Lab 1: Using Computers to Approximate Derivatives

Online editor and compiler: https://replit.com/languages/python3

Code snippet 1: Use a numeric for loop

for i in range(4):

print(i)

Code snippet 2: Use a for loop to calculate x+h and x-h as x diminishes

x=2

for i in range(5):

h=(1/10)\*\*i

xb=x-h

xf=x+h

print(i,h,xb,x,xf)

Code snippet 3: Find forward difference quotient for *f(x) = x3* for diminishing h’s at x=2.

x=2

for i in range(5):

h=(1/10)\*\*i

xb=x-h

xf=x+h

fdq=(xf\*\*3-x\*\*3)/h

print(h,fdq)

Code snippet 4: Calculate the error in the forward difference quotient for *f(x) = x3* for diminishing h’s at x=2.

x=2

precise=3\*x\*x

for i in range(5):

h=(1/10)\*\*i

xb=x-h

xf=x+h

fdq=(xf\*\*3-x\*\*3)/h

error=abs(fdq-precise)

print(h,error)

Problem 1: A function *f* is represented with the formula *f(x) = x3..* We are approximating *f’(2)* with the forwards, backwards and centered difference quotients.

1. Fill in the following table using 2 significant digits:

|  |  |  |  |
| --- | --- | --- | --- |
| h | Error in approximating with the forward difference quotient | Error in approximating with the backward difference quotient | Error in approximating with the centered difference quotient |
| 1 |  |  |  |
| .1 |  |  |  |
| .01 |  |  |  |
| .001 |  |  |  |

1. When *h* is divided by 10, what happens to the size of the error in
   1. The forward difference quotient
   2. The backward difference quotient
   3. The centered difference quotient

Problem 2: A function *f* is represented with the formula *f(x) = x3.* We are approximating *f’(1)* with the forwards, backwards and centered difference quotients. (same as problem 1 with x=1)

1. Fill in the following table using 2 significant digits:

|  |  |  |  |
| --- | --- | --- | --- |
| h | Error in approximating with the forward difference quotient | Error in approximating with the backward difference quotient | Error in approximating with the centered difference quotient |
| 1 |  |  |  |
| .1 |  |  |  |
| .01 |  |  |  |
| .001 |  |  |  |

1. When *h* is divided by 10, what happens to the size of the error in
   1. The forward difference quotient
   2. The backward difference quotient
   3. The centered difference quotient

Optional Problem 3: A function *f* is represented with the formula *f(x) = x4.* We are approximating *f’(1)* with the forwards, backwards and centered difference quotients. The actual value of *f’(1) = 4.*

1. Fill in the following table using 2 significant digits:

|  |  |  |  |
| --- | --- | --- | --- |
| h | Error in approximating with the forward difference quotient | Error in approximating with the backward difference quotient | Error in approximating with the centered difference quotient |
| .1 |  |  |  |
| .01 |  |  |  |
| .001 |  |  |  |

1. When *h* is divided by 10, what happens to the size of the error in
   1. The forward difference quotient
   2. The backward difference quotient
   3. The centered difference quotient