Body & Claw
Algebra 1

Now let us explore the relationship between a crab's body mass and its claw mass. Based on the data from Export My Data and using the techniques developed in Quite a Stretch, we will try to develop a model to show the relationship. If we find a good model, then we can predict the claw mass of a crab with any given body mass, and match a body mass with a given claw mass. Document all work on your paper, and/or in Word with screen shots. Remember that all graphs need a WINDOW.

- Run your program that stores the BODY and CLAW lists.
- Examine the values by looking at the lists in your List Editor. What pattern do you see between these two lists? Note that these values are mass in milligrams. Create an analytical pattern, that is, a formula to determine what to do mathematically with the body mass to get the claw mass.
- Set up a Scatter Plot of the list with the x-axis being the BODY list and the CLAW list for the y-axis.
- Place the following in the $\boxed{Y=}$ editor. $\mathbf{Y_1 = AX + B}$, $\mathbf{Y_2 = AX^2 + BX + C}$, $\mathbf{Y_3 = A*B^X}$. Turn only one of these on (darken the = sign).
- In the Home Screen assign the following starting values based on the rule you want to use. 1=A and 0=B for $\mathbf{Y_1}$; 1=A, 0=B, and 0=C for $\mathbf{Y_2}$; and 1=A, and 1=B for $\mathbf{Y_3}$.
- Look at the Graph with the Scatter Plot and see how well the line goes through the collection of points.
- Adjust the values of A and B until you get a good fit. Use the "pattern" that you saw when you examined the two lists to help you adjust the values.
- Report your best guess using the equation: CLAW = A*BODY + B; CLAW = A*BODY^2+B*BODY+C; or CLAW = A*B^{BODY} .
- Have the computer calculate the line using the LinReg; QuadReg; or ExpReg options. Place the Regression equation in Y_4.
- Of the two lines (Your guess, and the Regression), which "tells the story" best? Why?
- Set your window so that you may see the Origin (i.e. set Xmin = 0 and Ymin = 0). Now which line seems best?
- Examine the Residuals for the model you selected. Give a graph of the Residuals (with X as Body, and Y as the Residuals) and identify any pattern. Calculate the sum of the residuals and the sum of the squares of the residuals (looking for a minimum area). Recall the Data – Model gives the Residual.
- Using all three Methods (Graph, Table, and Solver) and your best model, answer the following: What will the BODY mass be when a crab has a CLAW mass of 7 grams? Recall 1 000 milligram = 1 gram.
- Which of the three models from the 7 Systemic Parts of Algebra did you select?
- How could you use this new rule that shows the relationship between the mass of a crab's body and its claw mass?