

Catch a Thief with a Scatterplot

by – Beth Loughry

Activity overview

A scatterplot can be used to determine if a relationship exists when comparing two sets of data. If a relationship does occur, that relationship could be positive or it could be negative. Once a relationship has been determined, predictions are possible.

Law enforcement officers rely on evidence to find and convict criminals. If officers find a “footprint” at the scene of a crime, a plaster mold is made of the shoe print, and measurements are carefully taken. From the print, the height of the criminal can be estimated. In this activity, height and foot length measurements will be made to determine a relationship and make a prediction.

Concepts

- Proportions
 - Linear functions
 - Direct variation and indirect variation
 - Linear regression
 - Scatterplots
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Teacher preparation

Students should be familiar with the TI-Nspire handheld prior to beginning the activity.

The teacher should anchor yardsticks or meter sticks prior to arrival of students. A few yardsticks/meter sticks should be taped to the floor to allow students to measure foot length. Several sets of two yardsticks or meter sticks should be anchored (end-to-end) to the wall at various locations for convenience in measuring student height. Activity sheets should be printed, and an overhead transparency should be available to project data as students record foot length and height. The teacher may choose to project the Lists and Spreadsheets application from the TI-Nspire computer software and allow students to enter data as measurements are taken.

Classroom management tips

As students enter the room, the teacher should instruct students to place books on desks, then immediately begin to take measurements. Working in pairs is the most efficient method of gathering this data, but individual students who have been previously coached in measuring accurately may be assigned to stand at each station and take measurements for consistency in measurements.

TI-Nspire Applications







Lists and Spreadsheets


Graphs and Geometry

Materials: Yardsticks or Metersticks, Projection capability, Transparency of table or TI-Nspire Lists and Spreadsheets, Activity Sheets

Step-by-step directions.

The students are to make a judgment about the height of a thief who left a shoeprint at the scene of a crime. Each student will collect and organize data, create a scatterplot, then determine a linear regression to describe the data, then make a judgment about the height of the unknown person.

- A. Each student should stand with his/her back to the wall with attached measurement instruments (yardstick, meter sticks, or measuring tape.) The height of the student will be marked, then recorded on a projected transparency or in Column A of Lists and Spreadsheets from TI-Nspire software that is being projected on a screen.
- B. Next, each student should measure the length of his/her shoe.
- C. Record this data in the projected table.
- D. Each student should complete an individual table and enter the class data
 1. After turning on the TI-Nspire handheld, Choose Home and select **3. Lists and Spreadsheets**. Press **Enter** or the **Click Button** .
 2. Highlight the white space just to the right of A in column A, type "height".
 3. While the space is still highlighted, press  to choose Menu, Action. Press the **RIGHT ARROW** on the navpad for **ACTION** choices.
 4. From this menu, highlight **2.Resize**, and press .
 5. With the entire column highlighted, press the right arrow on the navpad to widen the column. Make sure the entire text is visible, then press  and press .
 6. Highlight the white space just to the right of B in column B, type "Shoe.length" and press .
 7. Use the same procedure to widen column B as you used to widen Column A.
 8. Enter individual heights of students with corresponding shoe length, in Column A and Column B.

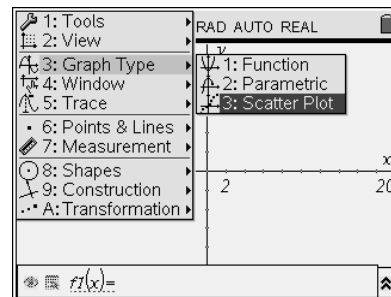


	A height	B shoe.length	C	D	E
1					
2					
3					
4					
5					

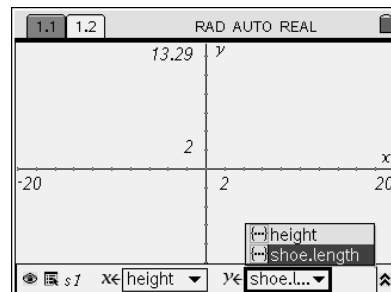
Materials: Yardsticks or meter sticks, Masking tape, Projector, Transparency of table or TI-Nspire computer software, Activity sheets

E. Analyzing Data - Graph

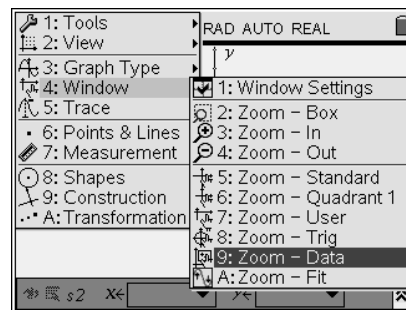
1. Use the shortcut **ctrl** **1** to insert a new page in your document.
2. Choose **2: Add Graphs & Geometry**
3. Press **menu** **3** **3** to choose **Menu, 3: Graph Type, 3: Scatter Plot**



4. Press **2** to open the x-values, insure "height" is highlighted and press **clear**
5. Move to the right to highlight the y-values list, and press **2**
6. Select **shoe.length**, and press **2**



7. Press **menu** **4** **9** to choose **Menu, 4: Window, 9: Zoom - Stat.**



Materials: Yardsticks or meter sticks, Masking tape, Projector, Transparency of table or TI-Nspire computer software, Activity sheets

F. Analyzing Data – Linear Regression

Next, determine the regression equation for the set of data.

