Choose a model

Concepts

- Determine an appropriate model for a set of data
- **Investigate the importance of residuals**

Materials

- TI-83/4 Plus
- TI-Navigator™ software

Overview

After students have experienced a variety of functions, this activity will allow them to explore a given data set and choose an appropriate mathematical model.
The **examination of the residuals** is important for this data set.

Introduction

This activity uses 'canned' data to investigate the importance of examining the pattern in the residuals of a regression algorithm.

This activity requires the files **Choose a Model listX.8xl** and **Choose a model listY.8xl**. (These files contain L1 and L2 respectively. The file **Choose A Model LC.edc** (a Learning Check activity) is optional.

Activity

1. Use TI-Navigator **Send To Class** to send the lists to the students.

2. Ask the students to:
   - Display a ScatterPlot (Plot1) of the data [L1, L2] (Figure 1).

     Choose a regression model that seems to fit the data. Try several models and decide which model might *best* fit the data. Have each student store their equation to a different Y= function (on the 83+, you are limited to 10 functions, so expect duplicates).

     Note: **SinReg** often requires a 'seed' for the period of the *sin* function:

     SinReg L1, L2, 360, Y1

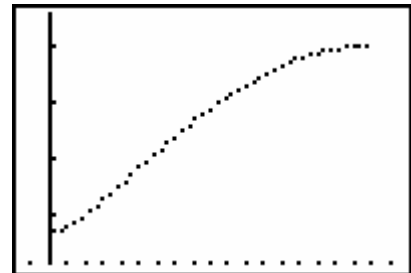   '360' is the assumed period of the *sin* function.

Figure 1

3. Use TI-Navigator **Activity Center** to collect students' **functions**. Configure to collect one equation from calculator (Y1). Optional: load the lists and configure the plot to display the data as well.

4. Use TI-Navigator **Screen Capture** to collect student **screens** showing data and fitted function and project for all to see.

5. *(most should have a pretty good fit)*

6. Ask students to display a ScatterPlot (Plot2) of **[L1, RESID]** (After fitting a CubicReg, the RESID plot is shown in Figure 2). *(be sure to turn off Plot1 and all Y= functions, then fit the plot into an appropriate viewing window (Zoom 9?)*

7. Collect student **screens** of the residual plots and project them for all to see.

8. Explain the significance of the residuals plot (that no pattern is a good thing; if there's a pattern then you have an imappropriate model).

Explanation

The data actually comes from two 'generated' lists:

L1= seq(x, x, 2, 180, 4)

L2= $round(\sqrt{(5\wedge2 + 7\wedge2 - 2*5*7\cos(L1°))}, 2)$

That is, two sides of a triangle are 5in and 7in. Measure the length of the third side as the angle between the two sides varies from 2 to 180 degrees in increments of 4 degrees. The independent variable is the angle measure, and the dependent variable is the length of the opposite side. The *round*( ) operation is used to emulate the approximation involved in actually doing the measuring with protractor, ruler, pencil, and paper.

None of the regression algorithms fit the data well, since all the regressions produce residuals with a pattern.

Note: SinReg often requires a 'seed' for the period of the *sin* function:

SinReg L1, L2, *360*, Y1
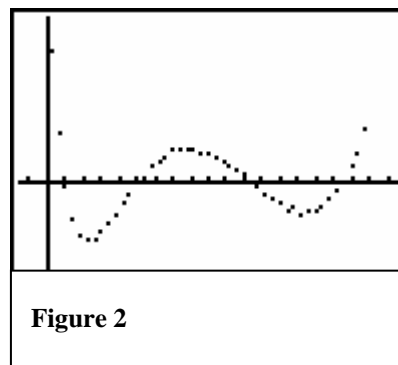
'360' is the assumed period of the *sin* function.

Figure 2

Finally, give students the function:

$$Y3 = \sqrt{(5\wedge2 + 7\wedge2 - 2*5*7\cos(L1°))}$$

Back to TI-Navigator…

10. Send the *TI-Learning Check* file **Choose a model.edc** to the students and have them complete the assignment.

11. Collect the answers from the students, examine the *Class Analysis*, and, if a projector is available, display the slideshow. Discuss answers.