**ЦЕЛЬ РАБОТЫ:**

Изучение возможных путей для вычисления определенных интегралов с помощью компьютера.

**Задачи:**

1. Написать код реализующий метод Симпсона.(Выбран как наиболее точный из представленных)
2. Написать код реализующий вывод графиков функции и интеграла.

**Реализация:**

Код выполнен на языке Pyhton.

1. Реализация Метода Симпсона

from sympy import \*

from sympy.parsing.sympy\_parser import parse\_expr

import numpy as np

def simpson(not\_pars\_integral, b, a, n):

init\_printing()

x = Symbol('x')

integral = parse\_expr(not\_pars\_integral)

width = (b-a)/n

simpson\_integral = 0

for step in range(n):

x1 = a + step\*width

x2 = a + (step+1)\*width

simpson\_integral += (x2-x1)/6\*(integral.subs(x,x1) + 4\*integral.subs(x,(x1+x2)\*0.5) + integral.subs(x,x2))

f4 = prime(integral, 4)

f = f4.subs(x,x2).evalf()

R = -((b-a)/2)\*\*5 \* f / (90\*n\*\*4)

it = [simpson\_integral, R]

return it

def prime(funk, n):

for i in range(n):

funk = diff(funk)

return funk

1. Реализация Вывода графика

from PyQt5 import QtCore, QtGui, QtWidgets

class Ui\_MainWindow(object):

def setupUi(self, MainWindow):

MainWindow.setObjectName("MainWindow")

MainWindow.resize(800, 600)

icon = QtGui.QIcon()

icon.addPixmap(QtGui.QPixmap("main\_icon.png"), QtGui.QIcon.Normal, QtGui.QIcon.Off)

MainWindow.setWindowIcon(icon)

self.centralwidget = QtWidgets.QWidget(MainWindow)

self.centralwidget.setObjectName("centralwidget")

self.frame = QtWidgets.QFrame(self.centralwidget)

self.frame.setGeometry(QtCore.QRect(30, 60, 41, 41))

self.frame.setFrameShape(QtWidgets.QFrame.StyledPanel)

self.frame.setFrameShadow(QtWidgets.QFrame.Raised)

self.frame.setObjectName("frame")

self.gridLayoutWidget = QtWidgets.QWidget(self.centralwidget)

self.gridLayoutWidget.setGeometry(QtCore.QRect(10, 10, 788, 541))

self.gridLayoutWidget.setObjectName("gridLayoutWidget")

self.gridLayout = QtWidgets.QGridLayout(self.gridLayoutWidget)

self.gridLayout.setSizeConstraint(QtWidgets.QLayout.SetMaximumSize)

self.gridLayout.setContentsMargins(0, 0, 0, 0)

self.gridLayout.setObjectName("gridLayout")

self.horizontalLayout\_3 = QtWidgets.QHBoxLayout()

self.horizontalLayout\_3.setObjectName("horizontalLayout\_3")

self.verticalLayout = QtWidgets.QVBoxLayout()

self.verticalLayout.setObjectName("verticalLayout")

self.label = QtWidgets.QLabel(self.gridLayoutWidget)

font = QtGui.QFont()

font.setFamily("Alef")

font.setPointSize(11)

font.setBold(True)

font.setWeight(75)

self.label.setFont(font)

self.label.setObjectName("label")

self.verticalLayout.addWidget(self.label)

spacerItem = QtWidgets.QSpacerItem(20, 40, QtWidgets.QSizePolicy.Minimum, QtWidgets.QSizePolicy.Minimum)

self.verticalLayout.addItem(spacerItem)

self.lineEdit = QtWidgets.QLineEdit(self.gridLayoutWidget)

self.lineEdit.setObjectName("lineEdit")

self.verticalLayout.addWidget(self.lineEdit)

spacerItem1 = QtWidgets.QSpacerItem(20, 40, QtWidgets.QSizePolicy.Minimum, QtWidgets.QSizePolicy.Minimum)

self.verticalLayout.addItem(spacerItem1)

self.pushButton = QtWidgets.QPushButton(self.gridLayoutWidget)

self.pushButton.setObjectName("pushButton")

self.verticalLayout.addWidget(self.pushButton)

self.horizontalLayout = QtWidgets.QHBoxLayout()

self.horizontalLayout.setObjectName("horizontalLayout")

self.label\_3 = QtWidgets.QLabel(self.gridLayoutWidget)

font = QtGui.QFont()

font.setFamily("Alef")

font.setPointSize(10)

font.setBold(True)

font.setWeight(75)

self.label\_3.setFont(font)

self.label\_3.setObjectName("label\_3")

self.horizontalLayout.addWidget(self.label\_3)

