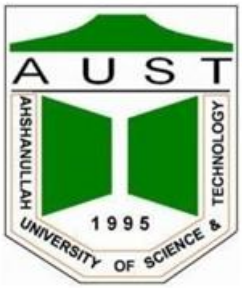


AHSANULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT
OF
ELECTRICAL AND ELECTRONIC ENGINEERING

LAB REPORT

COURSE NO	: EEE 2226
COURSE NAME	: Numerical Technique Laboratory
EXPERIMENT NO	: 07
DATE OF SUBMISSION	: 24/09/2025

Submitted by :

Name	: Rafayet Ahammad
ID	: 20230105206
Year	: 2nd
Semester	: 2nd
Section	: D(2)

 # Exercise1.

Integrate the function tabulated in Table 7.1 over the interval from x=1.6 to x=3.8 using composite trapezoidal rule with (a) h=0.2, (b) h=0.4 and (c) h=0.6

Table 7.1

X	f(x)	X	f(x)
1.6	4.953	2.8	16.445
1.8	6.050	3.0	20.086
2.0	7.389	3.2	24.533
2.2	9.025	3.4	29.964
2.4	11.023	3.6	36.598
2.6	13.468	3.8	44.701

 # Exercise 2.

(a) Integrate the function tabulated in Table 7.1 over the interval from x=1.6 to x=3.6 using Simpson's composite 1/3 rule.

(b) Integrate the function tabulated in Table 7.1 over the interval from x=1.6 to x=3.4 using Simpson's composite 3/8 rule.

 # Exercise 3.

(a) Find (approximately) each integral given below using the composite trapezoidal rule with $n = 12$.

(i) $\int_{-1}^{1} (1+x^2)^{-1} dx$ (ii) $\int_{0}^{4} x^2 e^{-x} dx$

(b) Find (approximately) each integral given above using the Simpson's composite 1/3 and 3/8 rules with $n = 12$.

