Assignment 5

Group Number 32

Software used: **Matlab**

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1. Integration of $\int_0^3 e^{-x} \sin x \, dx$

a. Trapezoidal Method

Code	Output
``clearvars``` ```clc``` ```fprintf('Trapezoidal Integration\n\n');``` ```n=input('Enter the number of subinterval = ');``` ```Ia=input('Actual value of Integration = ');``` ```a=0;``` ```b=3;``` ```h=(b-a)/n;``` ```x=a:h:b;``` ```y=exp(-x).*sin(x);``` ```%Trapezoidal Rule Formula``` ```sum=sum(y(2:n));``` ```I=h/2*(y(1)+y(n+1)+(2*sum));``` ```error=I-Ia;``` ```fprintf('\nIntegration by Trapezoidal Rule');``` ```I``` ```fprintf('Deviation from actual value ');``` ```error```	**a. For n = 10** Trapezoidal Integration Enter the number of subinterval = 10 Actual value of Integration = .5211314363 Integration by Trapezoidal Rule I = 0.513232627813492 Deviation from actual value error = -0.007898808486508 **b. For n = 30** Trapezoidal Integration Enter the number of subinterval = 30 Actual value of Integration = .5211314363 Integration by Trapezoidal Rule I = 0.520251463655403 Deviation from actual value error = -8.799726445967160e-04

	c. For n = 60 Trapezoidal Integration Enter the number of subinterval = 60 Actual value of Integration = .5211314363 Integration by Trapezoidal Rule I = 0.520911388830059 Deviation from actual value error = -2.200474699414201e-04

N	Numerical Value	Error
10	0.513232627813492	-0.007898808486508
30	0.520251463655403	-8.799726445967160e-04
60	0.520911388830059	-2.200474699414201e-04

b. Simpsons 1/3rd Rule

<table>
<tr><th>Code</th><th>Output</th></tr>
<tr><td>

```
clearvars
clc
fprintf('Simpson 1/3 Rule Integration\n\n');
n=input('Enter the number of subinterval = ');
Ia=input('Actual value of Integration = ');
a=0;
b=3;
h=(b-a)/n;
x=a:h:b;
y=exp(-x).*sin(x);

%Simpson 1/3 Rule Formula
sum1=0;
sum2=0;

for i=2:n
 %For choosing even and odd index in fromula
   if rem(i,2) == 0
      sum1=sum1+y(i);
   else
      sum2=sum2+y(i);
   end
end

I=h/3*(y(1)+y(n+1)+(2*sum2)+(4*sum1));
error=I-Ia;
fprintf('\nIntegration by Trapezoidal Rule');
I
fprintf('Deviation from actual value ');
error
```

</td><td>

a. For n = 10

```
Simpson 1/3 Rule Integration

Enter the number of subinterval = 10
Actual value of Integration = .5211314363

Integration by Trapezoidal Rule
I =

  0.521035634160109

Deviation from actual value
error =

   -9.580213989079933e-05
```

b. For n = 30

```
Simpson 1/3 Rule Integration

Enter the number of subinterval = 30
Actual value of Integration = .5211314363

Integration by Trapezoidal Rule
I =

  0.521130275452745

Deviation from actual value
error =

   -1.160847255432529e-06
```

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</table>

	c. For n = 60 Simpson 1/3 Rule Integration Enter the number of subinterval = 60 Actual value of Integration = .5211314363 Integration by Trapezoidal Rule I = 0.521131363888277 Deviation from actual value error = -7.241172295113785e-08

