Module 8: Assignment
Solving Mathematical Problems In Matlab

Problem Statement

You are part of a research team at an electric vehicle (EV) manufacturing company, responsible for enhancing EV design and performance using MATLAB. Your project involves optimizing different aspects of EV technology.

Tasks to be Performed

To accomplish this, you need to complete the following tasks:

- **Elementary Math (EV Battery Management):**

  The EV battery management system monitors three types of battery cells: lithium-ion, nickel-metal hydride, and lead-acid. If each EV requires 2 lithium-ion, 2 nickel-metal hydride, and 2 lead-acid cells, determine the total number of cells needed for a fleet of EVs.

- **Trigonometry (Charging Station Design):**

  In designing charging stations for EVs, understanding the angle at which charging plugs will be positioned against charging ports is crucial. If a charging plug forms a 60-degree angle with the ground and extends 12 meters, calculate how high up the charging station wall the plug reaches.

  [Note : Height = Ladder Length×sin(Angle)]

- **Linear Algebra (Powertrain Optimization):**

  The efficiency of an EV's powertrain system depends on various factors, including motor and battery performance. Solve the system of linear equations representing the powertrain optimization model to determine the optimal values for motor power (x) and battery capacity (y).
  Consider a system of linear equations:
  $2x + y = 5$
  $3x - 2y = 8$

- **Interpolation (Range Estimation):**

  EV range estimation relies on interpolating data points to predict battery consumption at different speeds. Given the data points (1, 4), (3, 8), and (5, 12) representing battery consumption at various speeds, interpolate the estimated battery consumption at a speed of 4 m/s using linear interpolation.

- **Numerical Integration (Energy Consumption Analysis):**

  Assessing the energy consumption of an EV involves integrating the function f(x) = x^2 from x = 0 to x = 2 representing power usage over time. Use the trapezoidal rule with 4 intervals to approximate the integral of the function representing the power consumption of an EV during a 2-hour drive.

- **Matrix and Pseudo Functions (Battery Management System Analysis):**

  Given matrices A=[1 2;3 4] and B=[5 6;7 8], calculate the product of the determinant of A and the inverse of B to analyze the stability of the battery management system in EVs. [This involves finding the determinant of A, then finding the inverse of B, and finally multiplying them together.]

- **Polynomial (Motor Control Optimization):**

  Factorize a polynomial expression x^2 + 5x + 6 representing motor torque as a function of speed, aiding in the optimization of motor control algorithms for EVs.