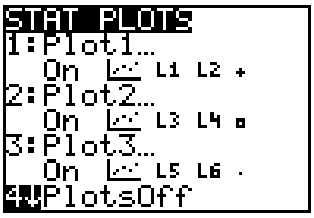
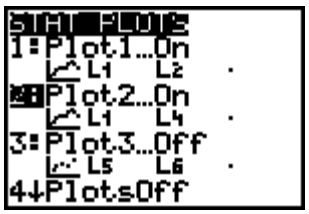
Mugwump Transformations on the TI-84

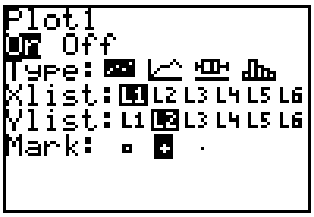
Turning Plots On and Off

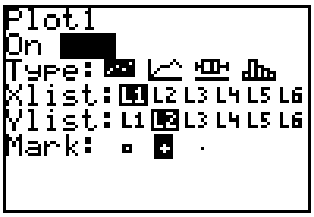
Press [2nd] [STATPLOT], which is above the [Y=] key in the top row.
You can turn all three Plots off at once by selecting #4: PlotsOff.
You can turn all three Plots on at once by selecting #5:PlotsOn.



You can turn plots on and off individually by selecting the number of the plot, place the cursor on the word "on" or "off", then press [ENTER] to anchor the selection.

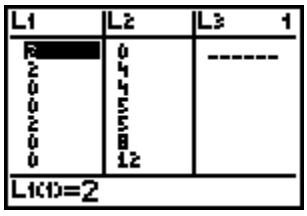






Editing Lists

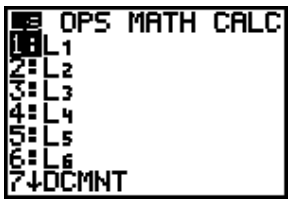
- Press [STAT] #1:edit.
- See the next page for Clearing Lists.
- To delete a list element, put the cursor on the element and press [DEL].



- To change a list element, just put the cursor on the element and type over, then press [ENTER].
- To insert a new element, place the cursor on the element after the desired point of insertion, then press [2nd][INS]. A "0" will appear in the list. Arrow back and key in the desired value, then press [ENTER].

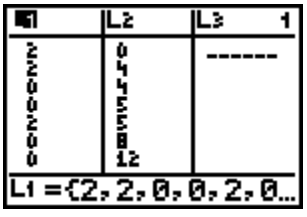
Selecting List Names

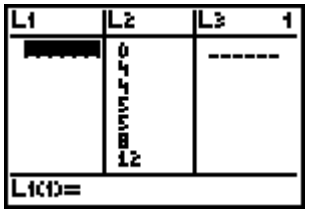
Press [2nd] [L1] (which is above the 1 key). The same would be true for any list number L1 through L6. Press [2nd] [LIST] to find all other list names.



Clearing Lists

- Press [STAT] #1:edit.
- Using the arrow keys, place the cursor on the list name (L1) to be cleared.
- Press [CLEAR] [ENTER].

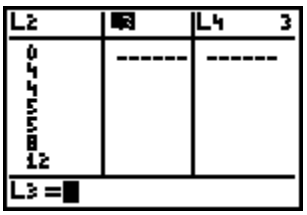


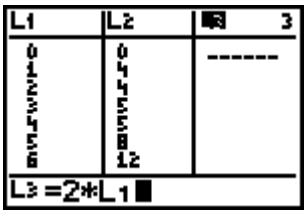


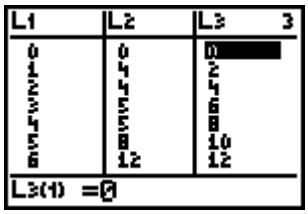
Creating a New List Dependent on Values from an Existing List

(This example will multiply each element of L1 by 2, storing the results in L3.)

- Press [STAT] #1:edit.
- Place cursor on the list name where the new list will be stored (L3), press [ENTER].
- Key in the computation formula (**2*L1**) which will appear on the entry line at the bottom of the screen. (**Important:** press [2nd][L1] to enter L1)
- Press [ENTER]. L3 will fill with values that are twice those in L1.





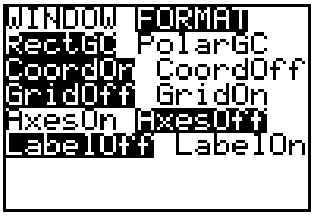


To View a Plot

- Turn off or clear all functions in the [Y=] editor.
- Make sure only the plot(s) you want to view is(are) turned on and the others are off.
- Make sure each plot that you want to view has been set up in the [STATPLOT] editor.
- Set your [WINDOW] values or select [GRAPH].