N	Numerical Value	Error
10	0.521035634160109	-9.580213989079933e-05
30	0.521130275452745	-1.160847255432529e-06
60	0.521131363888277	-7.241172295113785e-08

c. Gauss Quadrature Rule

<table>
<tr><th>Code</th><th>Output</th></tr>
<tr><td>

```
clearvars
clc
a=0;
b=3;
fprintf('Gauss Quadrature Integration\n');
n=input('\nSpecify order of gauss quadrature: ');
Ia=input('Actual value of Integration = ');

% Building the component matrix CMP
% CMP is such that det(xI-CMP)=P_n(x),P_n is Legendre polynomial
% CMP is symmetric matrix.
i   = 1:n-1;
dummy   = i./sqrt(4*i.^2-1);
CMP  = diag(dummy,1) + diag(dummy,-1);

% Determining the abscissas (x) and weights (w)
% abscissas are the roots of the characteristic polynomial (eigen values)
% weights can be derived from the corresponding eigenvectors.
[e_vect e_val]   = eig(CMP);
[Points k] = sort(diag(e_val));
e_vect = e_vect(:,k)';
Weights = 2 * e_vect(:,1).^2;
fprintf('\nTable points and weights are for interval [-1,1]\n');
Table= table(Points,Weights)
%conversion from [-1,1] to [a,b]
Points=(Points*(b-a)+a+b)/2.0;
y=exp(-Points).*sin(Points);
w=(b-a)*Weights/2;
fprintf('\nTable points and weights are for interval [%d,%d]\n',a,b);
Table= table(Points,Weights)
I=w'*y;
error=I-Ia;
fprintf('\nIntegration by Trapezoidal Rule');
I
fprintf('Deviation from actual value ');
error
```

</td><td>

a. For n = 10

```
Gauss Quadrature Integration

Specify order of gauss quadrature: 10
Actual value of Integration = .5211314363

Table points and weights are for interval [-1,1]

Table =

      Points               Weights
    ___________________    ___________________

    -0.973906528517171     0.0666713443086883
    -0.865063366688985     0.149451349150581
    -0.679409568299025     0.219086362515981
    -0.433395394129247     0.269266719309997
    -0.148874338981631     0.295524224714753
     0.148874338981631     0.295524224714753
     0.433395394129247     0.269266719309996
     0.679409568299024     0.219086362515982
     0.865063366688984     0.149451349150581
     0.973906528517172     0.0666713443086884


Table points and weights are for interval [0,3]

Table =

      Points               Weights
    ___________________    ___________________

    0.0391402072242428     0.0666713443086883
     0.202404949966523     0.149451349150581
     0.480885647551463     0.219086362515981
     0.849906908806129     0.269266719309997
      1.27668849152755     0.295524224714753
      1.72331150847245     0.295524224714753
      2.15009309119387     0.269266719309996
      2.51911435244854     0.219086362515982
      2.79759505003348     0.149451349150581
      2.96085979277576     0.0666713443086884
```

</td></tr>
</table>

Integration by Trapezoidal Rule
I =

0.521131436311284

Deviation from actual value
error =

1.128408477768517e-11

b. For n = 30

Gauss Quadrature Integration

Specify order of gauss quadrature: 30
Actual value of Integration = .5211314363

Table points and weights are for interval [-1,1]

Table =

Points	Weights
-0.996893484074649	0.0079681924961671
-0.983668123279747	0.0184664683110903
-0.960021864968308	0.0287847078833241
-0.926200047429274	0.0387991925696271
-0.882560535792053	0.0484026728305933
-0.829565762382768	0.0574931562176187
-0.767777432104826	0.0659742298821809
-0.697850494793316	0.0737559747377054
-0.620526182989243	0.08075589522942
-0.53662414814202	0.0868997872010829
-0.447033769538089	0.0921225222377862
-0.352704725530878	0.0963687371746441
-0.25463692616789	0.0995934205867952
-0.153869913608584	0.101762389748405
-0.0514718425553178	0.102852652893558
0.0514718425553176	0.102852652893559
0.153869913608583	0.101762389748406
0.25463692616789	0.0995934205867953
0.352704725530878	0.0963687371746442
0.447033769538089	0.0921225222377858
0.53662414814202	0.0868997872010828
0.620526182989243	0.0807558952294205
0.697850494793316	0.0737559747377052
0.767777432104826	0.0659742298821799
0.829565762382768	0.0574931562176193
0.882560535792052	0.0484026728305945
0.926200047429274	0.0387991925696271
0.960021864968307	0.0287847078833229
0.983668123279747	0.0184664683110908
0.996893484074649	0.00796819249616663