self.label\_4 = QtWidgets.QLabel(self.gridLayoutWidget)

font = QtGui.QFont()

font.setFamily("Alef")

font.setPointSize(10)

font.setBold(True)

font.setWeight(75)

self.label\_4.setFont(font)

self.label\_4.setObjectName("label\_4")

self.horizontalLayout.addWidget(self.label\_4)

self.verticalLayout.addLayout(self.horizontalLayout)

self.horizontalLayout\_3.addLayout(self.verticalLayout)

self.horizontalLayout\_4 = QtWidgets.QHBoxLayout()

self.horizontalLayout\_4.setContentsMargins(0, -1, -1, -1)

self.horizontalLayout\_4.setObjectName("horizontalLayout\_4")

spacerItem2 = QtWidgets.QSpacerItem(40, 20, QtWidgets.QSizePolicy.Minimum, QtWidgets.QSizePolicy.Minimum)

self.horizontalLayout\_4.addItem(spacerItem2)

self.verticalLayout\_5 = QtWidgets.QVBoxLayout()

self.verticalLayout\_5.setObjectName("verticalLayout\_5")

self.label\_2 = QtWidgets.QLabel(self.gridLayoutWidget)

font = QtGui.QFont()

font.setFamily("Alef")

font.setPointSize(10)

font.setBold(True)

font.setWeight(75)

self.label\_2.setFont(font)

self.label\_2.setObjectName("label\_2")

self.verticalLayout\_5.addWidget(self.label\_2)

self.label\_7 = QtWidgets.QLabel(self.gridLayoutWidget)

font = QtGui.QFont()

font.setFamily("Alef")

font.setPointSize(10)

font.setBold(True)

font.setWeight(75)

self.label\_7.setFont(font)

self.label\_7.setObjectName("label\_7")

self.verticalLayout\_5.addWidget(self.label\_7)

self.horizontalLayout\_4.addLayout(self.verticalLayout\_5)

self.verticalLayout\_2 = QtWidgets.QVBoxLayout()

self.verticalLayout\_2.setSizeConstraint(QtWidgets.QLayout.SetMinimumSize)

self.verticalLayout\_2.setSpacing(40)

self.verticalLayout\_2.setObjectName("verticalLayout\_2")

self.lineEdit\_2 = QtWidgets.QLineEdit(self.gridLayoutWidget)

self.lineEdit\_2.setObjectName("lineEdit\_2")

self.verticalLayout\_2.addWidget(self.lineEdit\_2)

self.lineEdit\_3 = QtWidgets.QLineEdit(self.gridLayoutWidget)

self.lineEdit\_3.setObjectName("lineEdit\_3")

self.verticalLayout\_2.addWidget(self.lineEdit\_3)

self.horizontalLayout\_4.addLayout(self.verticalLayout\_2)

self.horizontalLayout\_3.addLayout(self.horizontalLayout\_4)

self.horizontalLayout\_2 = QtWidgets.QHBoxLayout()

self.horizontalLayout\_2.setObjectName("horizontalLayout\_2")

self.horizontalLayout\_3.addLayout(self.horizontalLayout\_2)

self.gridLayout.addLayout(self.horizontalLayout\_3, 0, 0, 1, 1)

self.horizontalLayout\_5 = QtWidgets.QHBoxLayout()

self.horizontalLayout\_5.setObjectName("horizontalLayout\_5")

self.pushButton\_2 = QtWidgets.QPushButton(self.gridLayoutWidget)

self.pushButton\_2.setObjectName("pushButton\_2")

self.horizontalLayout\_5.addWidget(self.pushButton\_2)

spacerItem3 = QtWidgets.QSpacerItem(40, 20, QtWidgets.QSizePolicy.Minimum, QtWidgets.QSizePolicy.Minimum)

self.horizontalLayout\_5.addItem(spacerItem3)

self.gridLayout.addLayout(self.horizontalLayout\_5, 1, 0, 1, 1)

spacerItem4 = QtWidgets.QSpacerItem(20, 50, QtWidgets.QSizePolicy.Minimum, QtWidgets.QSizePolicy.Minimum)

self.gridLayout.addItem(spacerItem4, 2, 0, 1, 1)

self.label\_5 = QtWidgets.QLabel(self.gridLayoutWidget)

font = QtGui.QFont()

font.setFamily("Alef")

font.setPointSize(10)

font.setBold(True)

font.setWeight(75)

self.label\_5.setFont(font)

self.label\_5.setTextFormat(QtCore.Qt.AutoText)

self.label\_5.setObjectName("label\_5")

self.gridLayout.addWidget(self.label\_5, 3, 0, 1, 1)

