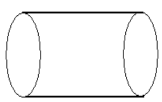
What is Your View Through the Tube?
By: Sylvia Brown

Materials for Each Group: $1\frac{1}{2}$" PVC pipe cut into 3”, 5”, and 7” pieces, a tape measure, a yard stick, tape, recording sheet, and a TI-Nspire calculator.

Each Group:
- A viewer (this student will look through the PVC pipe)
- A spotter (this student will mark the view on the wall)
- A measurer (this student will measure the distance from the wall to the end of the PVC pipe). To save time, these distances could be pre-determined and marked off before class.
- A recorder (this student will record the information into the chart)

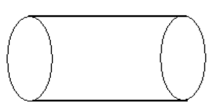
Procedure: A tape measure is taped vertically on a wall. The viewer will stand a designated distance from the tape measure. With the 3” PVC pipe in hand, the viewer will tell what length he/she sees on the wall. The data should be recorded in the chart below. Have students measure all values to the nearest sixteenth of an inch.

Data Tables:



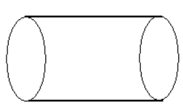
Short Tube Length of Tube __________ Inside diameter of Tube __________

Distance from the Wall	24”	36”	48”	60”	72”
Linear Vertical Height					



Medium Tube Length of Tube __________ Inside diameter of Tube __________

Distance from the Wall	24”	36”	48”	60”	72”
Linear Vertical Height					



Long Tube Length of Tube __________ Inside diameter of Tube __________

Distance from the Wall	24”	36”	48”	60”	72”
Linear Vertical Height					

1. Answer the following questions.

   a. What is the independent variable? ________________________

   b. What is the dependent variable? _________________________

   c. Should the same person be the viewer throughout the experiment? Why or why not?

____

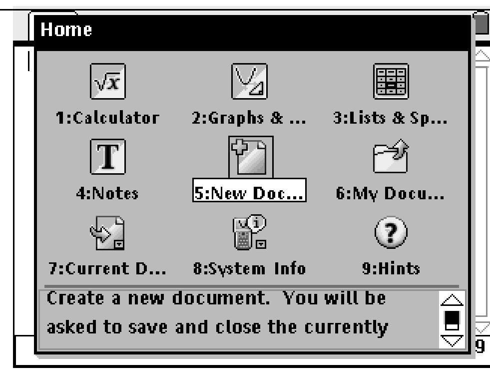
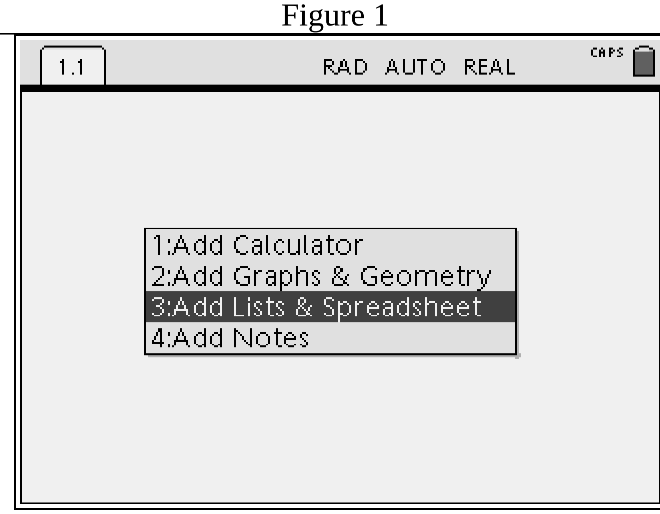
   d. On which axis will the distance from the wall be plotted? _____________

   e. On which axis will the linear vertical height be plotted? __________

   f. What happens to the rate of change as the tube gets longer? _________________________

   g. What would the visible linear vertical height if the distance from the wall is zero?

2. Graph the data for each tube in the calculator.

A. In order to enter data and then graph it, you will need to open a New Document. i. Press the key and 5 to select New Document. (Figure 1)	 Figure 1
ii. Press 3 to choose 3:Add Lists & Spreadsheets (Figures 2 and 3)	 Figure 2

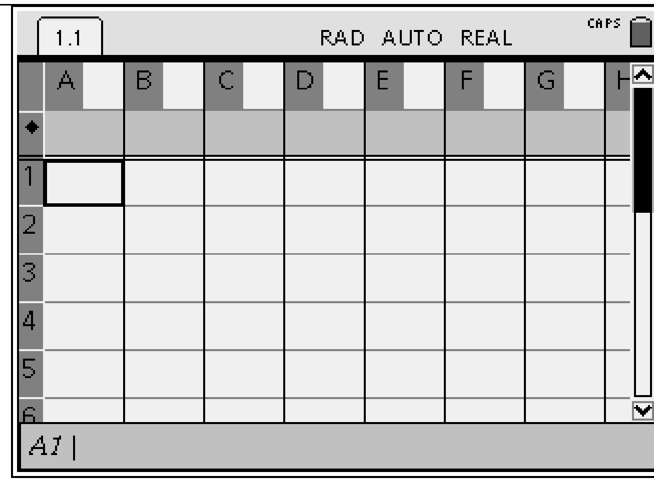


Figure 3

iii. Enter the Distances from the Wall into column A. Enter the Linear Vertical Height for 3" pipe in column B. Enter Linear Vertical Height for 5" pipe in column C. Enter Linear Vertical Height for 7" pipe in column D (Figure 4)

