Problem Name:

Solving Definite Integrals with the Trapezoidal Method.

Apparatus:

- Computing Device (e.g.; Computer)
- Programming Environment (MATLAB R2016b)

Method:

The Trapezoidal Method is a numerical technique used to solve definite integrals efficiently. It involves dividing the area under a curve into trapezoids, providing a practical approximation. Adjusting the width of these trapezoids allows for precision in the estimation. This method is known for its simplicity and effectiveness in numerical analysis discussions.

Algorithm:

1. Start

2. Define function f(x)

3. Read lower limit of integration, upper limit of
   integration and number of sub interval

4. Calculate: step size = (upper limit - lower limit)/number of sub interval

5. Set: integration value = f(lower limit) + f(upper limit)

6. Set: i = 1

7. If i > number of sub interval then goto

8. Calculate: k = lower limit + i * h

9. Calculate: Integration value = Integration Value + 2* f(k)

10. Increment i by 1 i.e. i = i+1 and go to step 7

11. Calculate: Integration value = Integration value * step size/2

12. Display Integration value as required answer

13. Stop

Code:

```
clc;
syms x;
y=input('input your function: ');
a=input('Enter lower limit: ');
b=input('Enter upper limit: ');
n=input('Enter sub interval: ');
```

```
%input integration limits and interval of ordinates
dx=(b-a)/n;
fa=eval(subs(y,x,a));
fb=eval(subs(y,x,b));
integration = fa+fb;
for i=1:n-1
  k=a+(i*dx);
  fk=eval(subs(y,x,k));
  integration = integration + (2*fk);
end
integration = (integration * dx)/2;
disp('integration: ');
disp(integration);
```

Input:

```
input your function: x^2
Enter lower limit:  0
Enter upper limit:  1
Enter sub interval:  4
```

Output:

Editor - C:\Rim(1039)\TrapezoidalMethod_1039.m

TrapezoidalMethod_1039.m

```matlab
clc;
syms x;
y=input('input your function: ');
a=input('Enter lower limit: ');
b=input('Enter upper limit: ');
n=input('Enter sub interval: ');
%input integration limits and interval of ordinates
dx=(b-a)/n;
fa=eval(subs(y,x,a));
fb=eval(subs(y,x,b));
integration = fa+fb;
for i=1:n-1
  k=a+(i*dx);
  fk=eval(subs(y,x,k));
  integration = integration + (2*fk);
end
integration = (integration * dx)/2;
disp('integration: ');
disp(integration);
```

Command Window

```
input your function: x^2
Enter lower limit: 0
Enter upper limit: 1
Enter sub interval: 4
integration:
    0.3438

>>
```

Discussion:

In this report, we implemented the Trapezoidal Method using MATLAB as a numerical approach for solving integration problems with efficiency and precision. The utilization of this method involved dividing the integral's area into trapezoids, allowing us to approximate the desired integral. Leveraging MATLAB's computational capabilities, we were able to streamline the implementation process and conduct a thorough analysis of the results.

During the implementation, we encountered challenges related to refining the precision of the approximation and aligning the computed values with the actual integration result. Despite these challenges, the Trapezoidal Method proved to be a valuable tool in our numerical analysis toolkit. The method's simplicity and effectiveness were evident, offering a practical solution for obtaining reasonably accurate results in the context of definite integrals within the MATLAB environment.