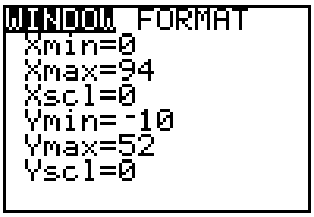
To Turn Axes On or Off

Press [2nd] [FORMAT].

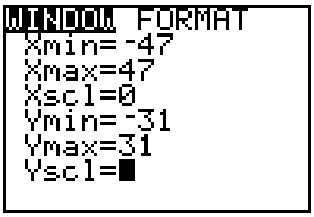


Windows to Use with Mugwump Activities

Integer window for Quadrant 1 only



Integer window for Quadrants I, II, III, and IV



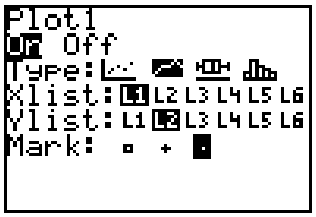
What do you think the integer window values would be for Quadrants I and II?

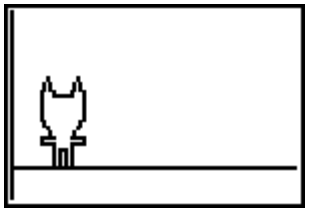
What do you think the integer window values would be for Quadrants I and IV?

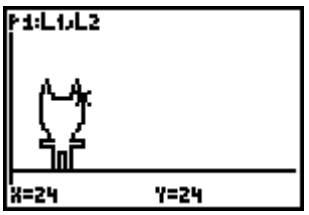
Plan of Action for Lesson

Introduction

- Enter coordinates for MugWump (see next page): X values in L1, Y values in L2.
- Set-up Plot 1 using a connected line plot and the dot mark.







- Use the Integer Window in Quadrant 1 to view MugWump. Press [GRAPH]. Press [TRACE] then the left and right arrow keys to view the coordinates on the screen. Press [GRAPH] again to erase the coordinates.

Exploration

- Transform Mugwump using mathematics. Do not change the original data in L1 and L2. Place the data of the transformed image in L3 and L4. Turn on Plot2 so that you can view the image. For better viewing, you may want to turn off Plot1, the original MugWump (pre-image). Also, for various transformations you may want to use an integer window that displays quadrants other than Quadrant 1.

- Below are two sets of questions to wet your students' appetites for exploration. Instead of giving them to the students directly, facilitate a brainstorming session, getting them to elicit these ideas.

- Also attached are some screen dumps of transformations.

  - ✓ Can you make MugWump slide to the left? the right?
  - ✓ Can you make MugWump jump up? Jump down?
  - ✓ Can you make MugWump move diagonally to the middle of the screen?
  - ✓ Can you make MugWump grow taller? Grow wider? Grow bigger proportionally?
  - ✓ Can you make MugWump grow smaller?
  - ✓ Can you make MugWump lie down?
  - ✓ Can you make MugWump hang upside down from the X-axes? Stand on his head on the X-axes?
  - ✓ Can you make MugWump see his reflection in the mirror – with the Y-axes being the mirror? With the line Y=X being the mirror?
  - ✓ Can you make MugWump see his reflection in a "puddle" on the ground?
  - ✓ Can you rotate MugWump 45 degrees? 90 degrees? 120 degrees? 180 degrees?

  - ❖ What happens to MugWump if you add 20 to every X coordinate? To every Y coordinate? To every X and Y coordinate? Why?
  - ❖ What happens to MugWump if you subtract 20 from every X coordinate? From every Y coordinate? From every X and Y coordinate? Why?
  - ❖ What happens to MugWump if you multiply every X coordinate by 2? Multiply by 3? Multiply every Y coordinate by 2? Why?
  - ❖ What happens to MugWump if you divide every X coordinate by 2? Divide every Y coordinate by 2? Why?
  - ❖ What happens to MugWump if you multiply the X coordinate by $^{-}1$? the Y coordinate by $^{-}1$? Both the X and the Y coordinates by $^{-}2$? Why?
  - ❖ What happens to MugWump if you swap the X and Y coordinates? Why?
  - ❖ What happens to MugWump when you **square** each X coordinate? Why?

Performance Assessment (MUGNHAT1)

Enter the MugWump Coordinates in L1 and L2. Enter the Hat Coordinates in L3 and L4. Perform one transformation on L3 and L4, storing the results in L5 and L6 that will place the hat on MugWump's head. For full credit the hat should be enlarged and backwards, as in the picture at the bottom of the next page. Make sure the appropriate plots are set up and turned on.

Describe your thinking strategies that that enabled you to accomplish this task. If you are only able to partially accomplish the task, describe the difficulties encountered.

Bonus Performance Task (MUGNHAT2)

- Write a program showing MugWump walking over to the hat.
- Write a program to showcase all your MugWump transformations.