MainWindow.setCentralWidget(self.centralwidget)

self.menubar = QtWidgets.QMenuBar(MainWindow)

self.menubar.setGeometry(QtCore.QRect(0, 0, 800, 21))

self.menubar.setObjectName("menubar")

MainWindow.setMenuBar(self.menubar)

self.statusbar = QtWidgets.QStatusBar(MainWindow)

self.statusbar.setObjectName("statusbar")

MainWindow.setStatusBar(self.statusbar)

self.retranslateUi(MainWindow)

QtCore.QMetaObject.connectSlotsByName(MainWindow)

def retranslateUi(self, MainWindow):

\_translate = QtCore.QCoreApplication.translate

MainWindow.setWindowTitle(\_translate("MainWindow", "Вычисление интеграла"))

self.label.setText(\_translate("MainWindow", "Введите интеграл без \'dx\'"))

self.pushButton.setText(\_translate("MainWindow", "Вычислить"))

self.label\_3.setText(\_translate("MainWindow", "Ответ:"))

self.label\_2.setText(\_translate("MainWindow", "Верхняя граница интеграла:"))

self.label\_7.setText(\_translate("MainWindow", "Нижяя границы интеграла:"))

self.pushButton\_2.setText(\_translate("MainWindow", "Построить график"))

self.label\_5.setText(\_translate("MainWindow", "Допустимые функции:\n"

" Тригонометрические: cos(x), sin(x), tan(x), asin(x), acos(x), atan(x). \n"

" Квадратный корень - sqrt(). Степень - \*\*. Производные - diff()"))

1. Основной исходный код

from PyQt5 import QtWidgets

from mydesign import Ui\_MainWindow # импорт нашего сгенерированного файла

import sys

from reshintegral import simpson

from sympy import \*

from sympy.parsing.sympy\_parser import parse\_expr

import numpy as np

import matplotlib as mlp

import matplotlib.pyplot as plt

import matplotlib.transforms as transforms

import matplotlib.patches as mpatches

init\_printing()

x = Symbol('x')

class mywindow(QtWidgets.QMainWindow):

def \_\_init\_\_(self):

super(mywindow, self).\_\_init\_\_()

self.ui = Ui\_MainWindow()

self.ui.setupUi(self)

self.ui.pushButton.clicked.connect(self.btnClicked)

self.ui.pushButton\_2.clicked.connect(self.btnClicked\_2)

def btnClicked(self):

lineeditvalue = self.ui.lineEdit.text()

upvalue = (self.ui.lineEdit\_2.text())

downvalue = (self.ui.lineEdit\_3.text())

if lineeditvalue == "":

error\_dialog.showMessage( "Ошибка! Введите интеграл")

elif upvalue == "":

error\_dialog.showMessage( "Ошибка! Введите верхнюю границу интегрирования")

elif downvalue == "":

error\_dialog.showMessage( "Ошибка! Введите нижнюю границу интегрирования")

else:

upvalue = float(upvalue)

downvalue = float(downvalue)

result = simpson(lineeditvalue, upvalue, downvalue, 1000)

otvet = str(result[0]) + " +- " + str(result[1])

self.ui.label\_4.setText(otvet)

def btnClicked\_2(self):

lineeditvalue = self.ui.lineEdit.text()

upvalue = (self.ui.lineEdit\_2.text())

downvalue = (self.ui.lineEdit\_3.text())

if lineeditvalue == "":

error\_dialog.showMessage( "Ошибка! Введите интеграл")

elif upvalue == "":

error\_dialog.showMessage( "Ошибка! Введите верхнюю границу интегрирования")

elif downvalue == "":

error\_dialog.showMessage( "Ошибка! Введите нижнюю границу интегрирования")

else:

upvalue = float(upvalue)

downvalue = float(downvalue)

integral = parse\_expr(lineeditvalue)

plot(integral,(x,downvalue,upvalue))

app = QtWidgets.QApplication([])

application = mywindow()

application.show()

error\_dialog = QtWidgets.QErrorMessage()

sys.exit(app.exec())

**Результаты**

*(по 8 опытам)*

|  |  |  |  |
| --- | --- | --- | --- |
| № | Функция f(x) | Результаты | График |
| 1 |  | J=  R= |  |
| 2 |  | J=  R= |  |
| 3 |  | J=  R= |  |
| 4 |  | J=  R= |  |
| 5 |  | J=  R= |  |
| 6 |  | J=  R= |  |
| 7 |  | J=  R= |  |
| 8 |  | J=  R= |  |

*J­ – интеграл; R – погрешность; [a,b]=[-50,50]*

Выводы

Изучили возможные пути для вычисления определенных интегралов с помощью компьютера.

Реализовали код.