Table points and weights are for interval [0,3]

Table =

Points	Weights
0.00465977388802585	0.0079681924961671
0.0244978150803796	0.0184664683110903
0.0599672025475384	0.0287847078833241
0.110699928856088	0.0387991925696271
0.176159196311921	0.0484026728305933
0.255651356425847	0.0574931562176187
0.348333851842761	0.0659742298821809
0.453224257810027	0.0737559747377054
0.569210725516136	0.08075589522942
0.69506377778697	0.0868997872010829
0.829449345692866	0.0921225222377862
0.970942911703683	0.0963687371746441
1.11804461074817	0.0995934205867952
1.26919512958712	0.101762389748405
1.42279223616702	0.102852652893558
1.57720776383298	0.102852652893559
1.73080487041288	0.101762389748406
1.88195538925183	0.0995934205867953
2.02905708829632	0.0963687371746442
2.17055065430713	0.0921225222377858
2.30493622221303	0.0868997872010828
2.43078927448386	0.0807558952294205
2.54677574218997	0.0737559747377052
2.65166614815724	0.0659742298821799
2.74434864357415	0.0574931562176193
2.82384080368808	0.0484026728305945
2.88930007114391	0.0387991925696271
2.94003279745246	0.0287847078833229
2.97550218491962	0.0184664683110908
2.99534022611197	0.00796819249616663

Integration by Trapezoidal Rule
I =

0.521131436311284

Deviation from actual value
error =

1.128375171077778e-11

c. For n = 60

Gauss Quadrature Integration

Specify order of gauss quadrature: 60
Actual value of Integration = .5211314363

Table points and weights are for interval [-1,1]

Table =

Points	Weights
-0.999210123227436	0.00202681196887369
-0.995840525118838	0.00471272992695357
-0.989787895222222	0.00738993116334517
-0.981067201752598	0.0100475571822884
-0.969701788765053	0.0126781664768159
-0.955722255839996	0.0152746185967853
-0.939166276116423	0.017829901014208
-0.920078476177628	0.0203371207294569
-0.898510310810046	0.0227895169439974
-0.874519922646898	0.0251804776215212
-0.848171984785929	0.0275035567499242
-0.819537526162146	0.029752491500789
-0.788693739932264	0.0319212190192966
-0.755723775306585	0.034003892724946
-0.72071651335573	0.0359948980510852
-0.683766327381355	0.0378888675692432
-0.644972828489477	0.0396806954523805
-0.60444059704851	0.041365551235585
-0.562278900753944	0.0429388928359354
-0.51860140005857	0.0443964787957871
-0.473525841761707	0.0457343797161145
-0.427173741583078	0.0469489888489121
-0.379670056576798	0.0480370318199712
-0.331142848268448	0.048995575455757
-0.281722937423262	0.0498220356905501
-0.231543551376029	0.0505141845325096
-0.180739964873426	0.0510701560698554
-0.129449135396945	0.0514884515009808
-0.0778093339495365	0.0517679431749103
-0.0259597723012477	0.0519078776312202
0.025959772301248	0.0519078776312207
0.0778093339495365	0.0517679431749105
0.129449135396945	0.0514884515009808
0.180739964873426	0.0510701560698562
0.231543551376029	0.0505141845325093
0.281722937423262	0.0498220356905503
0.331142848268448	0.0489955754557568
0.379670056576798	0.0480370318199711
0.427173741583078	0.046948988848912
0.473525841761707	0.0457343797161142
0.51860140005857	0.0443964787957868
0.562278900753945	0.0429388928359357

