**Code Workflow of Part b):**

1. **Data Loading:**

The datasets (trainProject2.txt and testProject2.txt) are loaded using numpy's genfromtxt function. The data is separated into input (x\_train and x\_test) and output (y\_train and y\_test) variables.

1. **Feature Generation:**

The generate\_features function is used to transform the input data based on the given function depth d and frequency increment k. For each depth, it generates sinusoidal features of the form

1. **Linear Regression Implementation:**

The linear\_regression function computes the model parameters (or weights) using the normal equation method. This is a closed-form solution to linear regression.

1. **Prediction**:

The predict function computes the output for given input features and model parameters.

1. **Model Fitting:**

The fit\_model function integrates the above steps. It generates the features, fits the linear regression model, and returns the model parameters.

**Results**:

c) Model Fitting and Visualization:

For each function depth (0 to 3), the model was fit to the training data. The resulting functions were plotted alongside the training data points. As the function depth increased, the model became more flexible, capturing more intricate patterns in the data.

d) Model Evaluation:

The Mean Squared Error (MSE) was computed for each function depth on the test data. By plotting the errors, we could identify which depth resulted in the lowest test error. The depth with the minimum error is considered the best prediction function as it generalizes well to unseen data.

Answers for c)

A graph on a grid

Description automatically generatedA graph with blue dots and red line

Description automatically generatedA graph with blue dots

Description automatically generatedA graph of a function

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Answers for d)

A graph with a line going up

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**The best function depth is d=3 with the minimum error of 0.0204.**

A close up of a piece of paper

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