NAME: __________________________

KNOT TYING INVESTIGATION

1.) Complete the table. Do not untie the knots!!!

<table>
<thead>
<tr>
<th>Number of Knots</th>
<th>Length of the Knotted Rope in Centimeters</th>
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<tbody>
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</table>

2.) Graph the data on the grid paper provided on the next page.
3.) Use the NSpire graphing calculator and enter the number of knots in the
column 1 and the length of the knotted rope in column 2.
- Press Menu
- Select 3: Add Lists & Spreadsheet
- Press Enter
- Once you are in the spreadsheet application, use the up arrow on
  the Nav Pad and highlight the A portion (naming section) of the
  first column.
- Use the alphabet keys and label this column knots.
- Press Enter.
- Use the right arrow and up arrow on the Nav Pad and highlight the
  B portion (naming section) of the second column.
Use the alphabet keys and label it cm.
Press Enter.
- Use the left arrow and down arrow of the Nav Pad and put the cursor beneath the first column in row 1.
- Enter the x values into the first column. Press Enter after each data entry.
- Use the right arrow and up arrow of the Nav pad and put the cursor beneath the second column in row 1.
- Enter the y values in the second column. Press Enter after each data entry.

**NOTE: You can not see all the data in the screen shot above.**

4.) Make a scatter plot of the data on the Nspire graphing calculator.
- Insert a new page by pressing the Control Key (ctrl) and the letter I.
- Select 5: Add Data and Statistics
- Press Enter.
Notice the message at the bottom of the screen and the left part of the screen:
Click to add variable.
- Move the cursor to this message on the x-axis.
- Press Enter.
- Select knots. You may have to use the down arrow of the Nav Pad.
- Press Enter.
- Move the cursor to this message on the y-axis. The message may not appear right away until the cursor gets close to it.
- Press Enter.
- Select cm.
- Press Enter.

5.) Determine the appropriate rate of change for your set of values.

<table>
<thead>
<tr>
<th>Length of Knotted Rope in cm.</th>
<th>Subtraction Sentence to Determine the Change in the y values</th>
<th>Amount of Change in the y values</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>
6.) Determine the amount of change in the y values using the NSpire.

- Press the Ctrl key and then press the left arrow on the Nav Pad to get back to the lists and spreadsheets page.
- Use the right arrow of the Nav Pad and then the up arrow and scroll to the top of column C (naming section). Label this column first for first differences.
- Press Enter.

- Highlight the space right beneath the word first. Press the catalog key. This key is in the last column and it is the second black key. The key has a picture of an open book on it. Find deltaList. Highlight it and press Enter.

- Press the variable key which is in the top row, second key. Select cm. Press Enter and Enter again. Compare the data in the column labeled first with the changes you wrote in the table. They should be the same.
7.) Find the mean and median for the approximate rate of change for your set of values. **Show your work.**

**Mean:**

**Median:**

8.) Determine the mean by following these steps on the NSpire.

- Press Ctrl I to insert a new page
- Select 1:Add Calculator
- Press Enter
- Type mean on the screen
- Press the opening parentheses key
- Press the variable key which is in the top row, second key and select first for the first differences. Press Enter. Press Enter again.
- Repeat these steps for the median

9.) What is the real – world meaning of the rate of change?

________________________________________________________________________

________________________________________________________________________
10.) What is the y-intercept (starting value)? ______________________

11.) What is the real-world meaning of the y-intercept?
___________________________________________________________
___________________________________________________________

12.) Write the function in the following form that you think best fits your data:

   Length of rope = rate of change • number of knots + y-intercept

13.) Put your equation into the calculator to verify that it is a good fit.
- Press Ctrl and the right arrow on the Nav Pad to go to the scatter plot.
- Press Menu.
- Select 4: Analyze
- Use the right arrow of the Nav Pad.
- Select 4: Plot Function
- Press Enter
- Type in your function
14.) Use your function to predict the length of your knotted rope with 9 knots and 10 knots. You can press Ctrl and the left arrow of the Nav pad to get back to the calculator page if necessary.

___________________________________________________________

___________________________________________________________

15.) Make two more knots and measure the length of the rope after each knot.

<table>
<thead>
<tr>
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<th>Length of the Knotted Rope in cm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Were your actual results close to your computed results?

Yes or No

16.) Use your function to predict the length of a knotted rope with 57 knots. Explain any particular difficulties you might have, if any, with this prediction.

___________________________________________________________

___________________________________________________________

___________________________________________________________

___________________________________________________________

___________________________________________________________
17.) If you tied the maximum number of knots that you can tie with your rope, theoretically, what is the length of the rope? _______________

Follow these steps to find out what is the maximum number of knots you can tie with your rope.

- Make sure you are on the graph page. If you are not on that page press the Ctrl key and the right arrow on the Nav Pad.
- Press Menu.
- Select 4: Analyze
- Press the right arrow on the Nav Pad
- Select A: Graph Trace
- Press Enter
- Use the right arrow on the Nav Pad
- Keep pressing the right arrow on the Nav Pad until you find the point where the graph intersects the x-axis.

18.) What was your maximum number of knots that could have been tied with your rope? _______________

19.) This point is called the x-intercept. Write the x-intercept as an ordered pair. __________________
20.) Does the thickness of the rope itself have anything to do with the results?

21.) Does the type of knot have anything to do with the results?

22.) Find the linear regression line on the calculator.
   - Press Menu.
   - Select 4: Analyze
   - Use the right arrow on the Nav Pad and select Regression.
   - Use the right arrow on the Nav Pad and select 1: Show Linear \( (mx + b) \)
   - Press Enter.
Write out your function:

___________________________

Write out the calculator’s function:

___________________________

Were the functions close?
Yes or No

23.) Find the Pearson r.

- Press the Ctrl key and the left arrow on the Nav pad to get back to the lists and spreadsheets.

- Highlight the top shaded area in column D.

- Press Menu, select 4:statistics and press the right arrow on the Nav Pad to 1: Stat Calculations

- Press the right arrow on the Nav Pad again
- Select 3: Linear Regression ($mx + b$)

- Press Enter

- Press the down arrow on the Nav Pad.
- Use the down arrow on the Nav Pad and select knots.
- Press Enter.
- Press Tab.
- Press the down arrow on the Nav Pad.
- Use the down arrow on the Nav Pad and select cm.
- Press Enter.
- Press Tab.
- F1 is fine.
- Press Tab.
- 1 is fine for frequency list.
- Press Tab.
- Leave Category List alone.
- Press Tab.
- Leave Include Categories alone.
- Press Tab.
- Leave 1\textsuperscript{st} result column alone.
- Press Tab.
- The cursor is now on OK.
- Press Enter.

What is the Pearson r? (round to the nearest hundredth)

___________________________

What does it mean?

___________________________
___________________________
___________________________
___________________________
___________________________

![Image of a table showing linear regression results]