0.60444059704851	0.0413655512355851
0.644972828489477	0.0396806954523809
0.683766327381355	0.0378888675692436
0.720716513355731	0.0359948980510841
0.755723775306586	0.0340038927249463
0.788693739932264	0.0319212190192959
0.819537526162146	0.0297524915007894
0.84817198478593	0.0275035567499249
0.874519922646898	0.0251804776215215
0.898510310810046	0.0227895169439978
0.920078476177627	0.0203371207294572
0.939166276116423	0.0178299010142079
0.955722255839996	0.0152746185967845
0.969701788765053	0.0126781664768157
0.981067201752598	0.0100475571822879
0.989787895222222	0.00738993116334542
0.995840525118838	0.0047127299269536
0.999210123227436	0.00202681196887372

Table points and weights are for interval [0,3]

Table =

Points	Weights
0.00118481515884561	0.00202681196887369
0.00623921232174252	0.0047127299269535
0.0153181571666674	0.00738993116334517
0.0283991973711024	0.0100475571822884
0.045447316852421	0.0126781664768159
0.0664166162400055	0.0152746185967853
0.0912505858253647	0.017829901014208
0.119882285733558	0.0203371207294569
0.152234533784931	0.0227895169439974
0.188220116029652	0.0251804776215212
0.227742022821106	0.0275035567499242
0.270693710756782	0.029752491500789
0.316959390101604	0.0319212190192966
0.366414337040122	0.034003892724946
0.418925229966404	0.0359948980510852
0.474350508927967	0.0378888675692432
0.532540757265785	0.0396806954523805
0.593339104427235	0.041365551235585
0.656581648869083	0.0429388928359354
0.722097899912145	0.0443964787957871
0.789711237357439	0.0457343797161145
0.859239387625382	0.0469489888489121
0.930494915134803	0.0480370318199712
1.00328572759733	0.048995575455757
1.07741559386511	0.0498220356905501
1.15268467293596	0.0505141845325096
1.22889005268986	0.0510701560698554
1.30582629690458	0.0514884515009808
1.3832859990757	0.0517679431749103
1.46106034154813	0.0519078776312202

1.53893965845187	0.0519078776312207
1.6167140009243	0.0517679431749105
1.69417370309542	0.0514884515009808
1.77110994731014	0.0510701560698562
1.84731532706404	0.0505141845325093
1.92258440613489	0.0498220356905503
1.99671427240267	0.0489955754557568
2.0695050848652	0.0480370318199711
2.14076061237462	0.046948988848912
2.21028876264256	0.0457343797161142
2.27790210008785	0.0443964787957868
2.34341835113092	0.0429388928359357
2.40666089557277	0.0413655512355851
2.46745924273422	0.0396806954523809
2.52564949107203	0.0378888675692436
2.5810747700336	0.0359948980510841
2.63358566295988	0.0340038927249463
2.6830406098984	0.0319212190192959
2.72930628924322	0.0297524915007894
2.77225797717889	0.0275035567499249
2.81177988397035	0.0251804776215215
2.84776546621507	0.0227895169439978
2.88011771426644	0.0203371207294572
2.90874941417463	0.0178299010142079
2.93358338375999	0.0152746185967845
2.95455268314758	0.0126781664768157
2.9716008026289	0.0100475571822879
2.98468184283333	0.00738993116334542
2.99376078767826	0.00471272992695366
2.99881518484115	0.00202681196887372

Integration by Trapezoidal Rule
I =

0.521131436311284

Deviation from actual value
error =

1.128397375538270e-11

N	Numerical Value	Error
10	0.521131436311284	1.128408477768517e-11
30	0.521131436311284	1.128375171077778e-11
60	0.521131436311284	1.128397375538270e-11

d. Modified Trapezoidal Rule

<table>
<tr><th>Code</th><th>Output</th></tr>
<tr><td>

```
clearvars
clc
fprintf('Modified Trapezoidal Rule Integration\n\n');
n=input('Number of subintervals: ');
Ia=input('Actual value of Integration = ');
a=0;
b=3;
h=(b-a)/n;
x=a:h:b;
dif=(exp(-x).*cos(x))-(exp(-x).*sin(x));
y=exp(-x).*sin(x);
sum1=0;
sum2=0;
for i=1:1:n+1
   sum1= sum2+((y(i).*2)+(dif(i).*(h)));
   sum2=sum1;
end
sum1=(sum1*h/2);
%Trapezoidal Rule Formula
error=sum1-Ia;
fprintf('\nIntegration by Trapezoidal Rule');
sum1
fprintf('Deviation from actual value ');
error
```

