HSPA 10 – CSI Investigation
Height and Foot Length: An Exercise in Graphing

In this activity, you will play the role of crime scene investigator. The remains of two individuals have recently been found trapped in a fisherman's net off the coast. A large portion of the individuals is missing, except for their feet, which remain completely intact. Your job is to help identify the individuals by determining how tall each of them was based solely on the length of their feet.

The first step in determining the victim's height is to establish a relationship between foot length and body height. To do this, you and your classmates will measure your foot length and body height. Once all measurements have been made, you will create a graph and determine if such a relationship exists. If there is indeed a relationship, you will use your graph to determine the height of each of the victims.

OBJECTIVES

In this experiment, you will

- ☺ collect height and foot length data from your fellow classmates.
- ☺ create a scatter plot using the collected data.
- ☺ determine if there is a relationship between height and foot length.
- ☺ determine the body height of each unknown victim.

MATERIALS

TI Nspire™	sheet of paper
pencil	masking tape
tape measure	meter stick

PROCEDURE – DATA COLLECTION
DAY #1
Activity 1 – Measurements

Foot Length

1. Place a sheet of paper on the ground.
2. Remove your shoes and stand with your right foot on the sheet of paper.
3. Using a pencil, carefully trace the outline of your foot on the paper. Keep the pencil straight up and down while tracing to get a more accurate foot measurement.
4. Remove your foot from the paper.
5. Using a metric ruler, measure the length of your foot tracing. Measurements should be made from the center of your heel to the tip of your large toe. All measurements should be made in centimeters. Check your length of your tracing to the actual length of your foot.

Body Height

6. Ask a fellow classmate for assistance. Stand with your shoes off and your back to the wall and have the measurer use a ruler to mark your height. Place your strip of masking tape with your name in a horizontal direction at the level of the ruler.
7. Using a tape measure, determine your height by measuring the distance from the floor to the mark on the tape. All measurements should be made in centimeters.
8. Share your data with the rest of the class. Record your name, foot length, and body height measurements on the class chalkboard.
9. When the entire class has submitted their data on the chalkboard, write down the data for the entire class in Table 1.

DATA TABLE

Table 1 (Class Data)		
Student Name	Foot Length (cm)	Body Height (cm)

Table 2 (Victim Data)		
Victim	Foot Length (cm)	Body Height (cm)
John Doe	26.3	
Jane Doe	23.9	

Activity #2 – Graph your data

Using the class data, create a graph and determine the height of each victim based on their foot length. When creating a graph, you must first know which variable should be placed on the *x*-axis and which should go on the *y*-axis. The independent variable is always placed on the *x*-axis and the dependent variable on the *y*-axis. **In this investigation, the independent variable should be based on what you know about the victims. The dependent variable is that which you are attempting to discover.** Provide a title for your graph and each axis.