 # Exercise 4.

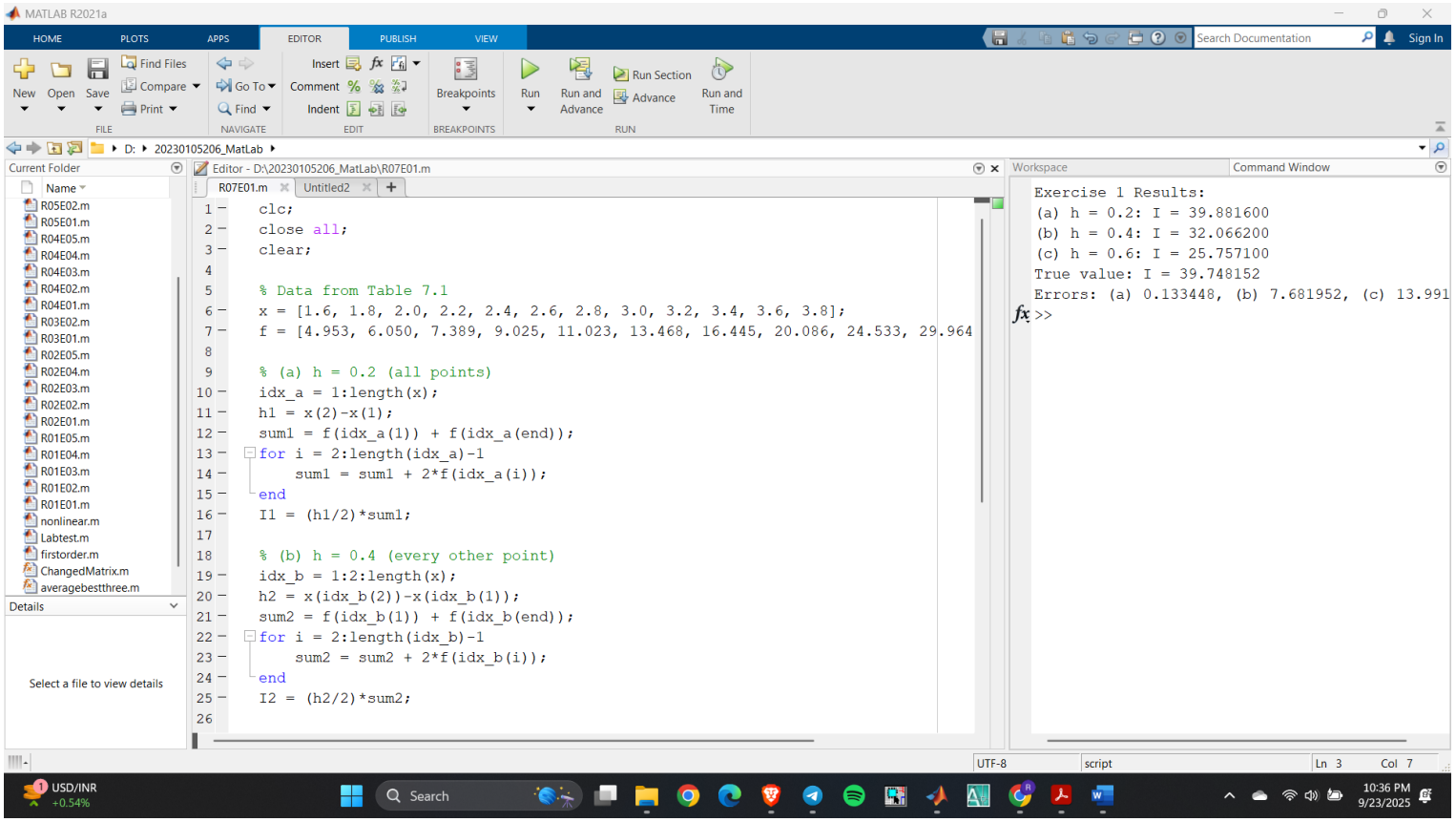
Evaluate the integral of xe^{-2x^2} between x=0 and x=2 using a tolerance value sufficiently small as to get an answer within 0.1% of the true answer, 0.249916 (Use adaptive integration for both Ex 4 & 5).

 # Exercise 5.

Evaluate the integral of $\sin^2(16x)$ between $x = 0$ and $x = \pi/2$. Why the result is erroneous? How can this be solved? (The correct result is $\pi/4$)