</td><td>

a. For n = 10

```
Modified Trapezoidal Rule Integration

Number of subintervals: 10
Actual value of Integration = .5211314363

Integration by Trapezoidal Rule
sum1 =

  0.538934247733972

Deviation from actual value
error =

  0.017802811433972
```

b. For n = 30

```
Modified Trapezoidal Rule Integration

Number of subintervals: 30
Actual value of Integration = .5211314363

Integration by Trapezoidal Rule
sum1 =

  0.523400712781964

Deviation from actual value
error =

  0.002269276481964
```

</td></tr>
</table>

	c. For n = 60 Modified Trapezoidal Rule Integration Number of subintervals: 60 Actual value of Integration = .5211314363 Integration by Trapezoidal Rule sum1 = 0.521863419767683 Deviation from actual value error = 7.319834676834391e-04

N	Numerical Value	Error
10	0.538934247733972	0.017802811433972
30	0.523400712781964	0.002269276481964
60	0.521863419767683	7.319834676834391e-04

- **Comparision of Results**

Error Table for all methods and different intervals

Method/Sub Interval	10	30	60
Trapezoidal	-0.007898808486508	-8.799726445967160e-04	-2.200474699414201e-04
Simpson 1/3	-9.580213989079933e-05	-1.160847255432529e-06	-7.241172295113785e-08
Gauss Quadrature	1.128408477768517e-11	1.128375171077778e-11	1.128397375538270e-11
Modified Trapezoidal	0.017802811433972	0.002269276481964	7.319834676834391e-04

- Comparison in Method

a) <u>Trapezoidal Rule</u>

- The error goes on decreasing as interval increases
- Method underestimates the results for all N and the converges to exact solution

b) Simpson 1/3 rule

- The error goes on decreasing as interval increases
- Method underestimates the results for all N and the converges to exact solution

c) Gauss Quadrature Rule

- The error goes on decreasing as interval increases
- Method over estimates the results for all N and the converges to exact solution

d) Modified Trapezoidal Rule

- The error goes on decreasing as interval increases
- Method over estimates the results for all N and the converges to exact solution

➢ Comparison in Intervals considering only absolute values of error

a) N = 10

- Error in Modified trapezoidal>Trapezoidal rule>Simpson 1/3 rule>Gauss Quadrature

b) N = 30

- Error in Modified trapezoidal>Trapezoidal rule>Simpson 1/3 rule>Gauss Quadrature

c) N = 60

- Error in Modified trapezoidal>Trapezoidal rule>Simpson 1/3 rule>Gauss Quadrature

2. Differentiation of $e^{-x}\sin(x)$

a. Differentiation scheme

Code

```
clc
clearvars
a=0;
b=3;
fprintf('Differntiation schemes\n\n');
n=input('Number of intervals: ');
h=(b-a)/n;
x=a:h:b;
y=exp(-x).*sin(x);
dxf=zeros(1,n+1);
dxb=dxf;
dxc=dxf;

for i= 1:n
   dxf(i)=(y(i+1)-y(i))/h;
   dxb(i+1)=(y(i+1)-y(i))/h;
   if i==1
      dxc(i)=0;
   else
      dxc(i)=(y(i+1)-y(i-1))/(2*h);
   end
end
%NOTE: zero values in
forward_diff,backward_diff,central diff are non
%existent
Table= table([x]',[dxf]',[dxb]',[dxc]');
Table.Properties.VariableNames =
{'x','Forward_diff','Backward_diff','Central_diff'}
```