Dependent variable: _____   Independent variable: _____   Graph Title: _____

Title:
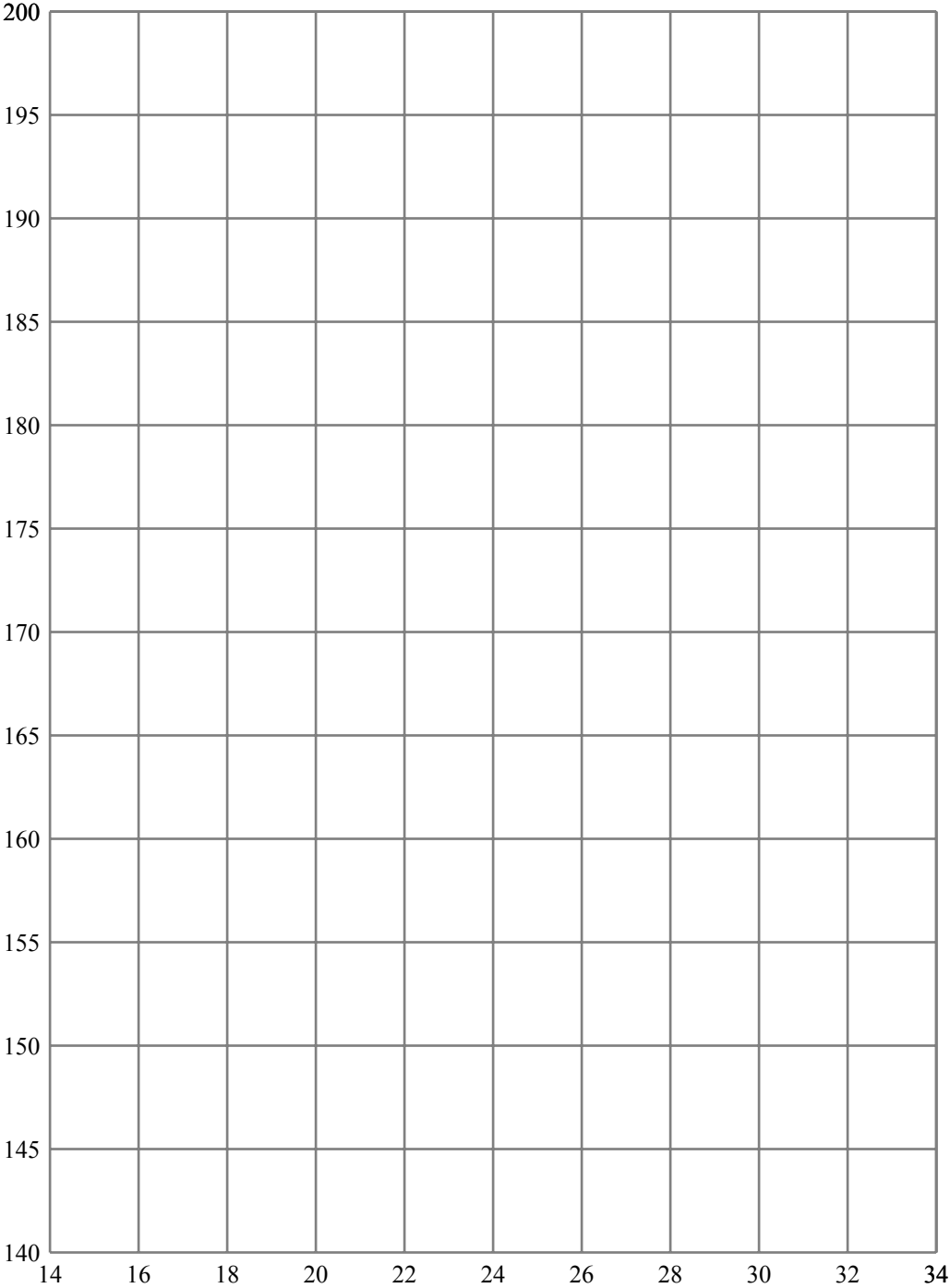
Activity #2 – Create a Line of Best Fit

A **line of best fit** is a straight line that best represents the data on a scatter plot.
This line may pass through some of the points, none of the points, or all of the points.

On your graph on page 3 of the feet and height data, draw a line of best fit through your points so you can predict the height of the victims.

Activity #3 – Analyze your Graph

Analyzing your graph

DIRECTIONS: Read and answer each question below using the graph that you created.

1. What was the title of your graph? Why?

2. What was the Dependent variable? Why?

3. What was the Independent variable? Why?

4. Does there appear to be a relationship between a person's height and the length of his/her foot? Describe the relationship.

5. Are there any outliers? Explain why the data are outlier in words relating their foot length and their height..

6. Using the line of best fit predict the height of Jane and John Doe. How did you make this prediction?

Table 2 – Victim Predictions		
Victim	Foot Length (cm)	Body Height (cm)
John Doe	26.3	
Jane Doe	23.9	

Activity #4 – Create a more exact line of best fit using the TI-Nspire
You will be using the TI-Nspire to create a scatter plot using the class data and determine the equation of the best fit line so you can predict the height of the victims more accurately.
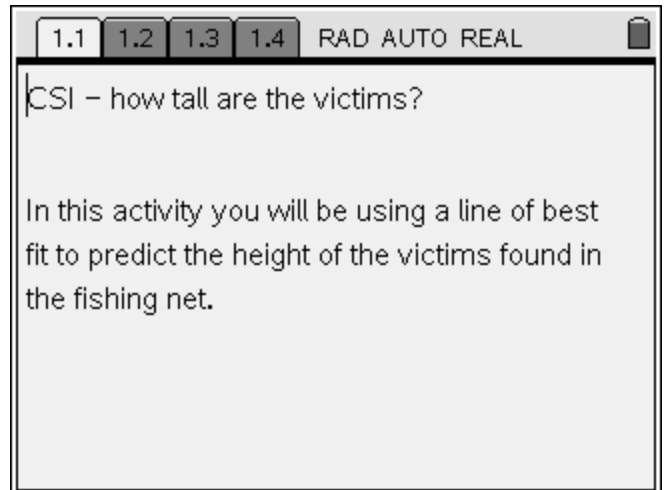
Create the Scatter Plot and actual line of Best Fit

|	
In this activity, you will explore: ***How to use Line of Best Fit to Predict the height of a person based on their foot size.*** 1. Press the (⌂) , 7. In your Period folder, open the file "CSI- how tall are the victims". **Use this document as a reference and to record your answers.** Push (ctrl)▸ to go to page 1.2.	┌─────────────────────────────┐ 1.1 1.2 1.3 1.4 RAD AUTO REAL CSI – how tall are the victims? In this activity you will be using a line of best fit to predict the height of the victims found in the fishing net. └─────────────────────────────┘
2. Enter the data for your class into the table. Make sure you put the data in the proper columns based on the labels. 3. **Save your data at this point - Push (ctrl)(⌂) 1:File 3:Save** Push (ctrl)▸ to go to page 1.3.	┌─────────────────────────────┐ 1.1 1.2 1.3 RAD AUTO REAL A foot.length │ B height.size │ C │ D 1 2 3 4 5 A1│ └─────────────────────────────┘

