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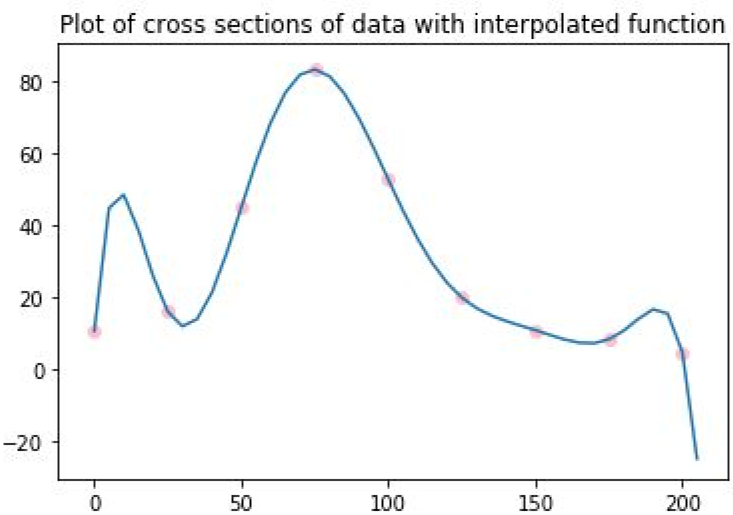
Computational Physics
Exercise 17
Fitting an Energy Spectrum with Lagrange Interpolation

After creating the function to perform a Lagrange interpolation, we can compare the calculated results with the expected results.
Resulting equation:

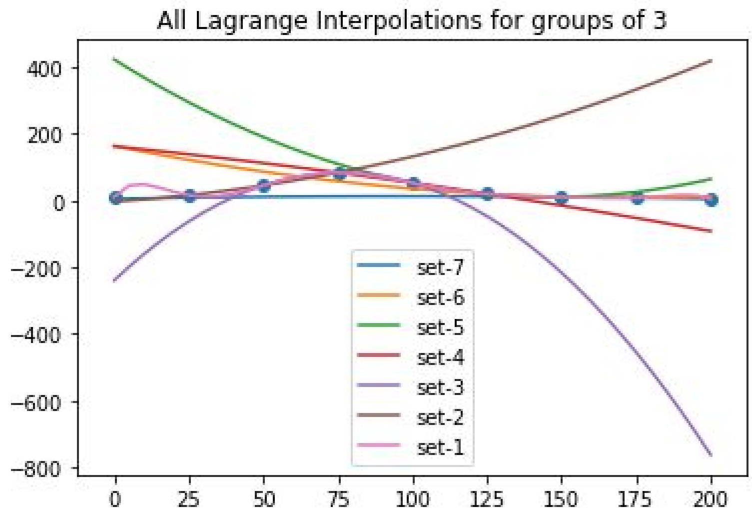
$$-1.155e\text{-}13\, x^{8} + 9.976e\text{-}11\, x^{7} - 3.543e\text{-}08\, x^{6} + 6.631e\text{-}06\, x^{5} - 0.0006943\, x^{4}$$
$$+ 0.03955\, x^{3} - 1.093\, x^{2} + 11.41\, x + 10.6$$

