

Tied Up in Knots

Start with a thin rope (shorter) and a thick rope (longer)

- Tie knots in each rope. Try to tie each knot so they are all the same size and tightness.
- Measure the length after each knot .
- Record the data in the charts below. Tie only 5 knots on each rope.

Thin Rope	
Number of Knots (L1)	Length of the Rope (cm) (L2)
0	
1	
2	
3	
4	
5	

Thick Rope	
Number of Knots (L1)	Length of the Rope (cm) (L3)
0	
1	
2	
3	
4	
5	

Enter the data in your calculator.

- Create a scatterplot for L1 vs. L2 using \square . Create a second scatterplot for L1 vs. L3 using $+$.
- What is happening to the length of the rope as you add additional knots? How is this reflected in the chart? How is this reflected in the graph?
- Study how the length of each rope is changing. Study the chart. Trace along the graph. Predict how the length of the rope is decreasing for each rope.
- To fit a line to the data press STAT, CALC, D. Manual-Fit. Manual Fit will appear on the homescreen. Place Y1 after the command and press ENTER. When the graph reappears move the cursor to the point where the data crosses the y-axis. Press ENTER. Use the cursor arrows to move the cursor and extend a line through the data. When the line passes through the line press ENTER. An equation will appear at the top of the screen. You can change the highlighted values by typing a new number and pressing ENTER. Move to the other constant and change that constant. When you have the two constants the way you want press 2nd QUIT. The line will graph and the equation will be placed in Y1.
- Equation for Thin Rope: _____
- Repeat the last step for the data stored in L1 vs. L3. Run the Manual Fit for Y2. Change the style of Y2 to Thick.

- Equation for Thick Rope: _____
- Are the lines parallel?
- What is the meaning of the y-intercept in each equation?
- What is the meaning of the slope in each equation?
- On which rope is the slope higher? Why do you think this higher slope belongs to this rope?
- Does it appear that the two lines will intersect? Change the values of the window to view where this intersection might occur?
- Create a table of value associated with y_1 and y_2 by pressing $\text{Tblset} = 0$ and $\Delta\text{tbl} = 1$. Press TABLE to view the table. Complete the table on page 1 to reflect the table on your calculator.
- What do the table of values illustrate?
- Move down the table to where you believe you have found the number of knots that produces the same length in the rope. (You may not be able to find number of knots that will produce ropes of the exact length, so try to locate the number of knots that makes the two ropes equal in length.) Describe this number of knots and the length of each rope.
- Write both equations: Since both equations equal y it is possible to say that the values equal to y must be equal to each other. Set the two x -expressions equal to each other and solve the resulting equation. What does the solution of this equation mean?