Summary of Weekly Reports

Week 1

Week 1 was spent mostly trying to understand the underlying physics of the experiment, so that the data I was receiving was understood be me in the right context. I initially tried to take all of the intensity data using, *data = np.loadtext(filename, skiprows = x),* this however proved unsuccessful and after some research and testing I realised that I was using *np.loadtext()* ineffectively. n*p.loadtext()*, reads the file line by line thus I could acquire the metadata and data with one code block rather than something more complicated. Furthermore, to ensure that I was practising error handling, I included *try-except* blocks to do so.

Week 2

Breaking the main task of fitting the data to different test functions, into smaller ones started with turning the dimensions into units of $\sin(\theta)$. This involved using trigonometry and Pythagoras' theorem. I decided to arbitrarily choose column or row 125 as the "middle" slice of the dataset because interpolation in between the columns was not possible without knowing the right function and since the numbers were already so small, the improvement in error would be negligible. To make next week easier for myself, I create the test functions that the slices of data would be curve-fitted to.

Week 3

Whilst experimenting with the test data and my functions, I was able to figure out which data strips would work best with which functions. For example, the diamond curve-fitting function gave more accurate results, if the vertical and horizontal strips were fitted against the $\mathrm{sinc}^4()$ function and the diagonal strips being tested against the $\mathrm{sinc}^2()$ function. This makes sense as a diamond is a square rotated 45*, meaning that the horizontal/vertical strip would become the diagonal strip. Another skill that I wanted to work on was writing more readable code, this involved condensing repeated code into one for loop, making the program less bloated.

Week 4

The dictionary data structure seemed to be the best way to store the values generated from the various tests. Having done so it made it easier to compare values and thus made the most important part of the project simple. With all of the obtained data for dimensions it was possible to do mathematical tests for what shape the diffraction grating was. An example would be identifying a rectangle over a square, one of the dimensions would have to be different form another. A problem was trying to account for the effect of noise: the simplest solution I thought of was adding an arbitrary 1% error to the value comparison, this would limit the program as it would identify rectangles with a difference of 1 microns as a square.

Week 5

This was the final week I spent on the program. Most of it was spent making sure all the separate parts of the code worked nicely together. I double checked that the code was

giving reasonable results for as many different types of data possible. Then I wrote up my report and created a flowchart of the code.