# Lab 11 : Numerical Integration

**Objectives**

The purpose of this lab is to get familiar with Numerical Integration.

**Tools/Software Requirement**

Matlab R2016a

**Lab Task**

1. The work produced by a constant temperature, pressure-volume thermodynamic process can be computed as

Where is work, is pressure and is volume. Using a combination of the trapezoidal rule, Simpson’s 1/3 rule and Simpson’s 3/8 rule, use the following data to compute the work in kN.m:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Pressure | 336 | 294.4 | 266.4 | 260.8 | 260.5 | 249.6 | 193.6 | 165.6 |
| , | 0.5 | 2 | 3 | 4 | 6 | 8 | 10 | 11 |

## Code:

Y = [336, 294.4, 266.4, 260.8, 260.5, 249.6, 193.6, 165.6]

X = [0.5, 2, 3, 4, 6, 8, 10, 11]

h1 = X(2) - X(1)

h2 = (X(4) - X(2)) /2

h3 = (X(7) - X(4)) /3

h4 = X(8) - X(7)

A1 = (h1/2) \* (Y(1) + Y(2))

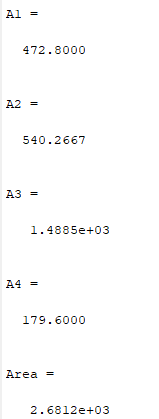
A2 = (h2/3) \* (Y(2) + 4 \* Y(3) + Y(4))

A3 = ((3/8) \* h3) \* (Y(4) + 3 \* Y(5) + 3 \* Y(6) +Y(7))

A4 = (h4/2) \* (Y(7) + Y(8))

Area = A1 + A2 + A3 + A4

## Output:



1. Suppose that the upward force of air resistance on a falling object is proportional to the square of the velocity. For this case velocity can be computed as

Where a second-order drag coefficient. If , and , use trapezoidal rule to determine how far the object falls in . Use a sufficiently high that you get eight significant digits of accuracy.

## Code:

g = 9.8;

m = 68.1;

c = 0.25;

t1 = 0;

t2 = 10;

n= 10;

u1 = sqrt((g\*m/c));

u2 = sqrt((g\*c/m));

V = [];

A = 0;

for i=0:10

v = u1\*tanh(u2\*i);

V = [V,v];

end

for i=1:10

a = vpa(0.5\*(V(i)+V(i+1)), 10);

A = vpa((A + a),10);

end

fprintf('Distance is %d\n', A);

## Output:

