Report of Assignment 1

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Results:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Number of Intervals | Trapezoidal Rule Result | Error | Convergence Order | Simpson Rule Result | Error | Convergence Order |
| N=20 | 1.99588597 | 0.00645964 | 2.00000000 | 2.00000678 | 0.00001063 | 4.00953176 |
| N=40 | 1.99897181 | 0.00161491 | 1.99999107 | 2.00000042 | 0.00000066 | 4.04439412 |
| N=80 | 1.99974297 | 0.00040373 | 2.00003573 | 2.00000003 | 0.00000004 |  |
| N=160 | 1.99993574 | 0.00010093 | 2.00014295 | 2.00000000 | 0.00000000 |  |
| N=320 | 1.99998394 | 0.00002523 |  | 2.00000000 | 0.00000000 |  |

PS: Codes as follows:

1. Trapezoidal Rule:

// stdafx.cpp : source file that includes just the standard includes

// Trapezoidal Rule.pch will be the pre-compiled header

// stdafx.obj will contain the pre-compiled type information

#include "stdafx.h"

// TODO: reference any additional headers you need in STDAFX.H

// and not in this file

// Trapezoidal Rule.cpp : Defines the entry point for the console application.

//

#include "stdafx.h"

#include <stdio.h>

#include <math.h>

double f(double x)

{

return (sin(x));

}

double g(double x)

{

return (-sin(x));

}

int main()

{

double a = 0.0;

double b =acos(-1);

int N = 20;

double h = (b - a) / N;

double s = 0.5\*h\*(f(a) + f(b));

for (int i = 1; i < N; i++)

{

s = s + h\*f(a + i\*h);

}

double E = (b - a)\*h\*h / 12;

printf("integration of sin(x), from 0 to PI, with Trapezoidal Rule is: %0.8f\n", s);

printf("error bound in Trapezoidal Rule is: %0.8f\n", E);

return 0;

}

1. Simpson Rule:

// stdafx.cpp : source file that includes just the standard includes

// Simpson Rule.pch will be the pre-compiled header

// stdafx.obj will contain the pre-compiled type information

#include "stdafx.h"

// TODO: reference any additional headers you need in STDAFX.H

// and not in this file

// Simpson Rule.cpp : Defines the entry point for the console application.

//

#include "stdafx.h"

#include <stdio.h>

#include <math.h>

double f(double x)

{

return (sin(x));

}

double h(double x)

{

return (sin(x));

}

int main()

{

double a = 0.0;

double b = acos(-1);

int N = 320;

double h = (b - a) / N;

double s = f(a) + f(b);

for (int i = 1; i < N; i++)

{

if (i % 2 != 0)

s = s + 4 \* f(a + i\*h);

else s = s + 2 \* f(a + i\*h);

}

s = h\*s / 3;

double E = (b - a)\*h\*h\*h\*h / 180;

printf("integration of sin(x), from 0 to PI, with Simpson Rule is: %0.8f\n", s);

printf("error bound in Simpson Rule is: %0.8f\n", E);

return 0;

}