Output

a. For n = 10

Differntiation schemes

Number of intervals: 10

Table =

x	Forward_diff	Backward_diff	Central_diff
0	0.72976	NA	NA
0.3	0.30319	0.72976	0.51647
0.6	0.028649	0.30319	0.16592
0.9	-0.12584	0.028649	-0.048596
1.2	-0.19385	-0.12584	-0.15984
1.5	-0.20532	-0.19385	-0.19958
1.8	-0.18423	-0.20532	-0.19478
2.1	-0.1481	-0.18423	-0.16617
2.4	-0.10851	-0.1481	-0.12831
2.7	-0.072321	-0.10851	-0.090418
3	NA	-0.072321	NA

b. For n = 30

Differntiation schemes

Number of intervals: 30

Table =

x	Forward_diff	Backward_diff	Central_diff
0	0.90333	NA	NA
0.1	0.72324	0.90333	0.81328
0.2	0.5627	0.72324	0.64297
0.3	0.42108	0.5627	0.49189
0.4	0.29751	0.42108	0.3593
0.5	0.19096	0.29751	0.24424
0.6	0.10027	0.19096	0.14561
0.7	0.024198	0.10027	0.062233
0.8	-0.038519	0.024198	-0.0071604
0.9	-0.089171	-0.038519	-0.063845
1	-0.12903	-0.089171	-0.1091
1.1	-0.15932	-0.12903	-0.14418
1.2	-0.18125	-0.15932	-0.17028
1.3	-0.19591	-0.18125	-0.18858
1.4	-0.20438	-0.19591	-0.20015
1.5	-0.20761	-0.20438	-0.20599
1.6	-0.2065	-0.20761	-0.20705
1.7	-0.20185	-0.2065	-0.20417
1.8	-0.19439	-0.20185	-0.19812
1.9	-0.18477	-0.19439	-0.18958
2	-0.17354	-0.18477	-0.17916
2.1	-0.16122	-0.17354	-0.16738
2.2	-0.1482	-0.16122	-0.15471
2.3	-0.13487	-0.1482	-0.14154
2.4	-0.12151	-0.13487	-0.12819
2.5	-0.10837	-0.12151	-0.11494
2.6	-0.095658	-0.10837	-0.10202
2.7	-0.083516	-0.095658	-0.089587
2.8	-0.072064	-0.083516	-0.07779
2.9	-0.061383	-0.072064	-0.066723
3	NA	-0.061383	NA

c. For n = 60

Differntiation schemes

Number of intervals: 60

Table =

x	Forward_diff	Backward_diff	Central_diff
0	0.95083	NA	NA
0.05	0.85583	0.95083	0.90333
0.1	0.76579	0.85583	0.81081
0.15	0.68068	0.76579	0.72324
0.2	0.60043	0.68068	0.64056
0.25	0.52497	0.60043	0.5627
0.3	0.45418	0.52497	0.48958
0.35	0.38798	0.45418	0.42108
0.4	0.32623	0.38798	0.3571
0.45	0.2688	0.32623	0.29751
0.5	0.21556	0.2688	0.24218
0.55	0.16636	0.21556	0.19096
0.6	0.12105	0.16636	0.14371
0.65	0.079481	0.12105	0.10027
0.7	0.041486	0.079481	0.060483
0.75	0.0069104	0.041486	0.024198
0.8	-0.024408	0.0069104	-0.0087489
0.85	-0.05263	-0.024408	-0.038519
0.9	-0.077916	-0.05263	-0.065273
0.95	-0.10043	-0.077916	-0.089171
1	-0.12031	-0.10043	-0.11037
1.05	-0.13774	-0.12031	-0.12903
1.1	-0.15285	-0.13774	-0.1453
1.15	-0.1658	-0.15285	-0.15932
1.2	-0.17672	-0.1658	-0.17126
1.25	-0.18577	-0.17672	-0.18125
1.3	-0.19307	-0.18577	-0.18942
1.35	-0.19876	-0.19307	-0.19591
1.4	-0.20296	-0.19876	-0.20086
1.45	-0.2058	-0.20296	-0.20438
1.5	-0.20738	-0.2058	-0.20659
1.55	-0.20783	-0.20738	-0.20761
1.6	-0.20725	-0.20783	-0.20754
1.65	-0.20574	-0.20725	-0.2065
1.7	-0.20339	-0.20574	-0.20457
1.75	-0.2003	-0.20339	-0.20185
1.8	-0.19655	-0.2003	-0.19843
1.85	-0.19223	-0.19655	-0.19439
1.9	-0.1874	-0.19223	-0.18981
1.95	-0.18214	-0.1874	-0.18477
2	-0.17651	-0.18214	-0.17932
2.05	-0.17058	-0.17651	-0.17354
2.1	-0.1644	-0.17058	-0.16749
2.15	-0.15803	-0.1644	-0.16122
2.2	-0.15151	-0.15803	-0.15477
2.25	-0.1449	-0.15151	-0.1482

