

Ph3 Mathematica Homework:

Week 5

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v1.1

1 Residuals

Residuals measure the differences between your data points and your theory.

$$r_i = y_i - f(x_i)$$

Exercise 1: Calculate the residuals $\{x_i, r_i\}$ for your data and fits from last week, and plot them on appropriate scales. Do this for both the linear and Lorentzian data sets. Include the same error bars of ± 0.3 on each value of r_i that you used on the y_i values in the linear data earlier.

If your fit is good, roughly half of your residual points should be above the x-axis, and half should be below. If the random error in your data is gaussian and your error bars are accurate, about two-thirds of them should enclose the x-axis, and the remaining third of your residuals will be more than one sigma away from zero. (Do you recall from Taylor, Chapter 5 why this is to be expected?) These are two simple but important tests that can tell you at a glance if your fit is off, your error bars are wrong, or your data is not gaussian. Any one of these should send up alarm bells, and if you see them you should try to find out what is going on.

Exercise 2: Do your residual plots satisfy these criteria? Do the error bars appear to have been chosen correctly?