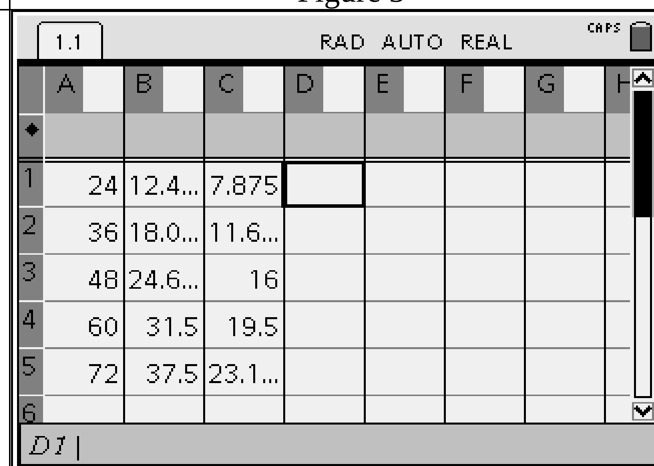


Figure 4

iv. Label the columns.

- Using the NavPad, move up and left to the white space next to the "A" column heading. Type in "FLDIST" (Figure 5)
- Press the enter key.

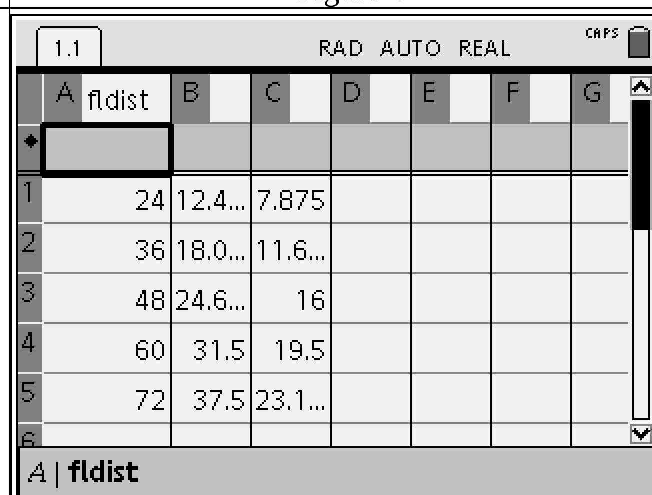


Figure 5

v. Do a similar operation for columns "B", "C", and "D" labeling them "TB3IN", TB5IN", TB7IN" respectfully. (Figure 6)

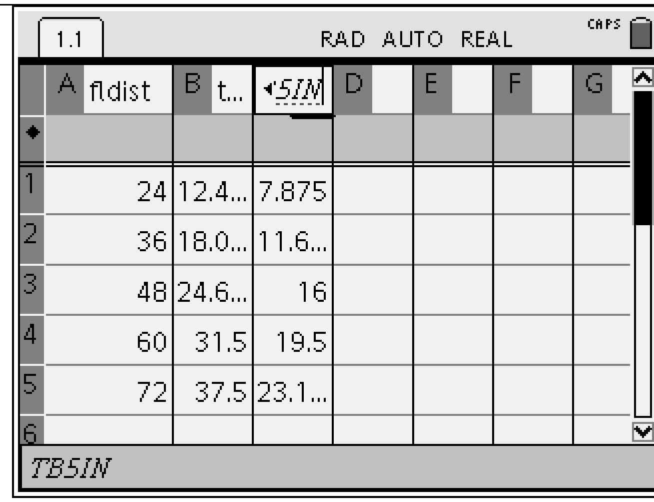


Figure 6

B. In order to graph the data, you will need to add a new page to this problem.

i. Press the ⌂ key and press 2 to add a Graphs & Geometry page (Figure 7)

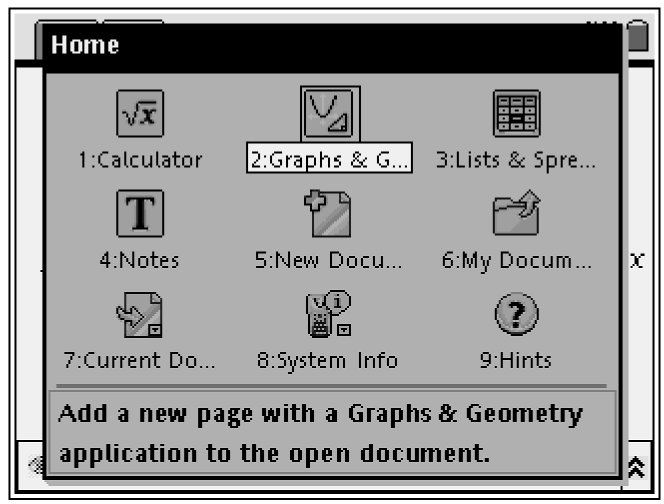


Figure 7

ii. The default graph screen is shown in Figure 8.