	2.3	-0.13822	-0.1449	-0.14156
	2.35	-0.13152	-0.13822	-0.13487
	2.4	-0.12483	-0.13152	-0.12818
	2.45	-0.11819	-0.12483	-0.12151
	2.5	-0.11161	-0.11819	-0.1149
	2.55	-0.10513	-0.11161	-0.10837
	2.6	-0.098772	-0.10513	-0.10195
	2.65	-0.092545	-0.098772	-0.095658
	2.7	-0.08647	-0.092545	-0.089508
	2.75	-0.080562	-0.08647	-0.083516
	2.8	-0.074834	-0.080562	-0.077698
	2.85	-0.069294	-0.074834	-0.072064
	2.9	-0.063952	-0.069294	-0.066623
	2.95	-0.058814	-0.063952	-0.061383
	3	NA	-0.058814	NA

3) Estimation of distance travelled

a. Trapezoidal Method

<table>
<tr><th>Code</th><th>Output</th></tr>
<tr><td><pre>clearvars
clc
fprintf('Trapezoidal Integration\n\n');
x=[0 1 2 2.5 3];
y=[0 10 12 13 14];
Table= table(x',y');
Table.Properties.VariableNames = {'Time','Velocity'}
[n n]=size(y);
%Trapezoidal Rule Formula
sum1=0;
sum2=0;
for i=1:1:4
  h=((x(i+1)-x(i)));
  sum1=sum2+((h/2)*(y(i)+y(i+1)));
  sum2=sum1;
end
fprintf('Distance Travelled in 0-3 sec is %f\n\n',sum2);</pre></td><td><pre>Trapezoidal Integration

Table =

    Time   Velocity
    ____   ________

     0   0
     1   10
     2   12
    2.5   13
     3   14

Distance Travelled in 0-3 sec is 29.000000</pre></td></tr>
</table>

b. Simpsons 1/3rd Rule

<table>
<tr><th>Code</th><th>Output</th></tr>
<tr><td><pre>clearvars
clc
fprintf('Simpson 1/3 Rule Integration\n\n');
x=[0 1 2 2.5 3];
y=[0 10 12 13 14];
Table= table(x',y');
Table.Properties.VariableNames = {'Time','Velocity'}
[n n]=size(y);
%Simpson 1/3 Rule Formula
sum1=0;
sum2=0;
for i=1:2:4
  h=((x(i+2)-x(i))/2);
  sum1=sum2+((h/3)*(y(i)+4*y(i+1)+y(i+2)));
  sum2=sum1;
end
fprintf('Distance Travelled in 0-3 sec is %f\n\n',sum2);</pre></td><td><pre>Simpson 1/3 Rule Integration

Table =

    Time   Velocity
    ____   ________

     0   0
     1   10
     2   12
    2.5   13
     3   14

Distance Travelled in 0-3 sec is 30.333333</pre></td></tr>
</table>