Testing Objectives

□ Create scatter plots for data sets.
□ Visually determine whether a linear model is a “good fit” for given data.
□ Determine if a set of data can be modeled exactly or approximately by a linear function.
□ Model a set of data with a linear function.
□ Solve problems using linear models.

Scatter Plots and “Good Fit”

EXAMPLE #1. Create scatter plots for each data set and visually determine whether a linear model will be a good fit for the data.

(I) \[ \begin{array}{c:c:c:c:c} x & 1 & 2 & 3 & 5 & 7 \\ \hline y & 1 & 3 & 6 & 1 & 9 \end{array} \]  

(II) \[ \begin{array}{c:c:c:c:c} x & 3 & 6 & 9 & 12 & 15 \\ \hline y & 4 & 6 & 8 & 10 & 12 \end{array} \]  

(III) \[ \begin{array}{c:c:c:c:c} x & 2 & 4 & 6 & 8 & 10 \\ \hline y & -5 & -6 & -7 & -9 & -10 \end{array} \]
First Differences

If the input values for a data set are uniform (equally spaced), then you can compute the first differences as the differences in consecutive output values. If the first differences are constant, then the data can be fit exactly by a linear model. If the first differences are not constant, then the data can be fit approximately by a linear model.

**REMARK #1.** If the input values are not uniform, then we cannot use the idea of first differences. We must resort to some other technique to find the linear model, such as using the Graph program.

**REMARK #2.** When we need to provide a model for a set of data, we often round values in the model for reporting purposes. Please round as instructed and please do not use the rounded model for calculations unless specifically instructed to do so.

**EXAMPLE #2.** (A) For each of the data sets in EXAMPLE #1, is the input data uniform? (B) If the input data is uniform, compute the first differences and determine if a linear model will fit the data exactly or only approximately. (C) Find linear models that are the “best fit” for each data set. You should use algebraic techniques if a linear model is an exact fit for the data.

Some Terminology

We are interpolating when we use a model to obtain an output value for some input that falls within or between the given input data. We are extrapolating when we use a model to predict an output value for some input that falls outside the given input data.

**EXAMPLE #3.** (A) Use the model found for data set (II) in EXAMPLE #1 to find the corresponding y-coordinate when $x = 8$. Is this an interpolation or an extrapolation from the data? (B) Use the unrounded model found for data set (III) to find the corresponding y-coordinate when $x = -4$. Is this an interpolation or an extrapolation from the data?