Rajshahi University of Engineering & Technology

CSE 2104: Sessional Based on CSE 2103

Lab Report 07

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Problem#01: Determining the numerical differentiation of a particulat number from given tabulated function

#include <iostream>

#define size 7

#define dySize size - 1

#define ddySize size - 2

#define d3Size size - 3

#define d4Size size - 4

#define d5Size size - 5

#define d6Size size - 6

using namespace std;

int main() {

double ax[size], ay[size], dy[dySize], ddy[ddySize], d3y[d3Size], d4y[d4Size], d5y[d5Size], d6y[d6Size];

for(int i = 0; i < size; i++) {

cin >> ax[i] >> ay[i];

}

for(int i = 0; i < dySize; i++) {

dy[i] = ay[i + 1] - ay[i];

}

for(int i = 0; i < ddySize; i++) {

ddy[i] = dy[i + 1] - dy[i];

}

for(int i = 0; i < d3Size; i++) {

d3y[i] = ddy[i + 1] - ddy[i];

}

for(int i = 0; i < d4Size; i++) {

d4y[i] = d3y[i + 1] - d3y[i];

}

for(int i = 0; i < d5Size; i++) {

d5y[i] = d4y[i + 1] - d4y[i];

}

for(int i = 0; i < d6Size; i++) {

d6y[i] = d5y[i + 1] - d5y[i];

}

cout << "X\tY\tdY\tddY\td3Y\td4Y\td5Y\td6Y\n";

for(int i = 0; i < size; i++)

{

cout << ax[i] << "\t" << ay[i] << "\t" << dy[i] << "\t" << ddy[i] << "\t" << d3y[i] << "\t" << d4y[i] << "\t" << d5y[i] << "\t" << d6y[i] << endl;

}

double inputX;

int index;

cout << "Enter x: ";

cin >> inputX;

for(int i = 0; i < size; i++) {

if(inputX == ax[i]) {

index = i;

break;

}

}

cout << "Index = " << index << endl;

double h = 1 / (ax[1] - ax[0]);

double diffY = h \* (dy[index] - .5\*ddy[index] + d3y[index]/3.0 - .25\*d4y[index] + .2\*d5y[index]);

double doublediffY = h \* h \* (ddy[index] - d3y[index] + 11/12.0 \* d4y[index] - 5/6.0 \* d5y[index]);

cout << "dy/dx = " << diffY << endl;

cout << "ddy/ddx = " << doublediffY << endl;

}

OUTPUT:

1.0 2.7183

1.2 3.3201

1.4 4.0552

1.6 4.9530

1.8 6.0496

2.0 7.3891

2.2 9.0250

X Y dY ddY d3Y d4Y d5Y d6Y

1 2.7183 0.6018 0.1333 0.0294 0.0067 0.0013 0.0001

1.2 3.3201 0.7351 0.1627 0.0361 0.008 0.0014 0.0013

1.4 4.0552 0.8978 0.1988 0.0441 0.0094 0.0067 0.0014

1.6 4.953 1.0966 0.2429 0.0535 0.0294 0.008 0.0067

1.8 6.0496 1.3395 0.2964 0.1333 0.0361 0.0094 0.008

2 7.3891 1.6359 0.6018 0.1627 0.0441 0.0294 0.0094

2.2 9.025 2.7183 0.7351 0.1988 0.0535 0.0361 0.0294

Enter x: 1.2

Index = 1

dy/dx = 3.32032

ddy/ddx = 3.31917

**DISCUSSION**:

Problem#02: Determining the maximum and minimun values of a tabulated function

#include <iostream>

#define size 5

#define dySize 4

#define ddySize 3

using namespace std;

int main() {

double x[size], y[size], dy[size], ddy[size], dddy[size], ddddy[size], bd[size], bdd[size], bddd[size];

dy[4] = ddy[4] = ddy[3] = dddy[4] = dddy[3] = dddy[2] = bd[0] = bdd[0] = bdd[1] = bddd[0] = bddd[1] = bddd[2] = 0;

for(int i = 0; i < size; i++) {

cin >> x[i] >> y[i];

}

for(int i = 0; i < dySize; i++) {

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

}

for(int i = 0; i < ddySize; i++) {

ddy[i] = dy[i + 1] - dy[i];

}

cout << "X\tY\tdY\tddY\n";

for(int i = 0; i < size; i++) {

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

}

int index = 0;

double h = x[index + 1] - x[index];

double p = (-2\*dy[index]/ddy[index] + 1) / 2.0;

cout << "p = " << p << endl;

double maxX = x[index] + p\*h;

cout << "Max\_X = " << maxX << endl;

double xx = maxX;

double pn = (double) (xx - x[0]) / (x[1] - x[0]);

dddy[0] = ddy[0] - ddy[1];

dddy[1] = ddy[1] - ddy[2];

ddddy[0] = dddy[0] - dddy[1];

ddddy[1] = ddddy[2] = ddddy[3] = ddddy[4] = 0;

cout << "X\tY\tdY\tddY\tdddY\tddddY\n";

for(int i = 0; i < 5; i++)

{

dddy[3] = 0;

cout << x[i] << "\t" << y[i] << "\t" << dy[i] << "\t" << ddy[i] << "\t" << dddy[i] << "\t" << ddddy[i] << endl;

}

double fy = x[0] + pn\*dy[0] + pn\*(pn-1)\*ddy[0]/2 + pn\*(pn-1)\*(pn-2)\*dddy[0]/6;

cout << "new P = " << pn << "\nMaximum output for MaxX: " << fy << endl;

}

OUTPUT:

1.2 0.9320

1.3 0.9636

1.4 0.9855

1.5 0.9975

1.6 0.9996

X Y dY ddY

1.2 0.932 0.0316 -0.0097

1.3 0.9636 0.0219 -0.0099

1.4 0.9855 0.012 -0.0099

1.5 0.9975 0.0021 0

1.6 0.9996 0 0

p = 3.75773

Max\_X = 1.57577

X Y dY ddY dddY ddddY

1.2 0.932 0.0316 -0.0097 0.0002 0.0002

1.3 0.9636 0.0219 -0.0099 0 0

1.4 0.9855 0.012 -0.0099 0 0

1.5 0.9975 0.0021 0 0 0

1.6 0.9996 0 0 0 0

new P = 3.75773

Maximum output for MaxX: 1.0023

**DISCUSSION**: