**Problem No: 01**

**Problem Name:** Use the trapezoidal and Simpson’s rule to evaluate the double integral

**Objective:** To learn Trapezoidal rule, Simpson’s 1/3 rule to evaluate a double integral.

**Source Code:**

#include<iostream>

using namespace std;

void trap(double a[10][10], int n);

void Sim(double a[10][10], int n);

const double h = 2.0, k=2.0;

int main()

{

int n = 4.0 / h;

int i, j;

double x[n+1],y[n+1];

x[0] = 0.0;

y[0] = -2.0;

for(i = 1; i <= n; i++){

x[i] = x[i-1] + h;

y[i] = y[i-1] + h;

}

cout<<"x\ty\n";

for(i = 0; i <= n; i++)

cout<<x[i]<<"\t"<<y[i]<<endl;

cout<<endl;

double a[10][10];

for(i = 0; i <= n; i++){

for(j = 0; j <= n; j++)

a[i][j] = x[j] \* x[j] - x[j] \* y[i] + y[i] \* y[i];

}

cout << "a[i][j]:\n";

for(i = 0; i <= n; i++){

for(j = 0;j <= n; j++)

cout<<a[i][j]<<"\t";

cout<<endl;

}

cout<<endl;

int n1;

while(1){

cout<<"\n1. Trapizoidal\n2. Simpson's 1/3\n3. Exit\nPress : ";

cin >> n1;

if(n1 == 1)

trap(a, n);

else if(n1 == 2)

Sim(a, n);

else

break;

}

return 0;

}

void trap(double a[10][10], int n)

{

int i, j;

double sum = 0, r;

for(i = 0; i <= n; i++){

for(j = 0; j <= n; j++){

if((i == 0 && j == 0) || (i == n && j == n))

sum += a[i][j];

else

sum += 2 \* a[i][j];

}

}

r = ((h \* k) / 4.0) \* sum;

cout<<"Solution from Trapezoidal rule: " << r << endl;

}

void Sim(double a[10][10], int n)

{

int i,j;

double sum = 0, r;

for(i = 0; i <= n; i++){

for(j = 0; j <= n; j++){

if((i==0||i==n)&&(j==0||j==n))

sum += a[i][j];

else if(i==j)

sum += 16 \* a[i][j];

else

sum += 4 \* a[i][j];

}

}

r = ((h \* k) / 9.0) \* sum;

cout<<"Solution from Simpson's rule: " << r << endl;

}

**Output:**