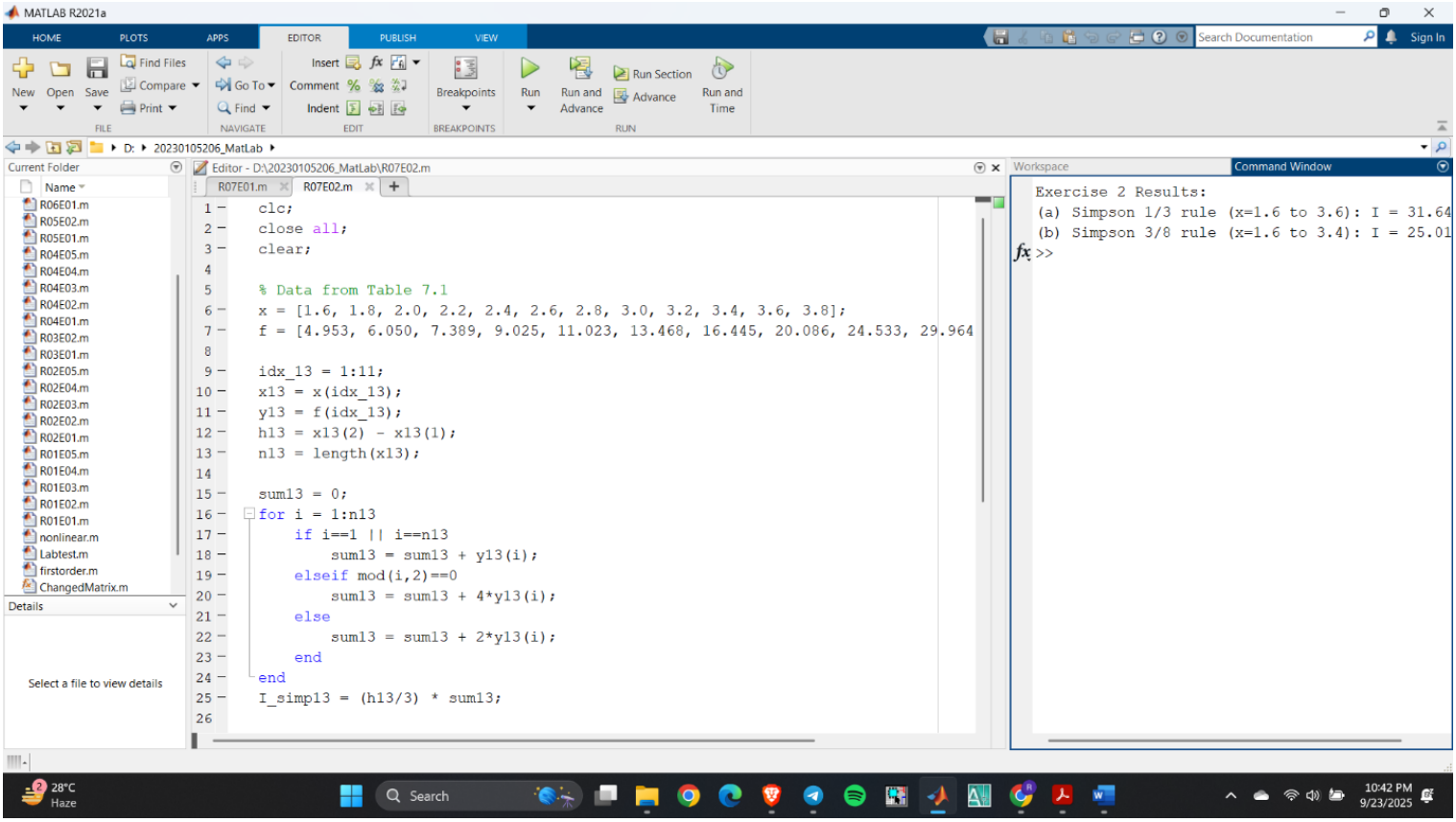
The data in Table 7.1 are for $f(x) = e^x$. Find the true value of the integral and compare this with those found in (a), (b) and (c).

Excercise01:



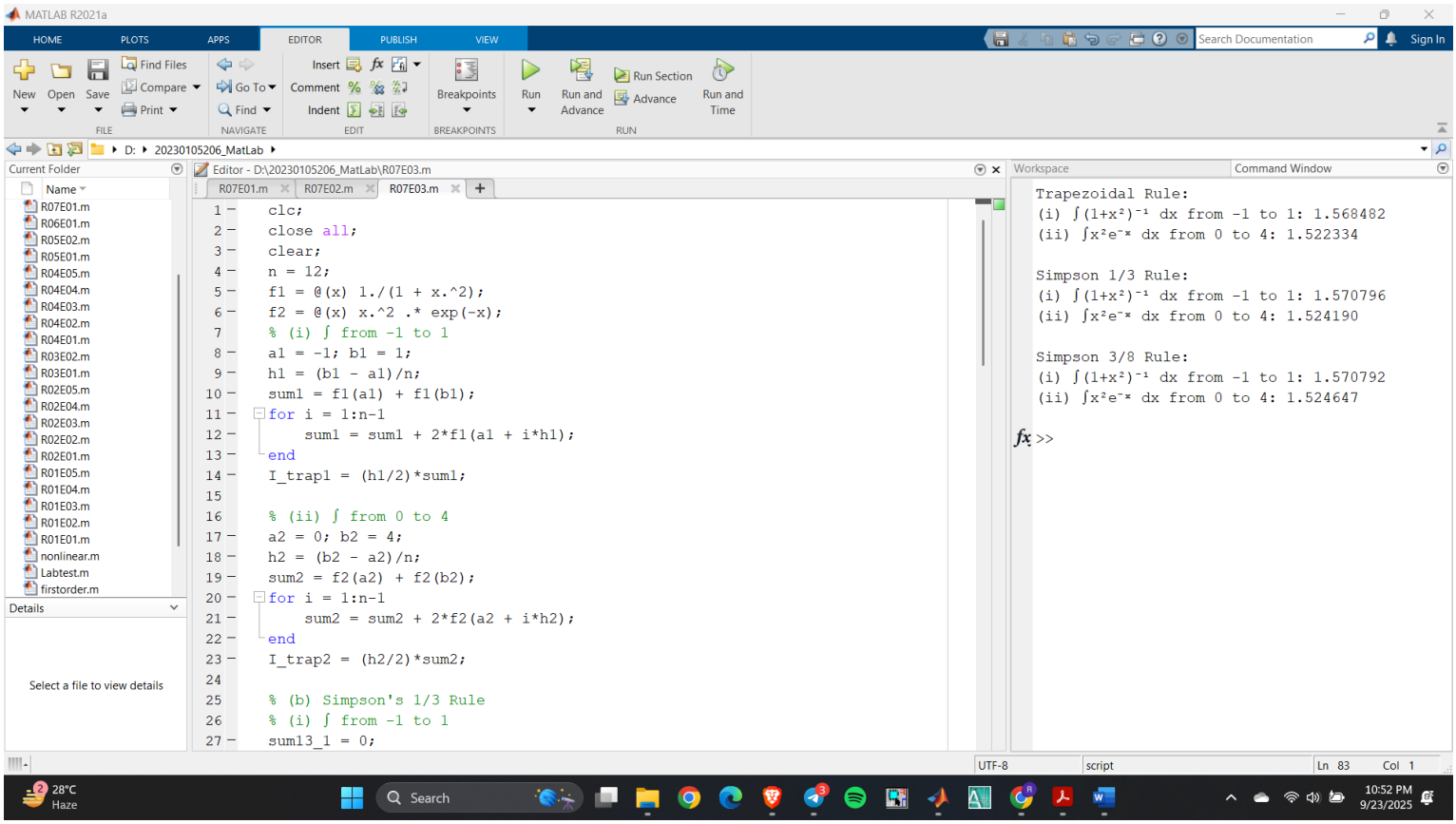
```
26
27      % (c) h = 0.6 (every third point)
28 -    idx_c = 1:3:length(x);
29 -    h3 = x(idx_c(2))-x(idx_c(1));
30 -    sum3 = f(idx_c(1)) + f(idx_c(end));
31 -    for i = 2:length(idx_c)-1
32 -        sum3 = sum3 + 2*f(idx_c(i));
33 -    end
34 -    I3 = (h3/2)*sum3;
35
36      % True value (f(x) = e^x)
37 -    true_val = exp(3.8) - exp(1.6);
38
39 -    fprintf('Exercise 1 Results:\n');
40 -    fprintf('(a) h = 0.2: I = %.6f\n', I1);
41 -    fprintf('(b) h = 0.4: I = %.6f\n', I2);
42 -    fprintf('(c) h = 0.6: I = %.6f\n', I3);
43 -    fprintf('True value: I = %.6f\n', true_val);
44 -    fprintf('Errors: (a) %.6f, (b) %.6f, (c) %.6f\n', ...
45              abs(I1-true_val), abs(I2-true_val), abs(I3-true_val));
46
```