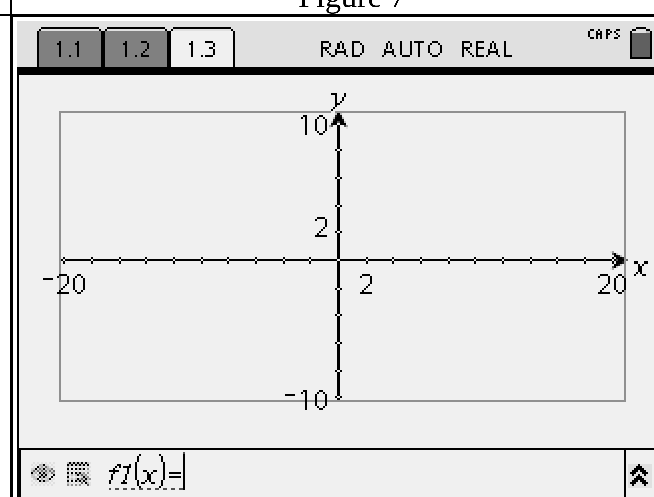


Figure 8

iii. Press menu 3 3 to choose Menu 3: Graph Type, 3: Scatter Plot (Figure 9).

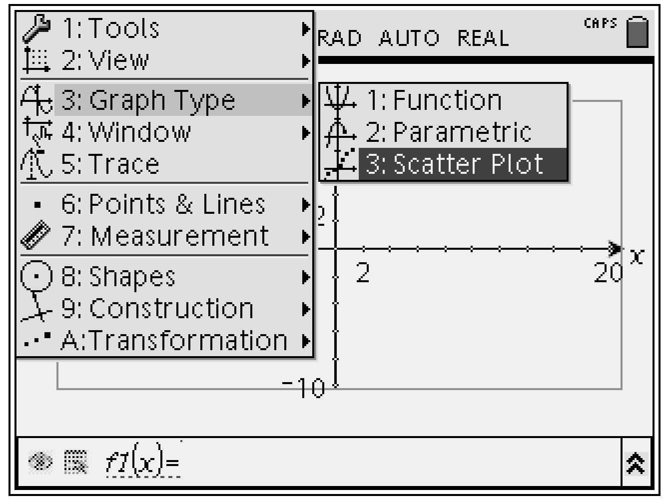


Figure 9

iv. Press to open the x-values list, arrow down to “fldist” and press to choose fldist (Figure 10).

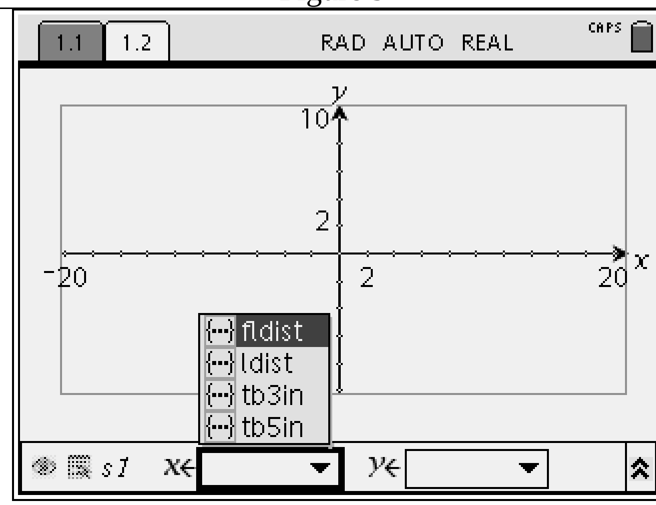


Figure 10

v. Move to the right (by pressing tab) to highlight the y-values list. Press . Arrow down to “tb3in” and press to choose “tb3in” (Figure 11).

