

Graphing Calculator Discussion:

This activity also provides an ideal situation for modeling using a graphing calculator.

Entering Data in Lists. We can begin by entering the Elapsed Year in a list, say L1. Let L1 = {0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10}. On a TI-83 calculator, press STAT, 1:Edit, and enter the data.

Let L1 = number of elapsed years

L2 = length of Jack's plot of land

L3 = width of Jack's plot of land

L4 = area of Jack's plot of land

We want to enter the length of Jack's plot of land in L2. How is the length of Jack's plot related to the values in L1? $L2 = 10 + L1$. Move the cursor so L2 is highlighted and type $10 + L1$. Then press ENTER. L2 should now include {10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20}.

We want to enter the width of Jack's plot of land in L3. How is the width of Jack's plot related to the values in L1? $L3 = 10 - L1$. Move the cursor so L3 is highlighted and type $10 - L1$. Then press ENTER. L3 should now include {10, 9, 8, 7, 6, 5, 4, 3, 2, 1, 0}.

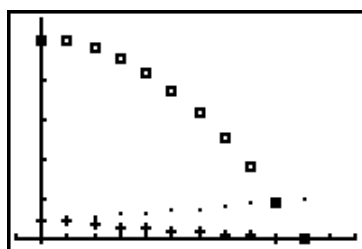
The area will be entered in L4. How is the area related to the values in L1, L2, and/or L3? The area is equal to $L2 * L3$. Highlight L4 and type $L2 * L3$, then press ENTER. L4 = {100, 99, 96, 91, 84, 76, 64, 51, 36, 19, 0}.

	L3	L4
10	10	100
11	9	99
12	8	96
13	7	91
14	6	84
15	5	76
16	4	64

L2 = {10, 11, 12, 13...

Using STAT PLOT to Graph. Graph the relation (L1, L2) in Plot 1; graph (L1, L3) in Plot 2; graph (L1, L4) in Plot 3.

Choose a reasonable graph WINDOW (i.e., -1, 12, 1, -1, 110, 20). Have participants suggest a reasonable window or ask participants to explain why you chose the window listed above (depending on the calculator expertise of the participants). Graph all three plots.



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WINDOW
Xmin=-1
Xmax=12
Xscl=1
Ymin=-1
Ymax=110
Yscl=20
Xres=1

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Determining and Verifying Algebraic Rules to Describe the Graphs. Ask participants to identify the algebraic rule that describes the relation between L1 and L2 and enter that rule in Y1. Ask participants to identify the algebraic rules that describe the relations between L1 and L3 and between L1 and L4. Enter those rules in Y2 and Y3 respectively.

$$Y1 = 10 + X$$

$$Y2 = 10 - X$$

$$Y3 = Y1 * Y2 \text{ or } (10 - X)(10 + X) \text{ or } (10)^2 - X^2 \text{ or } 100 - 10^2$$

Graph the STAT PLOTS and the algebraic function rules. Note that the function graphs encompass the corresponding STAT PLOTS.

Discuss why the first two relations are linear and the last one is quadratic.

Creating More Data in Lists. Let L5 = area loss from the preceding year. The Δ List command will generate a list of finite differences between consecutive elements of a specified list. Highlight L5 and press 2nd LIST, OPS, 7: $-\Delta$ List(L4), then press ENTER. We have to negate Δ List(L4) so that we get the values of $x_2 - x_1$ rather than $x_1 - x_2$. The Δ List command creates a list that has one less data entry than the list it used for computing the differences. To correct for this problem, insert -1 (the missing value) on line 1 of L5 so that L5 = {-1, 1, 3, 5, 7, ..., 17, 19}.

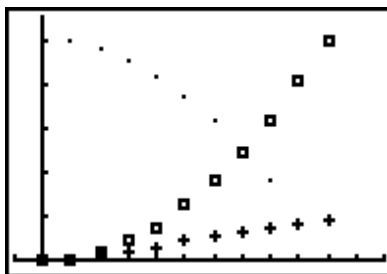
Let L6 = total area loss from the first year. The cumSum list command will generate the cumulative sums of the elements in a specified list. Highlight L6 and press 2nd LIST, OPS, 6: cumSum(L5), then press ENTER. L6 = {0, 1, 4, 9, 16, 25, ...81, 100}.

L4	L5	L6
100	0	0
99	1	1
96	3	4
91	5	9
84	7	16
75	9	25
64	11	36

L6 = {0, 1, 4, 9, 16, ...}

Using STAT PLOT to Graph. Graph the relation (L1, L4) in Plot 1; graph (L1, L5) in Plot 2; graph (L1, L6) in Plot 3. Choose a reasonable graph WINDOW (i.e., -1, 12, 1, -1, 110, 20). Turn off the functions Y1, Y2, Y3 and graph.

Why is Plot 2 linear and Plot 3 quadratic?



Determining and Verifying Algebraic Rules to Describe the Graphs. Ask participants to identify the algebraic functions that describe each plot. Enter those rules in Y4 and Y5 respectively. Turn Y3 on; leave Y1 and Y2 off. Leave Y4 and Y5 on.

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Plot1 Plot2 Plot3
\Y1=10+X
\Y2=10-X
\Y3=(10-X)*(10+X)
)
\Y4=2X-1
\Y5=X^2
\Y6=
    
```

