# Bahria University,

## Karachi Campus



LAB EXPERIMENT NO.

**\_05\_**

LIST OF TASKS

|  |  |
| --- | --- |
| **TASK NO** | **OBJECTIVE** |
| 01 |  |
| 02 |  |

Submitted On:

Date: 22/10/2024

**Task No 01:**

A screenshot of a math test

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**Solution:**

import math

x\_vals = [0.10, 0.15, 0.20, 0.25, 0.30]

y\_vals = [0.1003, 0.1511, 0.2027, 0.2553, 0.3093]

def forward\_difference\_table(y\_vals):

    n = len(y\_vals)

    diff\_table = [y\_vals]

    for i in range(1, n):

        next\_diff = []

        for j in range(n - i):

            diff = diff\_table[i - 1][j + 1] - diff\_table[i - 1][j]

            next\_diff.append(diff)

        diff\_table.append(next\_diff)

    return diff\_table

def newton\_forward\_interpolation(x\_vals, y\_vals, x):

    h = x\_vals[1] - x\_vals[0]

    u = (x - x\_vals[0]) / h

    diff\_table = forward\_difference\_table(y\_vals)

    result = y\_vals[0]

    u\_product = 1

    factorial = 1

    for i in range(1, len(diff\_table)):

        u\_product \*= (u - (i - 1))

        factorial \*= i

        result += (u\_product \* diff\_table[i][0]) / factorial

    return result

x\_to\_find = 0.12

tan\_approx = newton\_forward\_interpolation(x\_vals, y\_vals, x\_to\_find)

print(f"Approximated value of tan(0.12) using Newton's Forward Interpolation: {tan\_approx}")

**Output:**

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**Task No 02:**

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**Solution:**

x\_vals = [50, 100, 150, 200, 250]

y\_vals = [618, 724, 805, 906, 1032]

def backward\_difference\_table(y\_vals):

    n = len(y\_vals)

    diff\_table = [y\_vals]

    for i in range(1, n):

        next\_diff = []

        for j in range(n - i):

            diff = diff\_table[i - 1][j + 1] - diff\_table[i - 1][j]

            next\_diff.append(diff)

        diff\_table.append(next\_diff)

    return diff\_table

def newton\_backward\_interpolation(x\_vals, y\_vals, x):

    h = x\_vals[1] - x\_vals[0]

    u = (x - x\_vals[-1]) / h

    diff\_table = backward\_difference\_table(y\_vals)

    result = y\_vals[-1]

    u\_product = 1

    factorial = 1

    for i in range(1, len(diff\_table)):

        u\_product \*= (u + (i - 1))

        factorial \*= i

        result += (u\_product \* diff\_table[i][-1]) / factorial

    return result

x\_to\_find = 300

y\_at\_300 = newton\_backward\_interpolation(x\_vals, y\_vals, x\_to\_find)

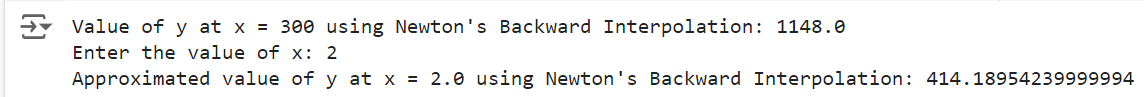
print(f"Value of y at x = 300 using Newton's Backward Interpolation: {y\_at\_300}")

x\_input = float(input("Enter the value of x: "))

y\_approx = newton\_backward\_interpolation(x\_vals, y\_vals, x\_input)

print(f"Approximated value of y at x = {x\_input} using Newton's Backward Interpolation: {y\_approx}")

**Output:**

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