4. Now you will look at the graph of your data.

5. Set up the window so you can see your data.

6. Enter (menu), 5:Window/Zoom, 1:Window Settings
   Use (tab) to move between the values.
☺ Xmin is the smallest value on the *x*−axis on page 5.
☺ Xmax is the largest value on the *x*−axis on page 5.
☺ Ymin is the smallest value on the *y*−axis on page 5.
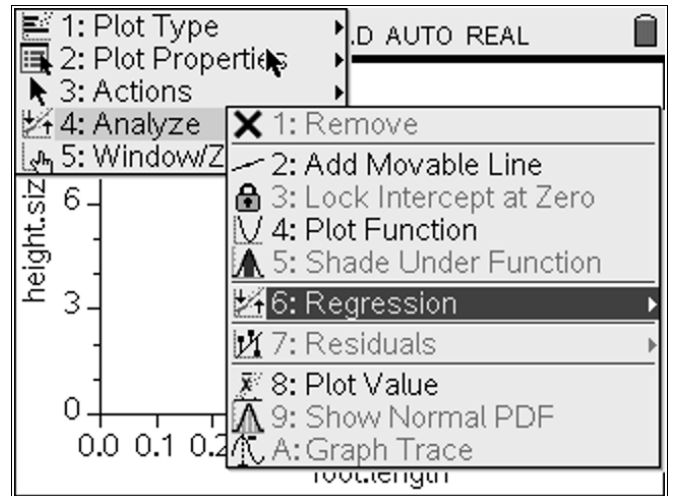☺ Ymax is the largest value on the *y*−axis on page 5.
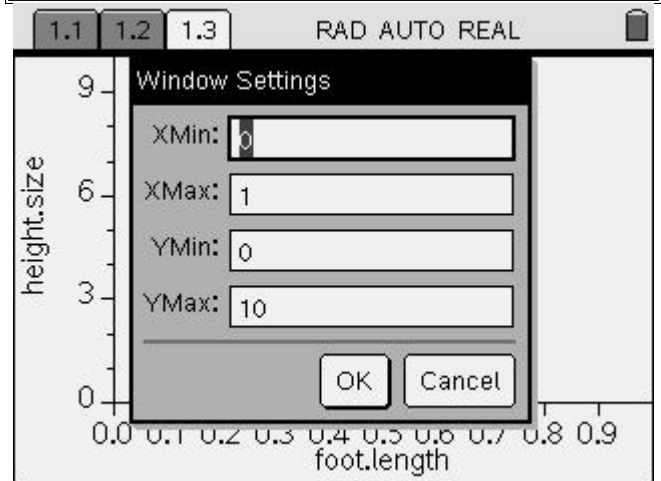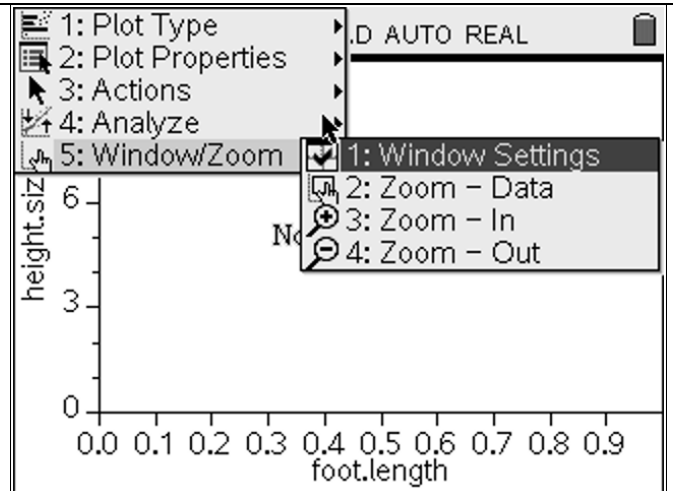
Sketch your data on the screen on the right.
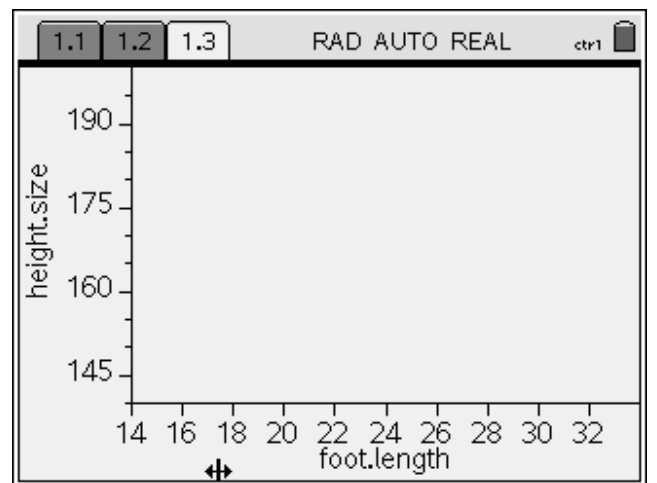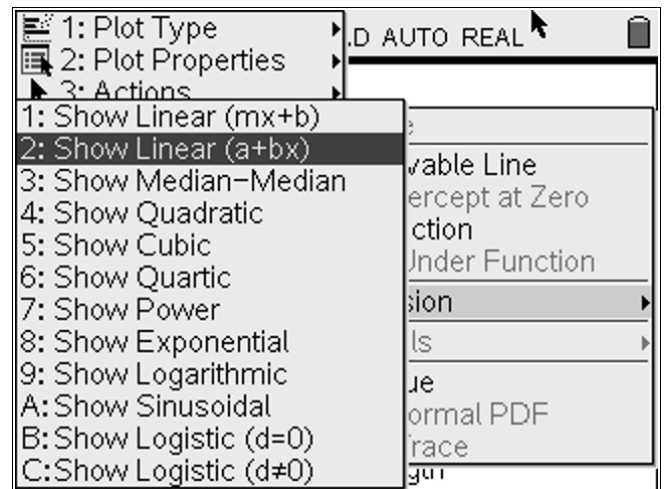
Find the line of best fit.

