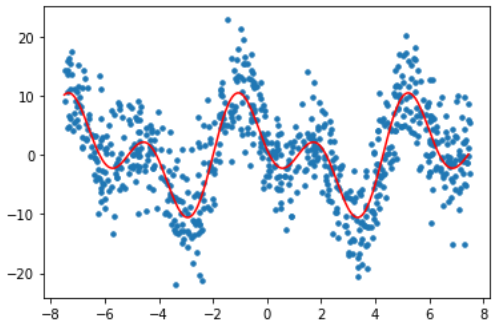
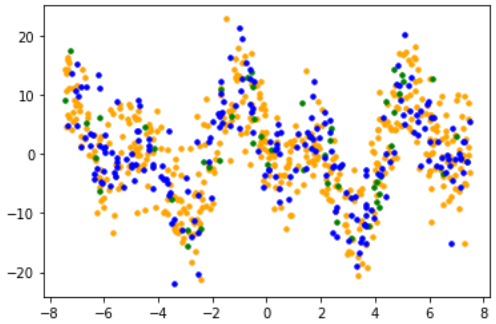
Assignment -1 Reports and Discussion

Plot of true function[Fig.1]:



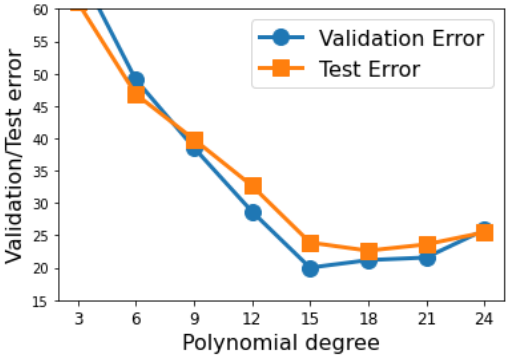
Scatter plot of data[Fig.2]:



<u>Regression with Polynomial basis function</u>

Evaluation of Validation Data and Test Data

Plot of d vs Validation Error and Test Error[Fig.3]



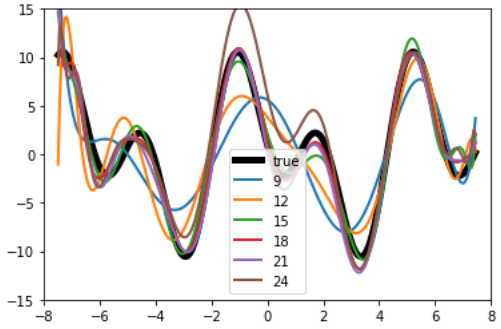
Part-D : Which choice of d generalize the best ?

From Fig.3, the value of d which generalizes best would be 15.

As discussed in class, The number of data points to number of parameters of Validation data set is 1:5 for a 15 degree polynomial whereas for test data set, it is 1:15. Hence , neither overfitting nor underfitting happens for polynomial degree 15.

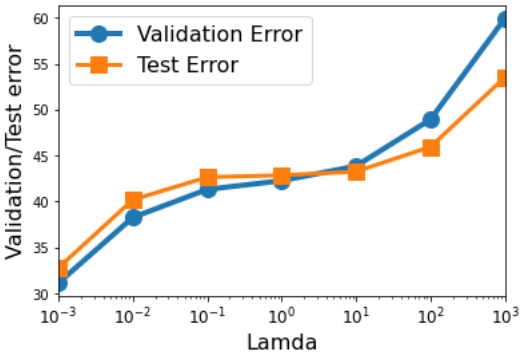
Also, the test error is below 25 and validation error is below 20, which seems to have learned the original model very well.

Visualization of learned model[Fig1.4]



Regression with Radial Basis function

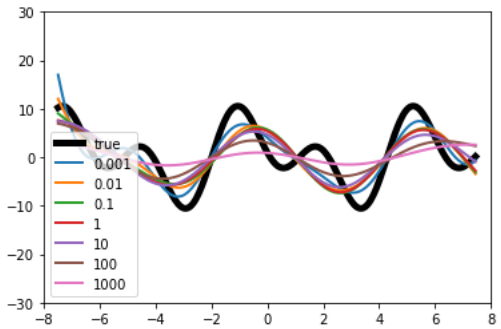
Plot of λ vs Validation and Test Error[Fig.5]



Part-C : What are some ideal values of λ ?

From Fig.5, we could see the error value increases with the increase in value of λ. The ideal values of λ would be 0.001,0.01, which neither underfits or overfits the data.

Visualization of learned models[Fig.6]



Part – D: How does the linearity of model change with λ ?

From Fig.5, when $\lambda=10^{-3}$, the model becomes more flexible and it almost tries to mimic the true function , but when $\lambda = 10^{3}$, the value of parameters becomes too restricted and it almost looks like a straight line .

Hence , the parameters are too flexible with λ nearing to -Infinity, the model is overfitting the data points and when λ nears to + Infinity, the values of parameters are too restricted and the model seems to underfit the data.

For the given data point, the ideal regularization would be setting λ to be 10^{-3}, 10^{-2}