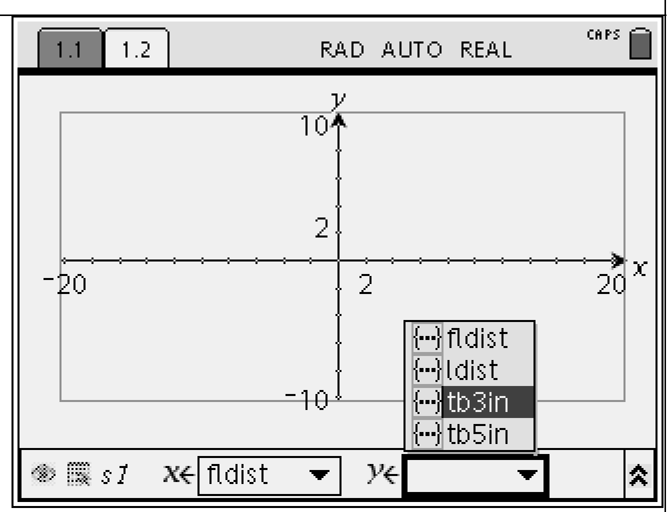


Figure 11

vi. Press tab four times or until you see the pointer in the graph area (Figure 12).

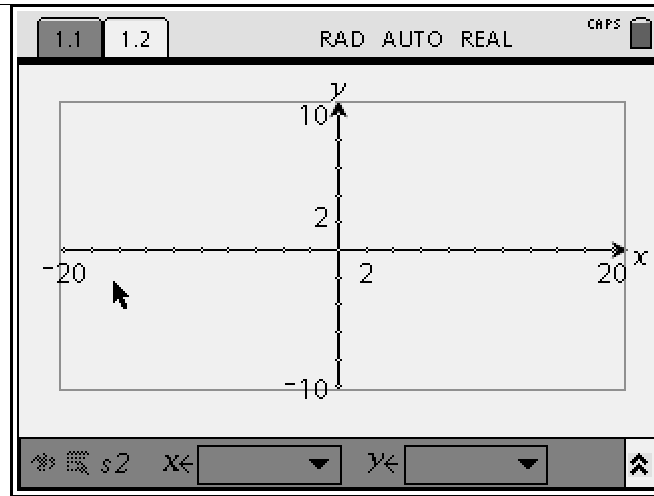


Figure 12

vii. The window needs to be changed before we graph our points.

Move the pointer near the value of -20. Press ctrl four time or until you see a text box around the value -20. (Figure 13)

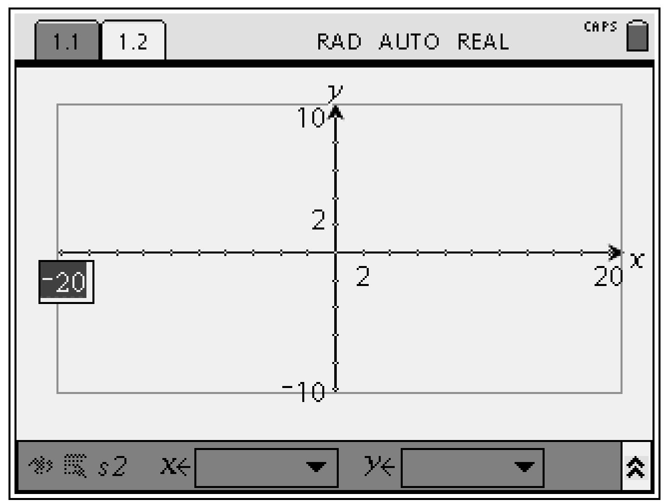


Figure 13

viii. Backspace using the clear key. Change the value to -1. (Figure 14)

Press enter clear clear

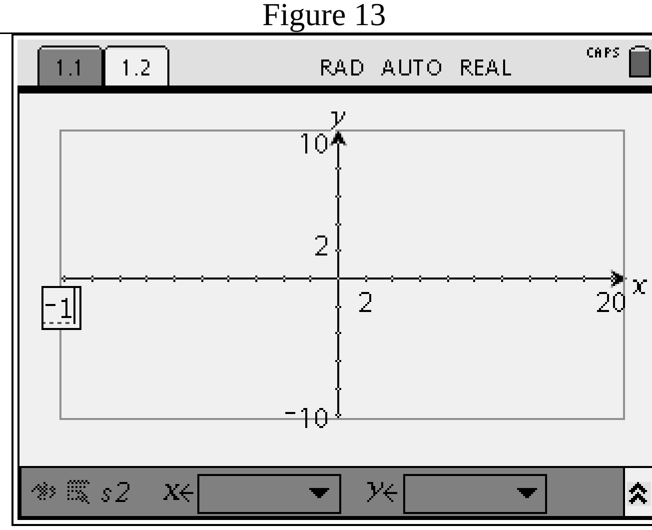


Figure 14

ix. Likewise, change the maximum and minimum x and y values on the graph. The points for the 3-inch tube should appear. (Figure 15)

