Assignment 1

Question 1

1. No, the relationship is not linear. When plotting the test data (Figure 1) you can see it look like part of either a sinusoidal wave or part of a higher order odd numbered polynomial. Trying to plot the data to a linear equation will result in large variance.
2. Yes, because the data looks like part of either a sinusoidal equation or a higher order odd numbered polynomial I will need to add a non-linear equation. The easiest way to engineer these types of equations is to use an online graphing calculator (I prefer desmos.com) to model them and see how well they could fit the data. I first tried a 5th degree polynomial (Equation 1) where I multiplied each instance of x by a unique constant and the entire thing by a weight (w). the resulting graph (Figure 3) was a close approximation. I then set the constants to set number to get a single usable equation (Equation 2) (Figure 4). While working with the graph trying to get a better equation I found it extremely difficult to get the data to line up. I then to try to find a new equation (Equation 3). The new equation was a sinusoidal and 3 order polynomials added together. The new equation gave me better control over the constants to change the points of the graph (Figure 5).

Chart, line chart

Description automatically generated

Figure 1. Given Test Data Modeled on Graph as Scatter Plot

Chart

Description automatically generated

Figure 2. Data From Equation Compared to Test Data

Chart, line chart

Description automatically generated

Figure 3. Equation 1 graphed

Chart, line chart

Description automatically generated

Figure 4. Equation 2 graphed

Chart, line chart

Description automatically generated

Figure 5. Equation 3 graphed

Chart

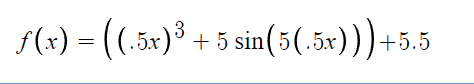
Description automatically generated with medium confidence

Equation 1. First Attempted Equation

A picture containing text, clock

Description automatically generated

Equation 2. First Attempted Equation with Set Coefficients



Equation 3. Second Attempted Equation

Question 2

1. The least squares error for the given data is:
   1. Local Price [28.56335311]
   2. Bathrooms [27.87238633]
   3. Land Area [107.38796413]
   4. Living area [29.09665536]
   5. # Garages [152.06157685]
   6. # Rooms [76.53857002]
   7. # Bedrooms [98.41039063]
   8. Age of home [175.9450102]
   9. Construction type [187.49174768]
   10. Architecture type [193.16061475]
   11. # Fire places [146.84583124]
2. The number of bathrooms has the largest effect on price. The smaller least square error indicates the larger effect on the price. You can justify this reasoning by looking at the data. You can see that when the number of bathrooms increase there is a large price increase compared to other houses with similar properties but less bathrooms
3. The Architecture type has the least effect on price. The smaller least square error indicates the smaller effect on the price. You can justify this reasoning by looking at the data. You can see that when the number for architecture type increase there is no noticeable price change compared to other houses with similar properties but lower architecture type.

Question 3

1. I did not need a bias function to find the weight
2. In question 1 I was to model based off an equation while in question 3 I was to model based off and equation and use weights to better fit my data to the equations

Chart

Description automatically generated

Figure 6. Test Data Compared To Weight Based Equations