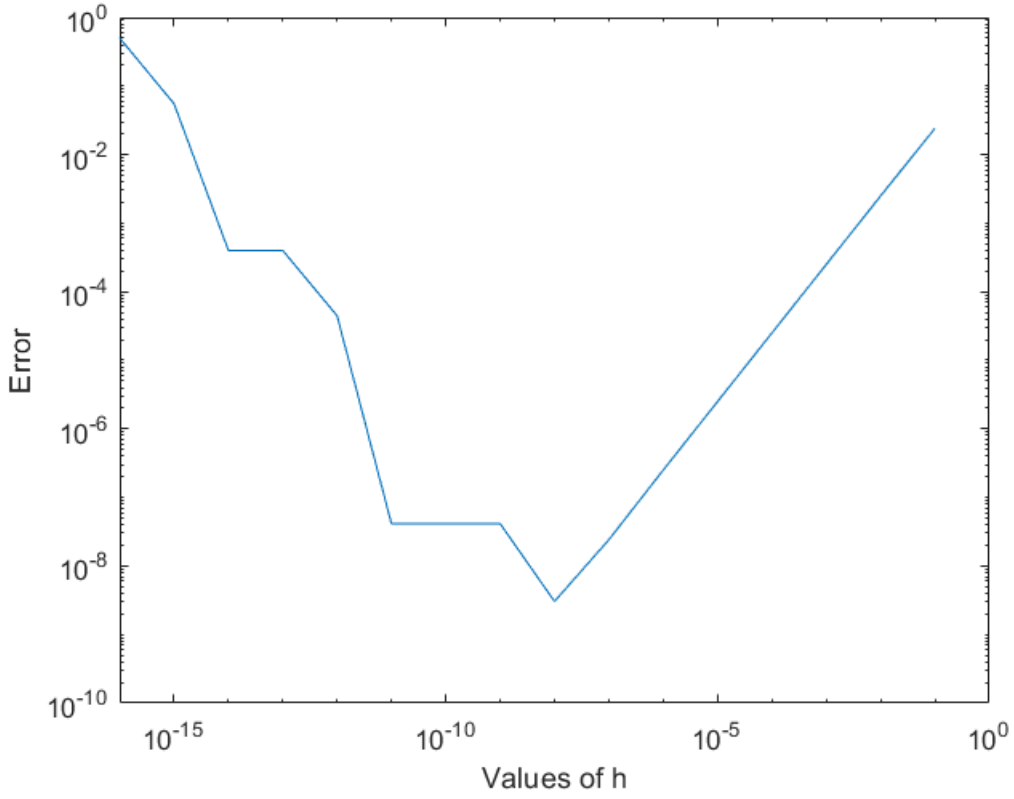


Q2.

```
% a.
prompt = 'Write the value of x';
x = input(prompt);
result=1/(1+x*x) %derivative of atan(x)
```

```
result = 0.0270
```

```
% b.
a=1;
trueval=1/(1+a*a); %derivative of atan(a)
Error=[];%creation of Error array
for i=1:16 %loop for executive error of different stepsizes
h=10^-i;
expval=(atan(a+h)-atan(a))/h;
Error(i)=abs(trueval-expval);%creates an array of 1X16 values of array at different valyes
end
n=[-1:-1:-16];
h=10.^n;%array of 16 different values of h
loglog(h,Error) %grapg betweeen values of h and Error
xlabel('Values of h');
ylabel('Error');
```



Q3.

```
% a.
A=[1.01 0.99;0.99 1.01];
b1=[2;2];
x=A\b1
```

```
x = 2×1
    1.0000
    1.0000
```

```
% b.
A=[1.01 0.99;0.99 1.01];
%b1=[2;2];
%x=A\b1
b2=[2.02;1.98];
x2=A\b2
```

```
x2 = 2×1
    2.0000
   -0.0000
```

```
% c.
A=[1.01 0.99;0.99 1.01];
b1=[2;2];
x=A\b1;
b2=[2.02;1.98];
x2=A\b2;
```

```
fprintf('Condition number of the given Matrix is');
```

```
Condition number of the given Matrix is
```

```
kappa=cond(A)
```

```
kappa = 100.0000
```

```
fprintf('The upper bound on the possible change in x indicates changes in all of the significar
```

```
The upper bound on the possible change in x indicates changes in all of the significant digits.
```

```
kappa*norm(b1-b2)/norm(b1)
```

```
ans = 1.0000
```

```
fprintf('The actual change in x resulting from this perturbation is');
```

```
The actual change in x resulting from this perturbation is
```

```
norm(x-x2)/norm(x)
```

```
ans = 1.0000
```

```
fprintf('Relative Error in observation is');
```

```
Relative Error in observation is
```

```
norm(b1-b2)/norm(b1)
```

```
ans = 0.0100
```

Q4.

```
A=[1.01 0.99;0.99 1.01];
b1=[2;2]; % observation vector b1
x=A\b1;
b2=[2.02;1.98]; % observation vector b2
x2=A\b2;
fprintf('Backward error is');
```

```
Backward error is
```

```
norm(b1-b2) % Backward error
```

```
ans = 0.0283
```