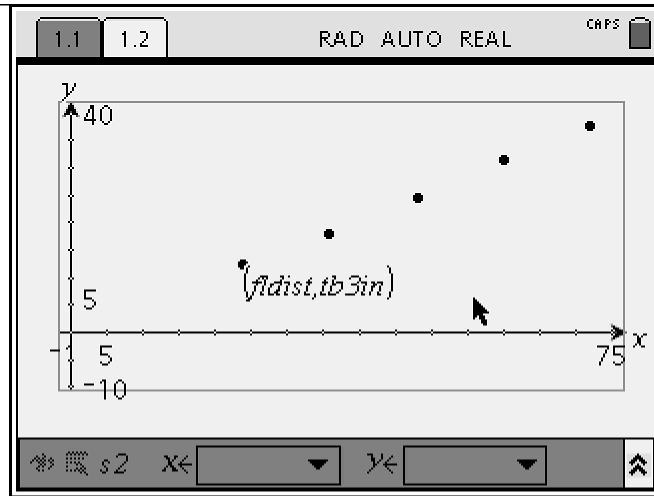


Figure 15

C. i. Press the ctrl ⊡ to return to the Graphs & Geometry page (Figure 29)

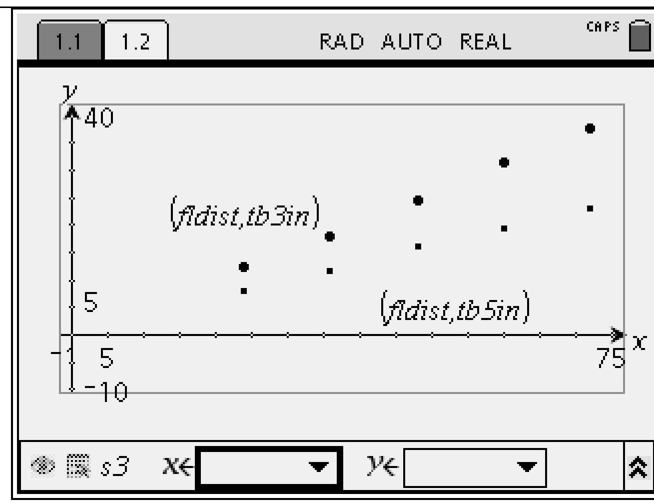


Figure 29

ii. Press menu 3 1 to choose Menu 3: Graph Type, 1: Function. (Figure 30 & 31)

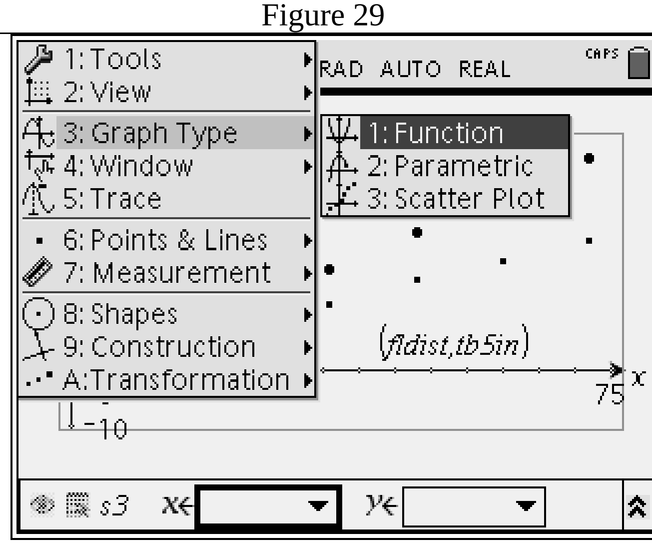


Figure 30

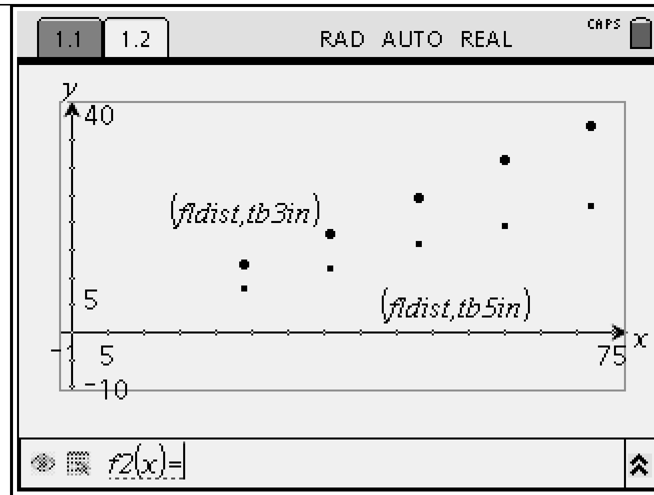


Figure 31

3. Let the student plot a line of best fit.

A. The student comes up with the equation by trial and error.
i. The student enters an equation in y=mx+b form for f1(x).

