ESC103F Engineering Mathematics and Computation: Lab #4

An experimenter believes that the electrical conductivity (*y*) of cotton fibre depends on the humidity (ξ) and that over the range of humidity of interest, an approximately linear relationship, obscured by experimental error, will exist. It is common to transform linearly a variable such as humidity to coded form:

$$x = (\xi - \xi_0) / S$$

where ξ_0 is a convenient reference humidity and *S* is a scale factor. The linear model may then be written as:

$$y = a + bx$$

The data collected by the experimenter is as follows:

Humidity percent (ξ)	20	30	40	50
Observed electrical conductivity	8	23	28	34

Code the humidity as follows:

$$x = (\xi - 35) / 5$$

a. Fit the above linear model based on the coded humidity and plot the fitted model along with the four points on a single figure. On the x-axis, plot the coded humidity and on the y-axis plot the electrical conductivity.
b. Fit a quadratic model to this same set of data of the form $y = a + bx + cx^2$ and plot this model fit on the same figure as part a) using a different line type.
c. Given that there are four data points, you can also curve fit the data with a cubic model of the form $y = a + bx + cx^2 + dx^3$. Plot this model fit on the same figure as part a) and b) using a different line type.
d. Comment on these different model fits in terms of their use/value for (i) interpolation and (ii) extrapolation. Which model would you recommend be used?