Excercise02:



```
26
27 -    idx_38 = 1:10;
28 -    x38 = x(idx_38);
29 -    y38 = f(idx_38);
30 -    h38 = x38(2) - x38(1);
31 -    n38 = length(x38);
32
33 -    sum38 = y38(1) + y38(end);
34 -    for i = 2:n38-1
35 -        if mod(i-1,3)==0
36 -            sum38 = sum38 + 2*y38(i);
37 -        else
38 -            sum38 = sum38 + 3*y38(i);
39 -        end
40 -    end
41 -    I_simp38 = (3*h38/8) * sum38;
42
43 -    fprintf('Exercise 2 Results:\n');
44 -    fprintf('(a) Simpson 1/3 rule (x=1.6 to 3.6): I = %.6f\n', I_simp13);
45 -    fprintf('(b) Simpson 3/8 rule (x=1.6 to 3.4): I = %.6f\n', I_simp38);
```

Exercise 03:

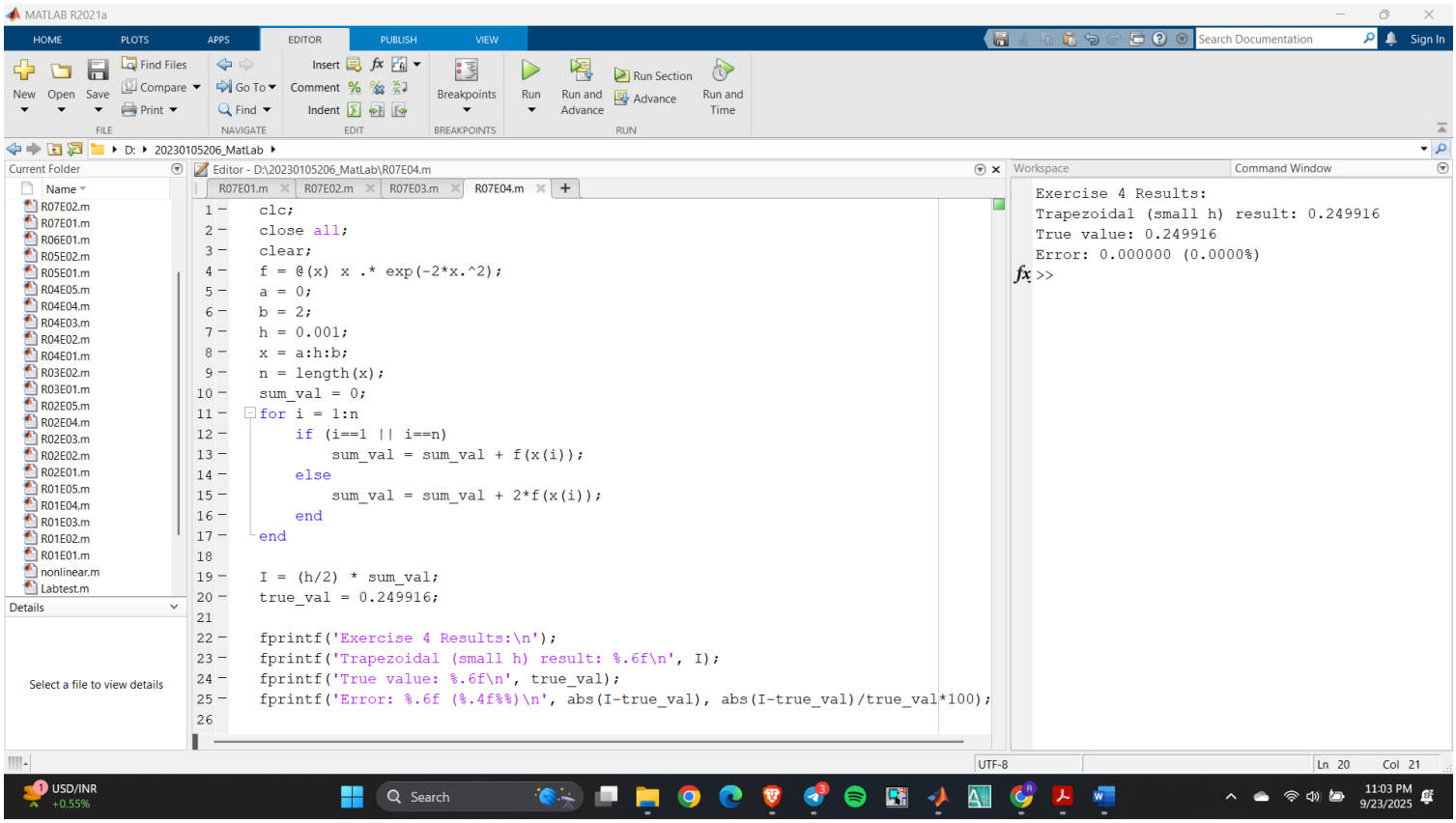


```
25      % (b) Simpson's 1/3 Rule
26      % (i) ∫ from -1 to 1
27 -    sum13_1 = 0;
28 -    x1 = a1:h1:b1;
29 -    fx1 = f1(x1);
30 -    m1 = length(x1);
31 -    for i = 1:m1
32 -        if i==1 || i==m1
33 -            sum13_1 = sum13_1 + fx1(i);
34 -        elseif mod(i,2)==0
35 -            sum13_1 = sum13_1 + 4*fx1(i);
36 -        else
37 -            sum13_1 = sum13_1 + 2*fx1(i);
38 -        end
39 -    end
40 -    I_simp1_13 = (h1/3)*sum13_1;
41
42      % (ii) ∫ from 0 to 4
43 -    sum13_2 = 0;
44 -    x2 = a2:h2:b2;
45 -    fx2 = f2(x2);
46 -    m2 = length(x2);
47 -    for i = 1:m2
48 -        if i==1 || i==m2
49 -            sum13_2 = sum13_2 + fx2(i);
50 -        elseif mod(i,2)==0
```