For example: The student may enter 0.5 x + 7. The graph of the line appears on the graph.
(Figure 45)

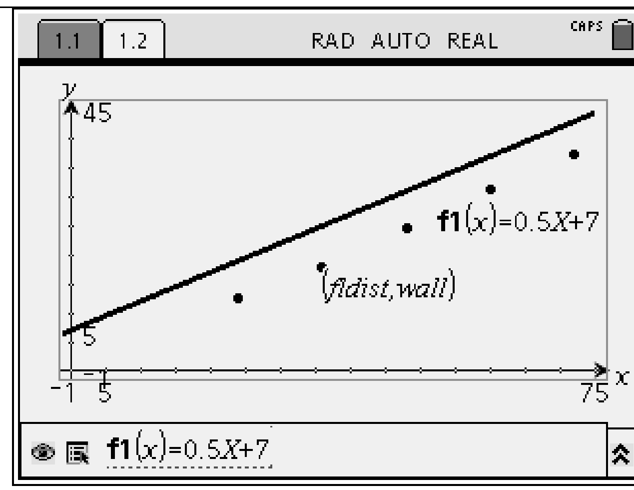


Figure 45

ii. Press the esc key to move the to the graph area. (Figure 46)

Notice, the line did not go through the points. We need to move the line so it goes through the points.

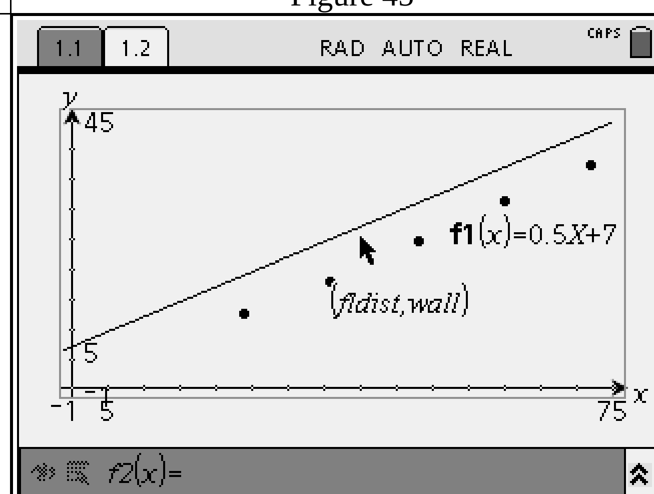


Figure 46

iv. Move the cursor next to the graph of the line using arrows on the NavPad. When the line begins to blink, press ctrl to grab the line.

(Figures 47 & 48)

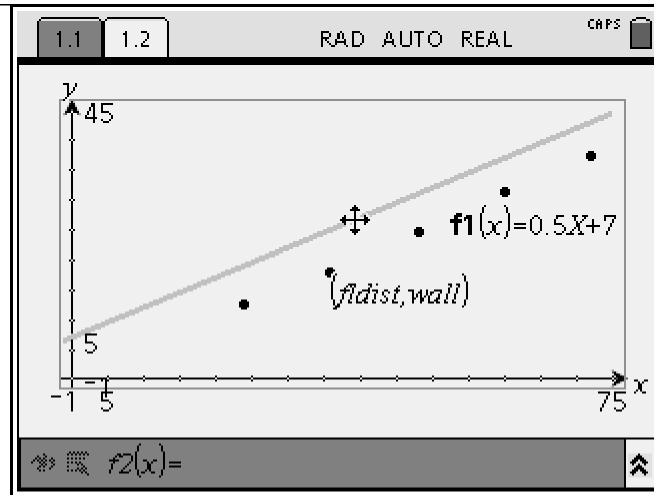


Figure 47

Notice, the hand closes up.

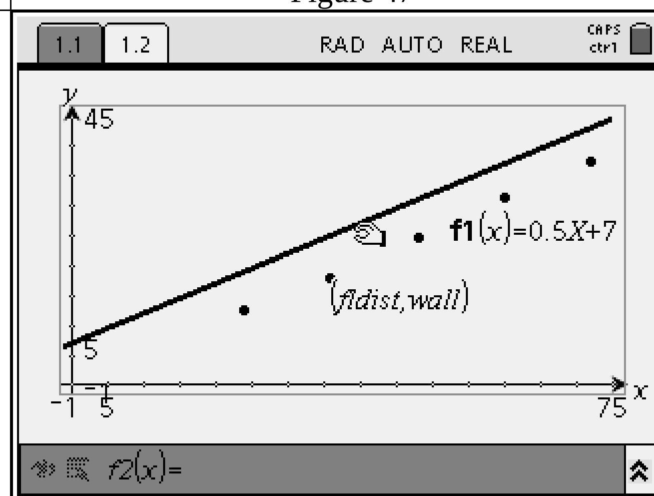


Figure 48

Now, press the ▲ and ▼ on the NavPad to move the line closer to the points.

(Figure 49)

We now have an equation of a line of best fit. Press enter to set the line in place.