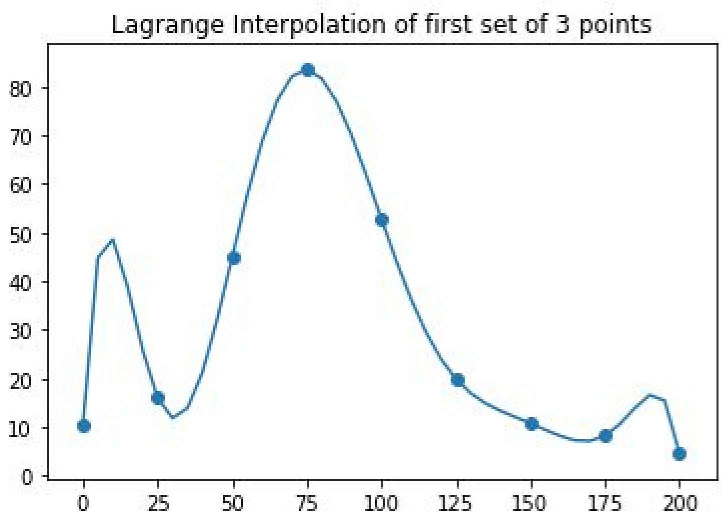



Peak position: 83.50000000003166
The FWHM: 55

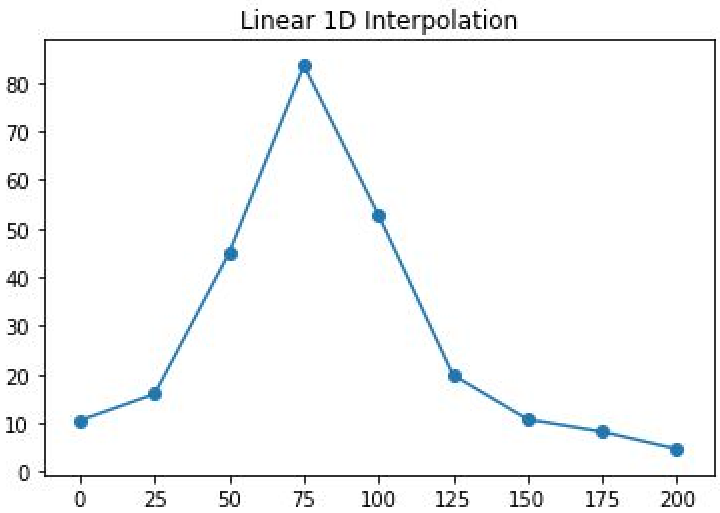
With the expected values of peak position and full width half max, 78 and 55 respectively, my experimental values and predicted theory are in agreement for the full width half maximum. There is not as much agreement for the peak positing. My peak position is slightly greater in value by about 5 points. I find this interesting. Even though the peak is off, the FWHM is actually on par.

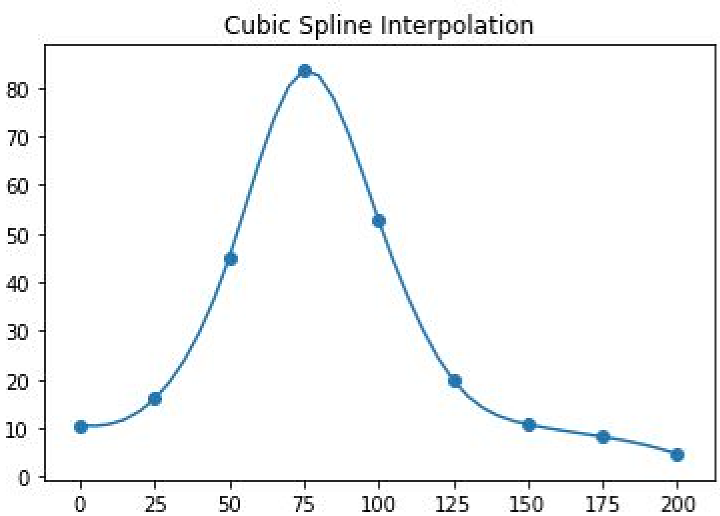
Below are the graphs produced when you perform the lagrange interpolation of sets of 3 values and a look at the first set of three values individually.




Here we can see that the first set is quite similar to the full lagrange interpolation computed before. They other set are quite different and are in reference to the individual sets of 3 values. Below are the two graphs representing the linear 1d interpolation and cubic spline interpolation respectively.




When looking at each graph for the different types of interpolation, it seems the cubic spline is providing the best fit curve for the data provided that goes through each of the points. When stepping through the dataset every three points, the first set provides the best curve fit when is comparable to the lagrange interpolation. Both the lagrange interpolation and the first set fit the data,but has issues with the end points. When viewing the different sets of 3, each one is fitting for the particular set of points, and therefore, if combined, would probably look like the first set, pretty close, but still off a bit. The linear 1-D interpolation, also fit the data well, from point to point, but it is pretty severe and most likely not like the actual function. The Cubic spline is the better curved version of the linear 1-D version so to speak. It hits all the points, but is continuous.