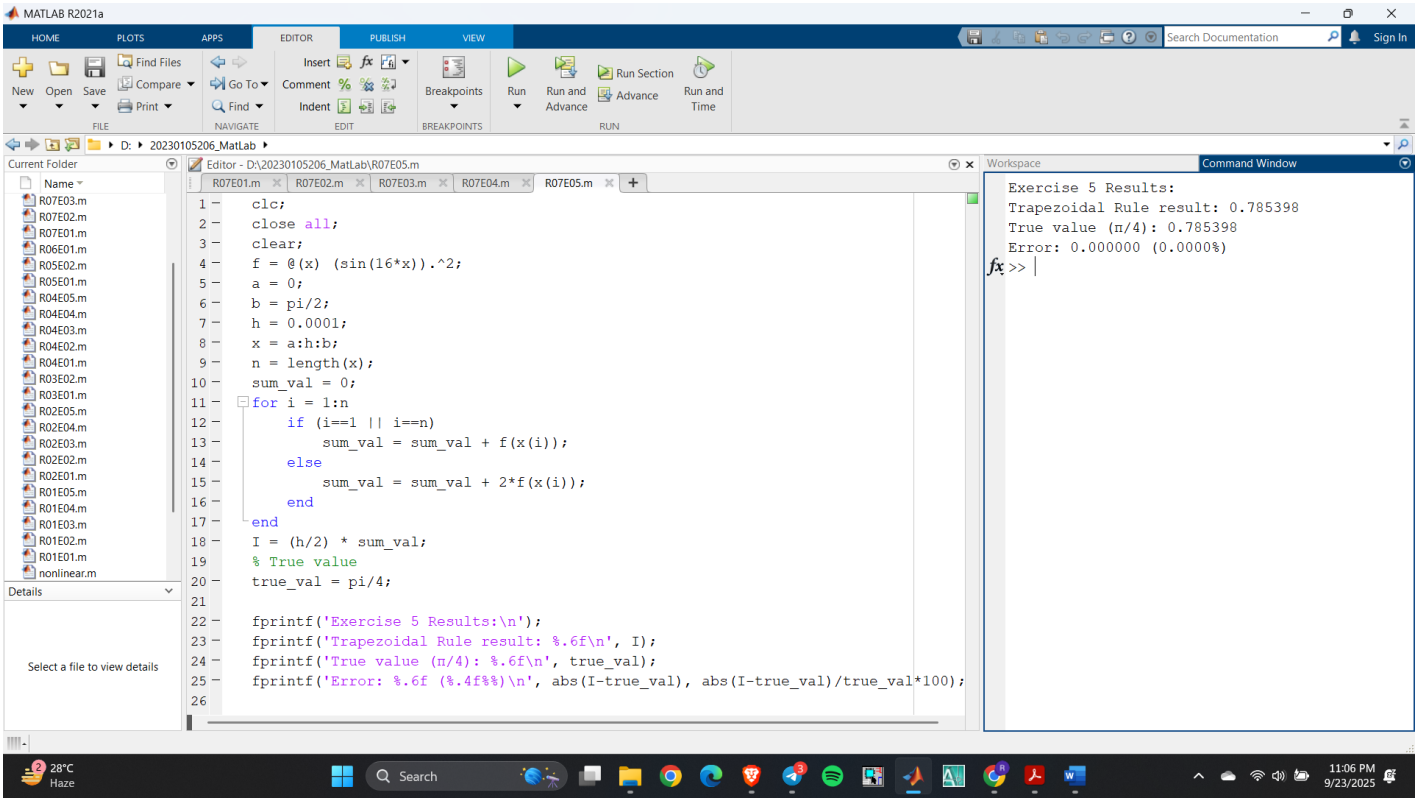
```
    elseif mod(i,2)==0
        sum13_2 = sum13_2 + 4*fx2(i);
    else
        sum13_2 = sum13_2 + 2*fx2(i);
    end
end
I_simp2_13 = (h2/3)*sum13_2;

% (c) Simpson's 3/8 Rule
% (i) ∫ from -1 to 1
sum38_1 = f1(a1) + f1(b1);
for i = 1:n-1
    xi = a1 + i*h1;
    if mod(i,3)==0
        sum38_1 = sum38_1 + 2*f1(xi);
    else
        sum38_1 = sum38_1 + 3*f1(xi);
    end
end
I_simp1_38 = (3*h1/8)*sum38_1;

% (ii) ∫ from 0 to 4
sum38_2 = f2(a2) + f2(b2);
for i = 1:n-1
    xi = a2 + i*h2;
    if mod(i,3)==0
        sum38_2 = sum38_2 + 2*f2(xi);
```

```
        sum38_2 = sum38_2 + 2*f2(xi);
    else
        sum38_2 = sum38_2 + 3*f2(xi);
    end
end
I_simp2_38 = (3*h2/8)*sum38_2;
%Results

fprintf('Trapezoidal Rule:\n');
fprintf('(i) ∫(1+x²)⁻¹ dx from -1 to 1: %.6f\n', I_trap1);
fprintf('(ii) ∫x²e⁻ˣ dx from 0 to 4: %.6f\n\n', I_trap2);

fprintf('Simpson 1/3 Rule:\n');
fprintf('(i) ∫(1+x²)⁻¹ dx from -1 to 1: %.6f\n', I_simp1_13);
fprintf('(ii) ∫x²e⁻ˣ dx from 0 to 4: %.6f\n\n', I_simp2_13);

fprintf('Simpson 3/8 Rule:\n');
fprintf('(i) ∫(1+x²)⁻¹ dx from -1 to 1: %.6f\n', I_simp1_38);
fprintf('(ii) ∫x²e⁻ˣ dx from 0 to 4: %.6f\n\n', I_simp2_38);
```