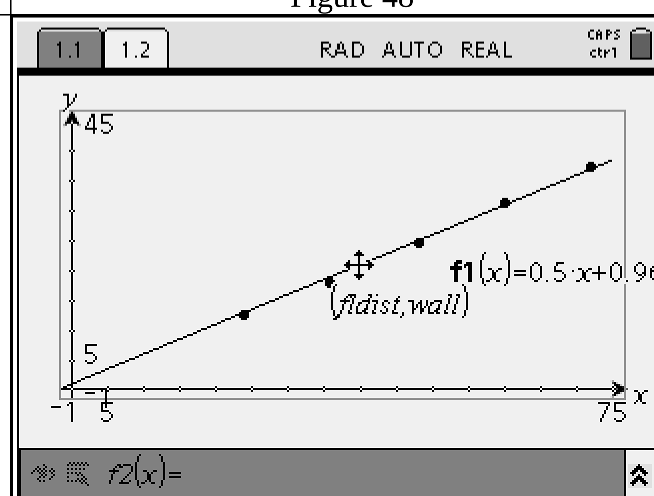


Figure 49

B. Use the Menu to draw a line of best fit through our data points. (Omit student drawing line by Trial and Error if doing this step).

i. Press (menu) (6) (4) to choose Menu 5: Points & Lines, 4: Line

(Figure 50)

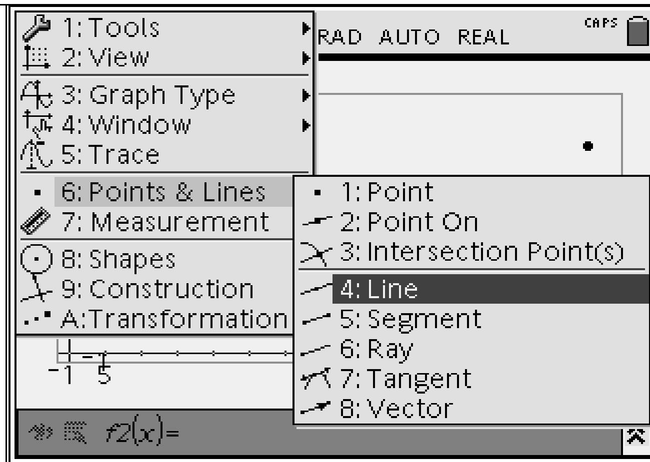


Figure 50

ii. Move the cursor pencil onto one of the points. The point will begin to blink. Press (enter) to set the point. (Figure 51)

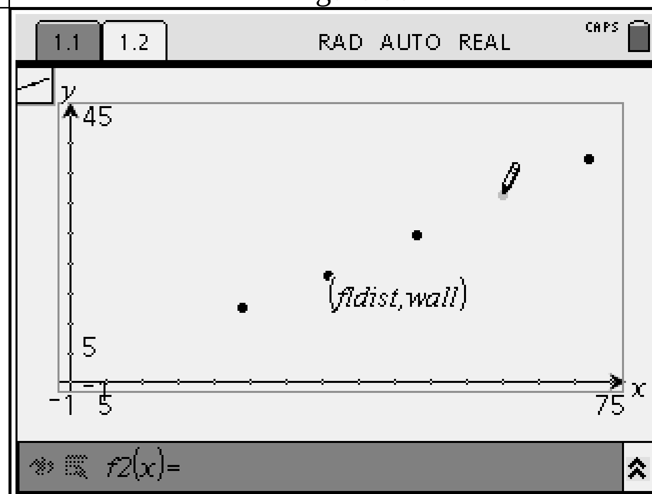


Figure 51

iii. As you move the cursor away from the point, a dotted line will appear. Move the cursor pencil to a second point. Press (enter) to set the second point.

(Figure 52)

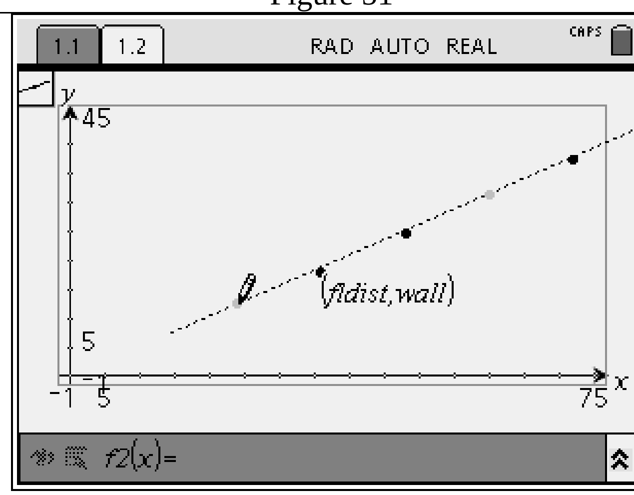


Figure 52

iv. Press (esc) to exit the line mode.

v. Label the equation of the line.
Press menu 1 6 to choose Menu 1:Tools, 6: Coordinates and Equations (Figure 53)

