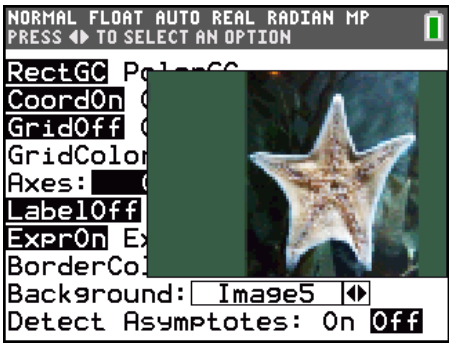
A Family of Starfish

In this activity students overlay a connected lineplot onto the image of a starfish to enhance its beauty. They will also create additional starfish by transforming its coordinates and explore if figures are similar.

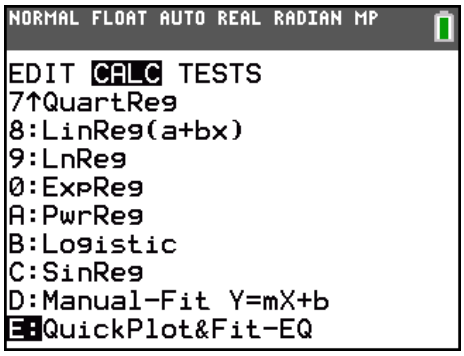
Enhancing the Natural Beauty of a Starfish

1. Display the image of the starfish by pressing [2nd] [FORMAT] to access the Graph Format menu.
   - Turn the Axes Off.
   - Use BorderColor 3.
   - For the Background, use built-in Image5.



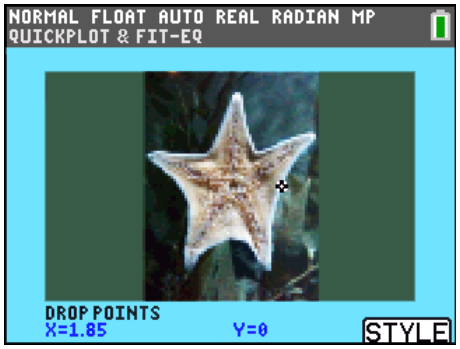
2. Clear any functions in Y=. Turn off any STAT Plots. Press ZOOM and use 4:ZDecimal.

   Press STAT and use the right arrow to reach the CALC menu. Scroll to the end of the menu to highlight E:QuickPlot&Fit-EQ. Press [ENTER].

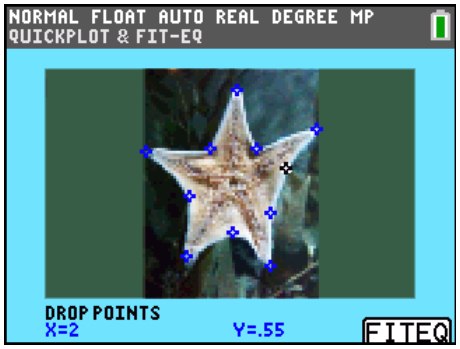


3. Drop points along the border of the starfish which will later be connected by line segments (in the order in which you dropped them) through the STAT PLOT menu.

   The default color (blue) can be changed now with the STYLE key or later when setting up the plots.



4. Once all the points have been dropped, press FITEQ.

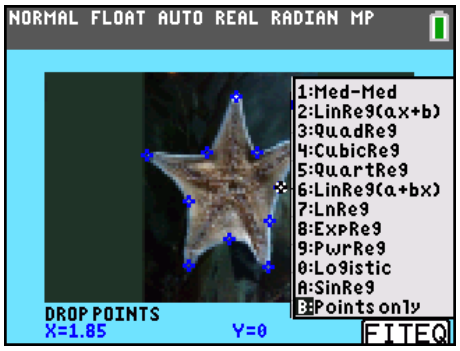


5. Pick any regression model. (It will be ignored. We just want the dropped points.)

   The model will be drawn on the screen.
   Press GRAPH to STORE.
   Use L1 and L2 and Y1.

   Select OK and press ENTER.

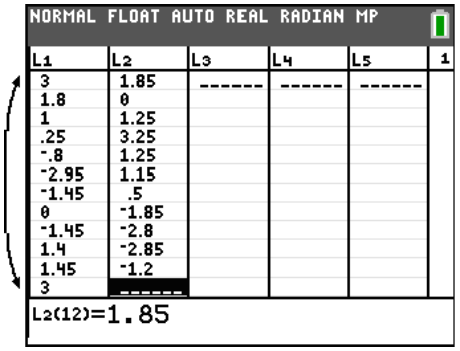
   Press Y= and clear Y1.



6. Press STAT and 1:Edit to reach the Stat-List Editor.

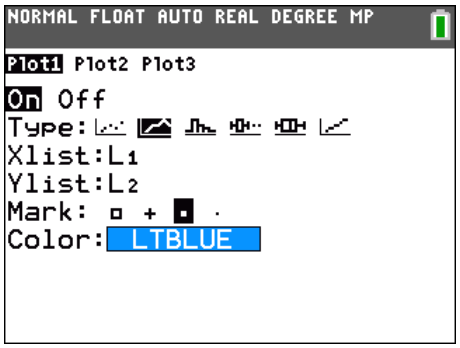
   To draw a closed connected polygon for the border of the starfish, we need the first ordered pair and the last ordered pair to be the same point.