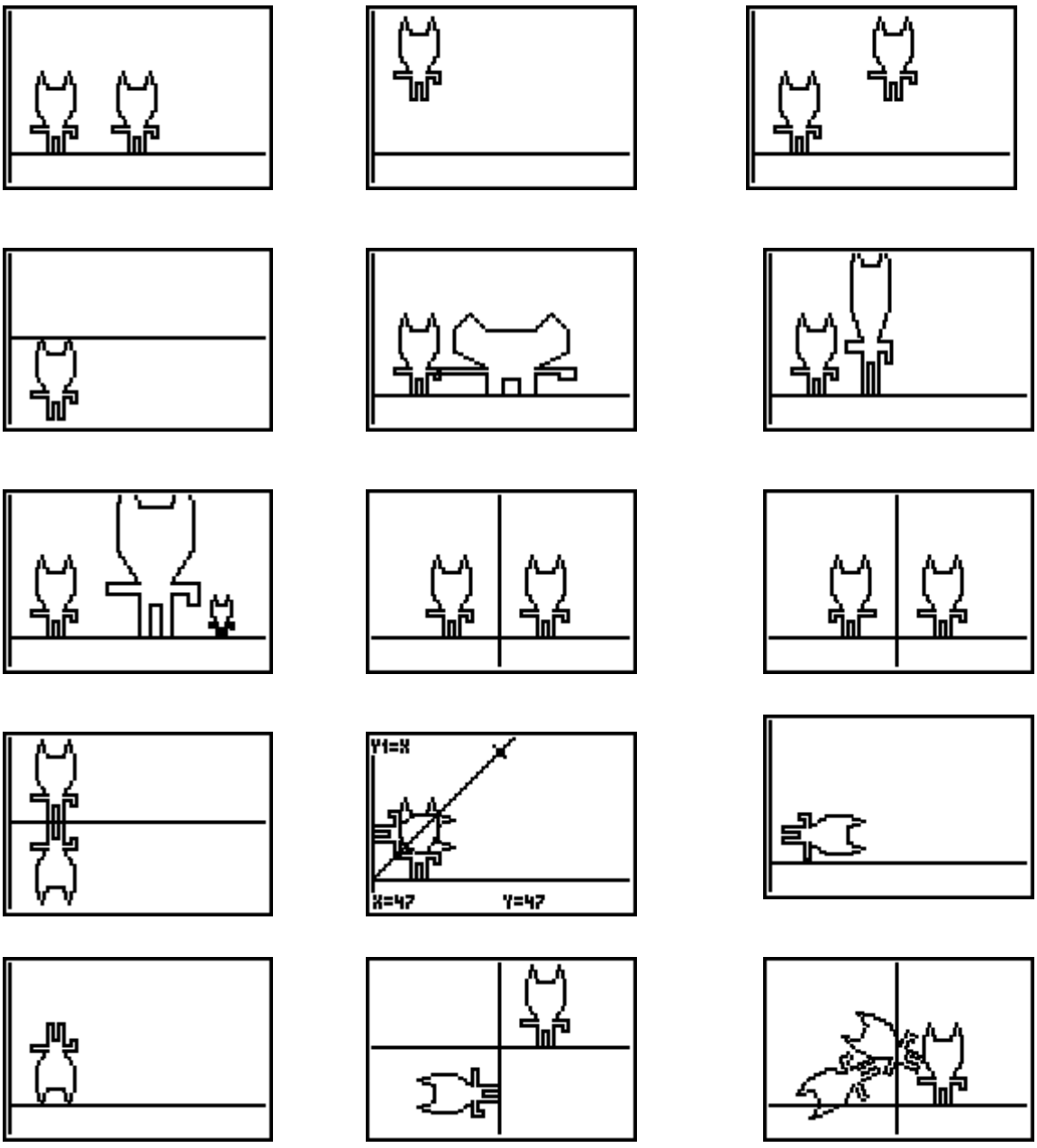
MugWump Coordinates

Point	X	Y
1	14	0
2	14	8
3	8	8
4	8	10
5	14	10
6	10	16
7	10	24
8	12	30
9	14	24
10	20	24
11	22	30
12	24	24
13	24	16
14	20	10
15	25	10
16	25	6
17	23	6
18	23	8
19	20	8
20	20	0
21	18	0
22	18	6
23	16	6
24	16	0
25	14	0

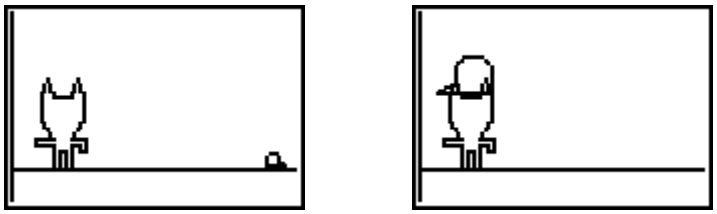
Hat Coordinates

Points	X	Y
1	85	4
2	85	1
3	91	1
4	89	2
5	89	4
6	88	5
7	86	5
8	85	4

MUGSHOW



Performance Task Pictures (MUGNHAT1)