1. Press **ctrl** ◀ (to the left of the NavPad) to return to the spreadsheet.

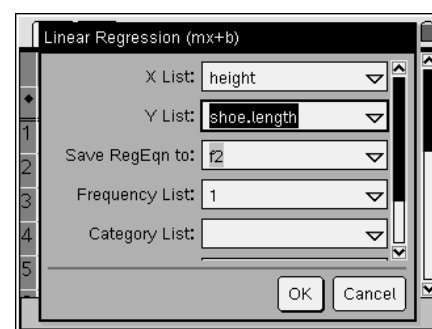
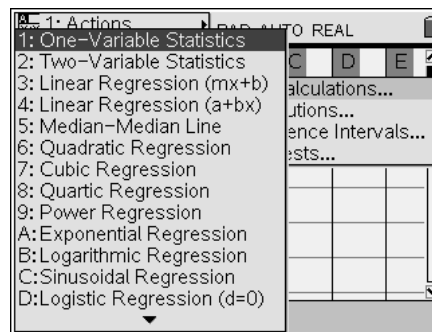
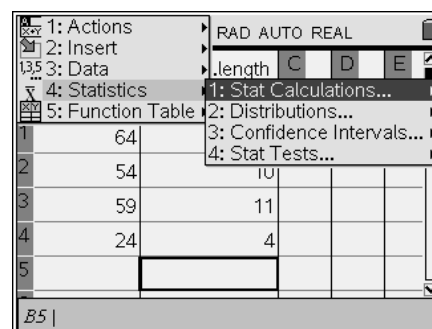
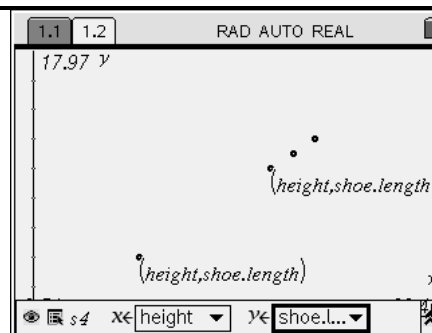
2. Press **menu** **4** **1** to choose Menu, 4:Statistics, 1:Stat Calculations.

3. Press **3** to choose 3:Linear Regression ($mx + b$)

4. The Linear Regression set up box will appear on the screen.

a. Press the down arrow on the NavPad cursor control to choose 'height,' and press **enter**

b. Press the **tab** key to change to the Y-list. Press the down arrow key and choose 'shoe.length.'



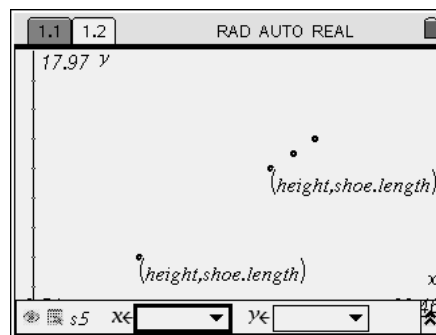
Materials: Yardsticks or meter sticks, Masking tape, Projector, Transparency of table or TI-Nspire computer software, Activity sheets

c. Press the **tab** until **OK** is highlight and press the **OK** button.

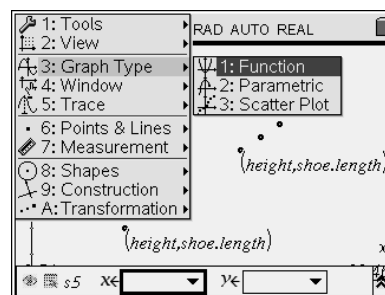
1.1	1.2	RAD AUTO REAL				
ht	B	shoe.length	C	D	E	F
				=LinR		=LinR
1	64	12	Title	Line...	Title	Line...
2	54	10	Reg...	m*x...	Reg...	m*x...
3	59	11	m	.2	m	.2
4	24	4	b	-.8	b	-.8
5			r ²	1.	r ²	1.

F1 | ="Linear Regression (mx+b)"

5. Press **ctrl** **↩** to return to the Graphs & Geometry page.




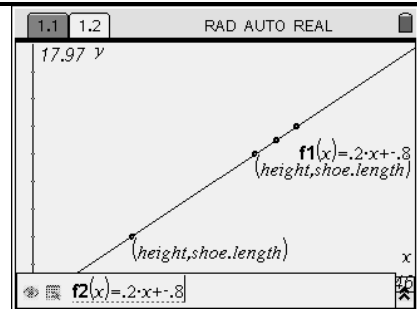
6. Press **menu** **3** **1** to choose Menu, 3:Graph Type, 1:Function.



7. Press the **▲** key so that the $f_1(x)$ appears in the

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Entry Line, and then press the  key to discover the Linear Regression that describes this data.



Assessment and evaluation (NOTE: this section can be separate or included in the step-by-step directions.)

- Did all students measure in the same units? Will the results change if the units are not all the same? Justify your answer. Why or why not?
- Will the sample size make a difference in the reliability of the prediction? Justify your answer.

Activity extensions

- Shoe sizes for men and women differ in America. Will shoe length determine if the shoe was worn by a man or by a woman?
- Research the differences in shoe size for men and women. Is there a direct correlation of foot length and size for men and/or for women. If both sets of data are graphed, what relationship is revealed?