   If they are not the same, press [2nd] [INS] to add the last point so it is the same as the first.



7. Press [2nd] [STATPLOT] to set up the plot.

   The light blue color provides the starfish with a glowing appearance.



Adding to the Starfish Family.

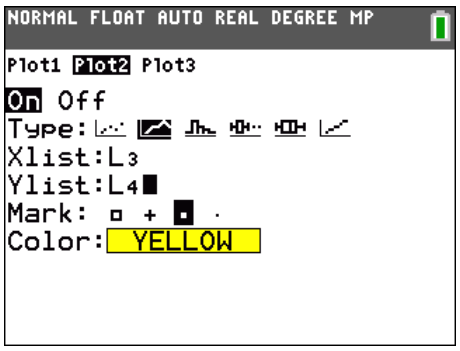
Students make additional starfish by multiplying the coordinates of the original.

1. On the home screen create L3 using `1.2L1→L3`
   (press 1.2 [2nd] 1 [STO▸] [2nd] 3).
   Similarly create L4 using `1.2L2→L4`.

   Ask students to predict and explain what will happen to the shape. Is this starfish shape similar to the original shape?

   Press STAT and 1:Edit to view the data.
   Press [2nd] [STATPLOT] to set up the plot in Plot2, leaving Plot 1 on.

   Press GRAPH to see the changes.

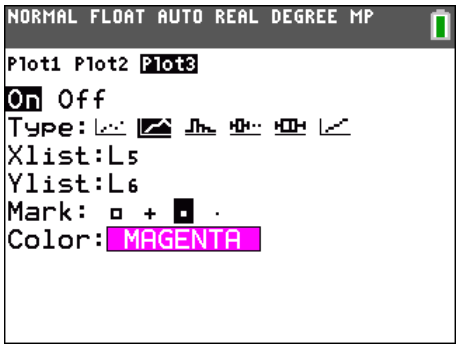


2. On the home screen create L5 using .5L1→L5

   Similarly create L4 using .5L2→L6
   Ask students to predict and explain what will happen to the shape. Is this starfish shape similar to the original shape?

   Press STAT and 1:Edit to view the data.
   Press 2nd [STATPLOT] to set up the plot in Plot3, leaving Plot 1 and Plot 2 on.

   Press GRAPH to see the changes.



Extensions

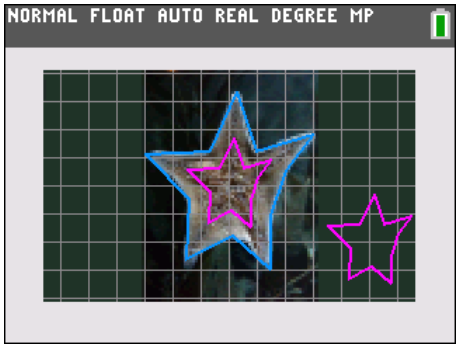
Let's name the smaller, magenta colored starfish Patrick, i.e. the plot with XList as L5 and Ylist as L6 where .5L1→L5 and .5L2→L6. Predict how Patrick's shape is changed after entering the following commands on the home screen. Then press GRAPH to verify your prediction.

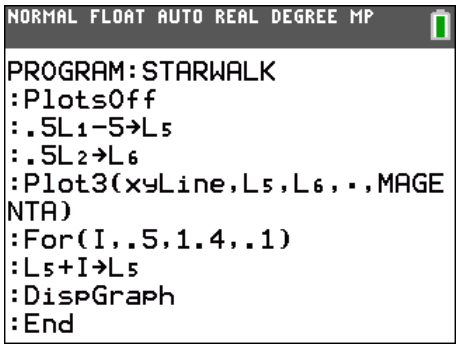
1. Enter .5L1+5→L5 on the home screen to change Patrick's *x*-coordinates. Do not change L6. Note: You could also just do L5+5→L5 as long as you are careful, but then you will need to subtract 5 from each coordinate to return to Patrick's original coordinates for the next exploration.
2. Make additive changes to Patrick's *x*-and *y*-coordinates by entering .5L1−5→L5 and .5L2+2→L6 .
3. Explore what happens to Patrick's *x*- and *y*-coordinates if you enter
   a. L1→L5 and .5L2→L6 b. L1→L5 and ⁻L2→L6
4. Enter your own creative explorations!
5. Show students a transformation of Patrick and ask them how they can create it.

   It may be helpful to have Plot 2 show Patrick's original shape by entering .5L1→L3 and .5L2→L4 on the home screen and changing the color to magenta. The gray GridLine might be helpful here.

   For example, in the screen shown, Patrick has been shifted 5 units to the right and 2 units down.

   Answer: .5L1+5→L5 and .5L2−2→L6



6. If you are interested in programming, you can create a simple animation of Patrick walking across the screen.

   This program assumes you have already created the lists L1 and L2 first.