Exercise 04:


MATLAB R2021a
HOME
PLOTS
APPS
EDITOR
PUBLISH
VIEW
Search Documentation
Sign In
New
Open
Save
Find Files
Compare
Print
Go To
Find
Insert
Comment
Indent
Breakpoints
Run
Run and Advance
Run Section
Advance
Run and Time
FILE
NAVIGATE
EDIT
BREAKPOINTS
RUN
D: ▸ 20230105206_MatLab ▸
Current Folder
Name
R07E02.m
R07E01.m
R06E01.m
R05E02.m
R05E01.m
R04E05.m
R04E04.m
R04E03.m
R04E02.m
R04E01.m
R03E02.m
R03E01.m
R02E05.m
R02E04.m
R02E03.m
R02E02.m
R02E01.m
R01E05.m
R01E04.m
R01E03.m
R01E02.m
R01E01.m
nonlinear.m
Labtest.m
Details
Select a file to view details
Editor - D:\20230105206_MatLab\R07E04.m
R07E01.m
R07E02.m
R07E03.m
R07E04.m
1 clc;
2 close all;
3 clear;
4 f = @(x) x .* exp(-2*x.^2);
5 a = 0;
6 b = 2;
7 h = 0.001;
8 x = a:h:b;
9 n = length(x);
10 sum_val = 0;
11 for i = 1:n
12 if (i==1 || i==n)
13 sum_val = sum_val + f(x(i));
14 else
15 sum_val = sum_val + 2*f(x(i));
16 end
17 end
18
19 I = (h/2) * sum_val;
20 true_val = 0.249916;
21
22 fprintf('Exercise 4 Results:\n');
23 fprintf('Trapezoidal (small h) result: %.6f\n', I);
24 fprintf('True value: %.6f\n', true_val);
25 fprintf('Error: %.6f (%.4f%%)\n', abs(I-true_val), abs(I-true_val)/true_val*100);
26
Workspace
Command Window
Exercise 4 Results:
Trapezoidal (small h) result: 0.249916
True value: 0.249916
Error: 0.000000 (0.0000%)
fx >>
UTF-8
Ln 20
Col 21
USD/INR
+0.55%
Search
11:03 PM
9/23/2025

Exercise 05:


MATLAB R2021a
HOME
PLOTS
APPS
EDITOR
PUBLISH
VIEW
Search Documentation
Sign In
New
Open
Save
Find Files
Compare
Print
Go To
Find
Insert
Comment
Indent
Breakpoints
Run
Run and Advance
Run Section
Advance
Run and Time
FILE
NAVIGATE
EDIT
BREAKPOINTS
RUN
D: ▸ 20230105206_MatLab ▸
Current Folder
Name
R07E03.m
R07E02.m
R07E01.m
R06E01.m
R05E02.m
R05E01.m
R04E05.m
R04E04.m
R04E03.m
R04E02.m
R04E01.m
R03E02.m
R03E01.m
R02E05.m
R02E04.m
R02E03.m
R02E02.m
R02E01.m
R01E05.m
R01E04.m
R01E03.m
R01E02.m
R01E01.m
nonlinear.m
Details
Select a file to view details
Editor - D:\20230105206_MatLab\R07E05.m
R07E01.m
R07E02.m
R07E03.m
R07E04.m
R07E05.m
1 clc;
2 close all;
3 clear;
4 f = @(x) (sin(16*x)).^2;
5 a = 0;
6 b = pi/2;
7 h = 0.0001;
8 x = a:h:b;
9 n = length(x);
10 sum_val = 0;
11 for i = 1:n
12 if (i==1 || i==n)
13 sum_val = sum_val + f(x(i));
14 else
15 sum_val = sum_val + 2*f(x(i));
16 end
17 end
18 I = (h/2) * sum_val;
19 % True value
20 true_val = pi/4;
21
22 fprintf('Exercise 5 Results:\n');
23 fprintf('Trapezoidal Rule result: %.6f\n', I);
24 fprintf('True value (π/4): %.6f\n', true_val);
25 fprintf('Error: %.6f (%.4f%%)\n', abs(I-true_val), abs(I-true_val)/true_val*100);
26
Workspace
Command Window
Exercise 5 Results:
Trapezoidal Rule result: 0.785398
True value (π/4): 0.785398
Error: 0.000000 (0.0000%)
>>
28°C
Haze
Search
11:06 PM
9/23/2025