7. Press the (menu), 4:Analyze, 6:Regression,
   2:Show Linear (a+bx)
   and press (enter).

8. Write down the equation for the line of best fit:

$y = $ _____ $+$ _____ x

9. Save your data at this point - Push (ctrl)(⌂)
   1:File 3:Save

10. Push ⌨ to go to page 1.4.
11. Use the equation to find the body height of each victim. Use the best fit equation and <u>substitute for *x*</u>.

John Doe $y =$ _____ + _____   _____
John Doe's height=
Jane Doe $y =$ _____ + _____   _____
Jane Doe's height=

12. Type your substitution into the screen and calculate the "exact answers" and enter your calculations into the table:

Predictions using equations		
Victim	Foot Length (cm)	Body Height (cm)
John Doe	26.3	
Jane Doe	23.9	

1.1	1.2	1.3	1.4	RAD AUTO REAL	

0/99
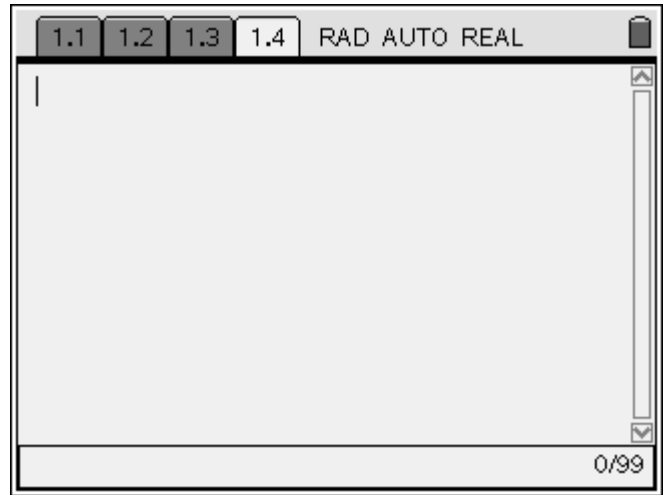
Close your document at this point.
Press the 🏠, 6, Enter (for yes)
This will prevent other classes from overwriting your file.

Activity 5 – Analysis QUESTIONS - compare manual graph to calculation based on line of best fit.

Victim	Foot Length (cm)	Body Height (cm)-manual graph	Body Height (cm)- calculation based on line of best fit
John Doe	26.3		
Jane Doe	23.9		

1. How tall was each of the victims?

2. When creating your graph, what data did you use as your Dependent variable and why?

8

3. Based on your data, is there a direct relationship between the length of a person's foot and their height? Explain this relationship.

4. Was it necessary to create a graph to determine the height of the victims? Could the same information have been obtained simply from the class data table?

5. How did you increase the accuracy of the results from this investigation?

6. Compare the values that you estimated from the graph to the calculated values based on the line of best fit from the TI-Nspire.. Is there a difference? What may have accounted for this difference? What may have accounted for the values being the same?

7. What have you learned from this activity? You are to respond to this question using 3-4 complete sentences. Look back through this document to help you remember all of the steps in the activity.

_____

_____

_____

_____

_____

_____