AI4ICPS IIT Kharagpur	**IIT KHARAGPUR AI4ICPS I HUB FOUNDATION** **H**ands-on **A**pproach to **AI**, **Cohort-4, November 2025 - January 2026** **Programming Assignment 2**

Objective:

The objective of this assignment is to create a Python program using NumPy that performs different mathematical computations based on an input value. This will test your understanding of NumPy functions, and conditional logic in Python.

Problem Statement:

Write a Python program that performs advanced mathematical computations based on an input value (x).

1. Students should only modify the function advanced numpy calculator(x) to implement the computations.
2. Do not modify anything in the main section or the rest of the code.
3. The function advanced numpy calculator(x) should return the output correspond ing to the input x rounded to four decimal places.
4. All output values should be rounded to four decimal places.
5. Submit your solution in a file named assignment2.py.

Mathematical Operations:

Input Range (x)	Operation	Description	NumPy Functions
$x < 0$	Exponential Decay	Compute e^x	np.exp(x)
$0 \leq x < 10$	Trigonometric Transformation	Compute $\sin(x) + \cos(2x)$ (convert degrees to radians)	np.sin(), np.cos(), np.radians()
$10 \leq x < 50$	Logarithmic Scaling	Compute $\log(1 + x) \times \sqrt{x}$	np.log1p(x), np.sqrt(x)
$50 \leq x < 100$	Matrix Determinant	Determinant of $[[x, x/2], [x/3, x/4]]$	np.array(), np.linalg.det()

$x \geq 100$	Polynomial Evaluation	Evaluate $x^3 - 2x^2 + 3x - 4$	np.polyval(coeffs, x)

Test Cases:

Test Case	Input (x)	Expected Operation	Expected Output
1	-5	Exponential decay	0.0067
2	-0.1	Exponential decay	0.9048
3	3	Trigonometric transformation	1.0469
4	15	Logarithmic scaling	10.7382
5	30.25	Logarithmic scaling	18.9311
6	55	Matrix determinant	252.0833
7	100	Polynomial evaluation	980296.0000

Skeleton Code:

Students are required to modify the following Python code:

```
# assignment2.py

import sys
import numpy as np

def advanced_numpy_calculator ( x ) :
    """
    Perform a mathematical calculation based on the value of x. To be implemented by the
    student .
    """
    # TODO : Implement the logic based on x
    # Hint : Use conditional statements to handle different ranges of x
    # Use NumPy functions for calculations
    pass

def main () :
    if len ( sys . argv ) != 2:
        print (" Usage : python assignment2 .py <number >")
        sys . exit (1)

    try :
        x = float ( sys . argv [1])
    except ValueError :
        print (" Please enter a valid number .")
        sys . exit (1)
```

```
        result = advanced_numpy_calculator ( x )
        print ( f" Output : { result :.4 f}\n")

if __name__ == " __main__ ":
        main ()
```

Instructions for Students:

1. Modify the advanced numpy calculator(x) function to handle all 7 operations.

2. Use NumPy functions wherever possible.

3. You can run the program from the command line to check if it performs correctly:

    python assignment2.py 25