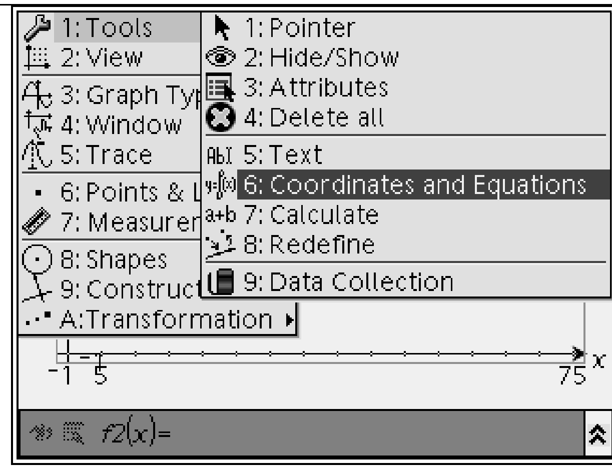


Figure 53

Move the cursor near the line. The line will begin to blink. The equation of the line will appear faded.

Press ctrl enter to set the equation. (Figure 54)

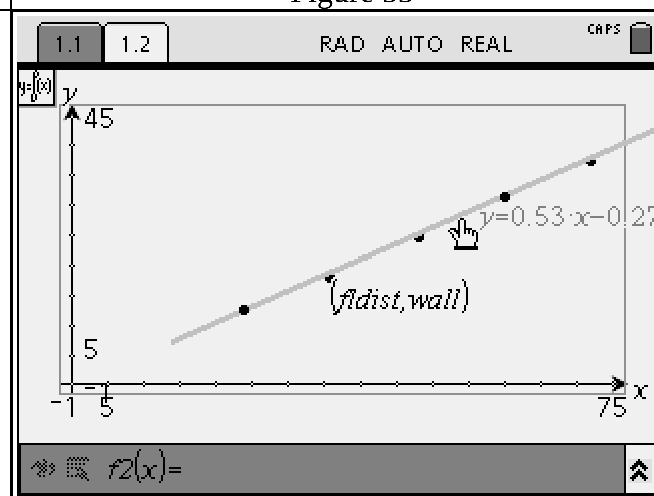


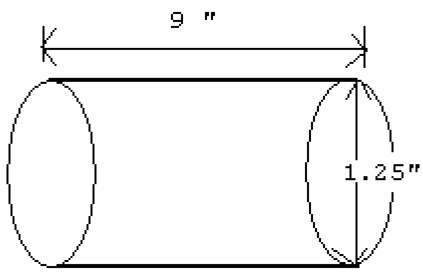
Figure 54

4. Answer the following questions.
    a. Use your graph for the 3” tube to predict how much of the tape measure you could see if you stood 18 inches from the wall. ________________
    b. Use your 3” data again. Tell how many inches you could see if you stood 7 feet away. ______________
    c. If you could see 28” on the wall using a 3” tube, how far away are you from the wall? __________

5. Answer the following questions.
    a. Use your graph for the 5” tube to predict how much of the tape measure you could see if you stood 18 inches from the wall. ________________
    b. Use your 5” data again. Tell how many inches you could see if you stood 7 feet away. ______________
    c. If you could see 28” on the wall using a 5” tube, how far away are you from the wall? __________

6. Answer the following questions.
    a. Use your graph for the 7" tube to predict how much of the tape measure you could see if you stood 18 inches from the wall. ________________
    b. Use your 7" data again. Tell how many inches you could see if you stood 7 feet away. ______________
    c. If you could see 28" on the wall using a 7" tube, how far away are you from the wall? __________

7. If Jacob has the given tube shown below. What do you think his graph will look like?



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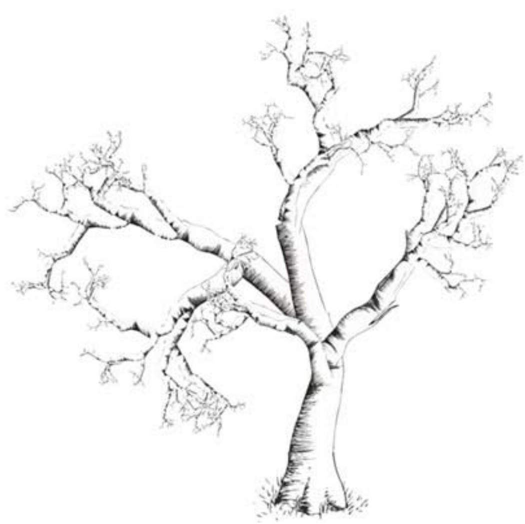
8. Tom uses a 4 inch tube to view a tree 30 feet away (note the units). The tube has an inside diameter of 1.25". How tall is the tree (in inches)? ________________________________



9. Below are the graphs of the curves for both Tammy and Steve. How might the dimensions of Tammy's tube differ from Steve's?