MATHEMATICAL PHYSICS-2 (LAB)

ASSIGNMENT-4

Name: Aditya Pachar

Rollno:245673989

Course: BSc Physics Hons

Date:10-04-2025

Question-1 :

Que 1. **Interpolation:** Concept of Interpolation, Lagrange form of interpolating polynomial, Error estimation, optimal points for interpolation.

(a) Write program to determine and plot the unique polynomial of a degree *n* that agrees with a given set of (*n*+1) data points (*xi,yi*) and use this polynomial to find the value of *y* at a value of *x* not included in the data. (Use DataFrame Also)

Given Data Points:

X	1	3	4	6	7
Y	-3	9	30	132	100

Program Code :

```
import numpy as np

import pandas as pd

import matplotlib.pyplot as plt

x = np.array([1, 3, 4, 6, 7])

y = np.array([-3, 9, 30, 132, 100])
```

```
data = pd.DataFrame({'X': x, 'Y': y})
print("Given Data Points:")
print(data)
def lagrange_interpolation(x_values, y_values, x_point):
    n = len(x_values)
    result = 0
    for i in range(n):
        term = y_values[i]
        for j in range(n):
            if i != j:
                term *= (x_point - x_values[j]) / (x_values[i] - x_values[j])
        result += term
    return result
x_new = np.linspace(min(x), max(x), 100)
y_new = [lagrange_interpolation(x, y, xi) for xi in x_new]


plt.scatter(x, y, color='red', label='Given Points')
plt.plot(x_new, y_new, label='Lagrange Polynomial',
color='grey',linestyle='dashed')
plt.xlabel('X')
plt.ylabel('Y')
plt.legend()
plt.title('Lagrange Interpolation')
```

```
plt.grid()

plt.show()

x_val = 5

y_val = lagrange_interpolation(x, y, x_val)

print(f'Estimated y at x={x_val}: {y_val}')
```

Program Output :

```
Given Data Points:
  X   Y
0 1  -3
1 3   9
2 4  30
3 6 132
4 7 100
Estimated y at x=5: 82.88888888888889
```