Display Program that Matches Screen Dumps (MUGSHOW)

```
FnOff
Ø→Xmin
94→Xmax
Ø→Xscl
⁻1Ø→Ymin
52→Ymax
Ø→Yscl

{14,14,8,8,14,1Ø,1Ø,12,14,2Ø,22,24,24,2Ø,25,25,23,23,2Ø,2Ø,18,18,
16,16,14}→L1
{Ø,8,8,1Ø,1Ø,16,24,3Ø,24,24,3Ø,24,16,1Ø,1Ø,6,6,8,8,Ø,Ø,6,6,Ø,Ø}→L2

Plot1(xyLine,L1,L2,·)
Plot2(xyLine,L3,L4,·)
Plot3(xyLine,L5,L6,·)

PlotsOff
PlotsOn 1
DispGraph
Pause

L1+3Ø→L3
L2→L4
PlotsOff
PlotsOn 1,2
DispGraph
Pause

L1→L3
L2+2Ø→L4
PlotsOff
PlotsOn 2
DispGraph
Pause

L1+3Ø→L3
L2+2Ø→L4
PlotsOff
PlotsOn 1,2
DispGraph
Pause
```

```
L1→L3
L2-3Ø→L4
⁻31→Ymin
31→Ymax
PlotsOff
PlotsOn 2
DispGraph
Pause

3*L1→L3
L2→L4
⁻1Ø→Ymin
52→Ymax
PlotsOff
PlotsOn 1,2
DispGraph
Pause

L1+2Ø→L3
2*L2→L4
PlotsOff
PlotsOn 1,2
DispGraph
Pause
```

```
2*L1+2Ø→L3
2*L2→L4
.5*L1+7Ø→L5
.5*L2→L6
PlotsOff
PlotsOn 1,2,3
DispGraph
Pause

L1-35→L3
L2→L4
-47→Xmin
47→Xmax
PlotsOff
PlotsOn 1,2
DispGraph
Pause

-L1→L3
L2→L4
-47→Xmin
47→Xmax
PlotsOff
PlotsOn 1,2
DispGraph
Pause

L1→L3
-L2→L4
Ø→Xmin
94→Xmax
-31→Ymin
31→Ymax
PlotsOff
PlotsOn 1,2
DispGraph
Pause

L1→L4
L2→L3
"X"→Y1
Ø→Xmin
94→Xmax
-1Ø→Ymin
52→Ymax
PlotsOff
PlotsOn 1,2
DispGraph
Pause

FnOff
L1-8→L4
L2+5→L3
PlotsOff
PlotsOn 2
DispGraph
Pause

L1→L3
-L2+3Ø→L4
PlotsOff
PlotsOn 2
DispGraph
Pause

-L1→L4
-L2→L3
-47→Xmin
47→Xmax
-31→Ymin
31→Ymax
PlotsOff
PlotsOn 1,2
DispGraph
Pause

L1cos(6Ø)-L2sin(6Ø)→L3
L1sin(6Ø)+L2cos(6Ø)→L4
L1cos(12Ø)-L2sin(12Ø)→L5
L1sin(12Ø)+L2cos(12Ø)→L6
-47→Xmin
47→Xmax
-1Ø→Ymin
52→Ymax
PlotsOff
PlotsOn 1,2,3
DispGraph
Pause
```

Bonus Performance Task (MUGNHAT2

Write a program showing MugWump walking over to the hat.
Write a program to showcase all your MugWump transformations.

```
FnOff
Ø→Xmin
94→Xmax
Ø→Xscl
⁻1Ø→Ymin
52→Ymax
Ø→Yscl

{14,14,8,8,14,1Ø,1Ø,12,14,2Ø,22,24,24,2Ø,25,25,23,23,2Ø,2Ø,18,18,
16,16,14}→L1
{Ø,8,8,1Ø,1Ø,16,24,3Ø,24,24,3Ø,24,16,1Ø,1Ø,6,6,8,8,Ø,Ø,6,6,Ø,Ø}→L2
{85,85,91,89,89,88,86,85}→L3
{4,1,1,2,4,5,5,4}→L4

Plot1(xyLine,L1,L2,·)
Plot2(xyLine,L3,L4,·)
Plot3(xyLine,L5,L6,·)
PlotsOff
PlotsOn 1,2
For(I,1,12,1)
L1+5→L1
DispGraph
End

⁻3(L3-85)+84→L5
3L4+22→L6
PlotsOff 2
PlotsOn 1,3
For(I,1,12,1)
L1-5→L1
L5-5→L5
DispGraph
End
```