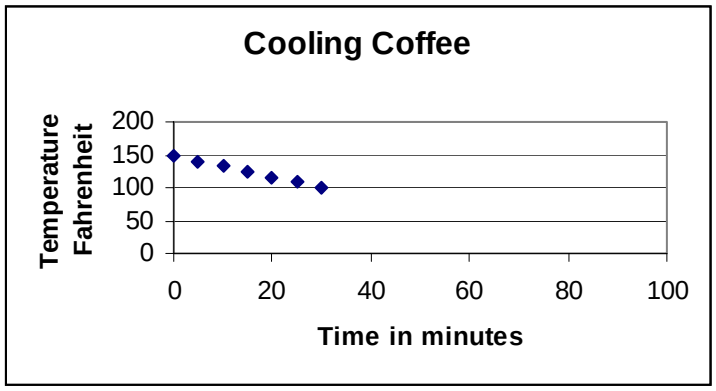
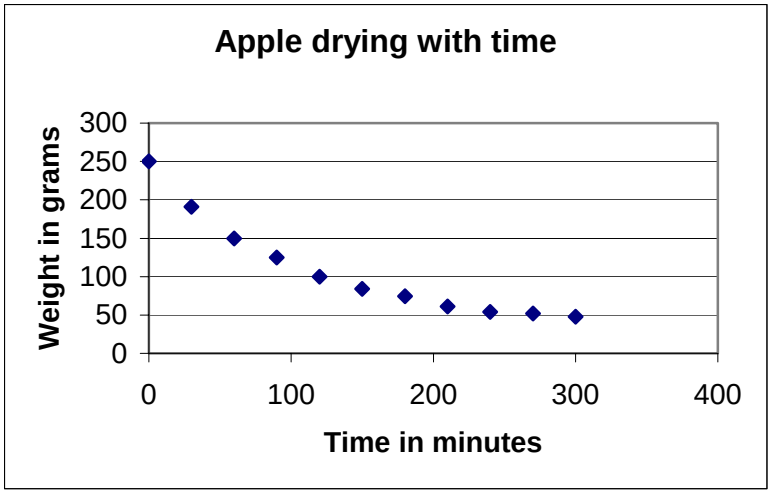
Extrapolation of non-linear data

Often there is not enough data that has been obtained from experimentation and we need to extend, or extrapolate, from known data to values beyond the known. Often the extrapolation is linear, we draw or the computer draws a straight line from the last point to point in the future. Think about a cup of coffee cooling. If you were to plot the data, the temperature would decrease over time. The data might initially look like,



However, if you were to extend this with a straight line, the temperature at 100 minutes would be below freezing, not room temperature. So using straight-line extrapolation is not always possible and we need to think about what is happening physically to the item we are analyzing. In this case we know that the coffee should be at room temperature at 100 minutes so there will be an approximated data point of 75 F at 100 minutes. A curved line is used to connect the last point to the 75 F point. This line represents the extrapolation of data. For instance, we would use this to determine the value of temperature at 60 minutes.

When apples are dried, the water evaporates but the fibrous material and some entrapped water remains. Apples can be dried to 15-18 % of their initial weight, so just as the coffee can only cool to room temperature, the apple can only dry to a weight that is in the 15-18 % range. A plot of the data might be as shown below. However, students will typically not have the time to plot all the data and need to non-linearly extrapolate from known to unknown conditions.



Imagine that the students only measured data for the first 120 minutes, they would need to extrapolate the data to the 300 minute value of 20% of the initial weight. The student will need some information as to approximately how long the drying will take and the final weight (or percent of initial weight) that can be expected at that time. The data can be extrapolated in an analogous manner used for the coffee. It is not possible to use this extrapolation technique if no information is known about the final state.