Testing the Vitruvian Man
ID: 11304

Activity Overview
In this activity, students will collect height and wingspan measurements and plot the data. They will then determine a line of best fit using a movable line. Through teacher-led discussion, students will learn the properties of a line of best fit.

Topic: Two-variable statistics
- *Scatterplots*
- *Lines of best fit*

Teacher Preparation and Notes
- *This activity has students collect data as a class and then use the data to construct a scatter plot and line of best fit. To collect data, students will need a tape measure or meter/yard stick for each group of students.*
- *If students do not have time to collect data, the teacher can give the class a data set to be used for the scatter plot and analysis.*
- *The teacher tns file has a sample data set.*
- *This activity can be used as a teacher-led discussion about line of best fit or as a review/assessment of a line of best fit lesson.*
- ***To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter "11304" in the quick search box.***

Associated Materials
- *Vitruvian_Teacher.doc*
- *Vitruvian.tns*
- *Vitruvian_Soln.tns*

Suggested Related Activities
To download any activity listed, go to education.ti.com/exchange and enter the number in the quick search box.
- *Predicting White Blood Counts (TI-84 Plus) — 5784*
- *TI: Line Up #2 (TI-89 Titanium) — 3418*
- *Run me a Linear Regression (TI-84 Plus) — 5137*
- *daVinci's Proportions (TI-84 Plus) — 5546*
- *Round about Circles (TI-Nspire technology) — 8554*
- *Find Line of Best Fit (TI-Nspire technology) — 9883*

Step 1 – Collecting the data

Divide the class in small groups. Have each student measure his/her height and wingspan. The wingspan is measured from the longest fingertip of one hand to the longest fingertip of the other hand, with the arms held perpendicular to the body. Choose to use either centimeters or inches.

The data should be recorded in the *List & Spreadsheet* on page 1.3. There are several options for distributing the data to students.

a. If using Connect-to-Class, have students enter the data in the activity .tns file on a class computer and then distribute to each student.

b. Without Connect-to-Class, the information can still be input on a class computer and then the file sent to each student with the TI-Nspire Link software.

c. Choose one student's calculator to be the "collector." Send the activity .tns file calculator to calculator.
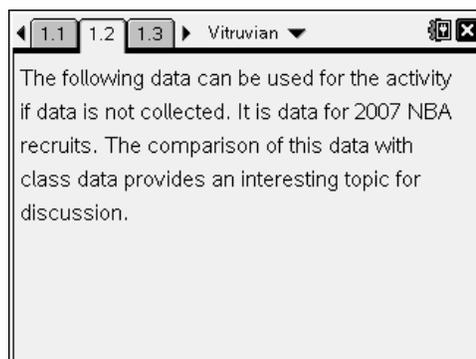
Step 2 – Creating the Scatter plot

On page 1.5, students are to create a scatter plot of the data with height on the bottom (*x*) axis and wingspan on the left (*y*) axis.

Some may argue that height is the independent variable because wingspan is thought to be determined by height. However, others may argue that neither are independent or dependent variables because height and wingspan are determined by genetics.

The scatter plot will appear in an appropriate window. It may be important to discuss the window dimensions as it provides a good discussion of domain and range. The specific dimensions can be found by pressing **MENU > Window/Zoom > Window Settings**.
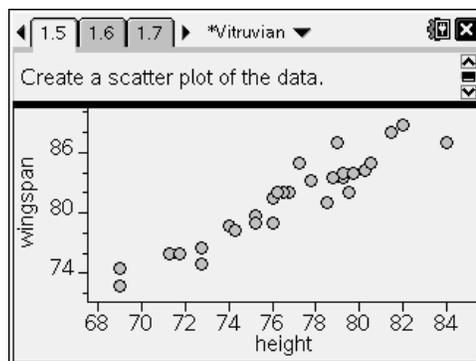
To analyze the data, students should determine if a pattern appears after graphing. If so, they should describe the pattern with the following terms.

- positive vs. negative association
- strength of relationship
- linear vs. non-linear

The graph should have a positive association; meaning as one variable increases the other variable also increases. The graph has a relatively strong relationship because the points are clustered close together. The graph is linear and can be represented by a straight line.

Discuss with students what the line would look like that would describe the pattern of the data. (It would have a positive slope.)
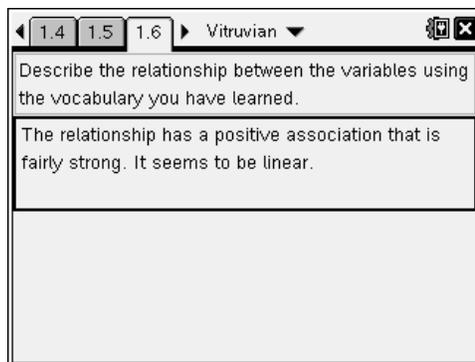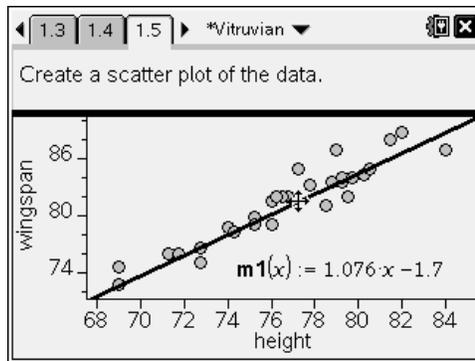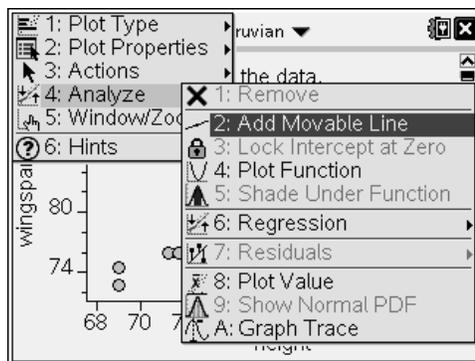
Step 3 – Drawing the line of best fit

The goal of this activity is for students to understand the concept of the line of best fit.

Students are to return to the scatter plot on page 1.5 and **add a movable line** from the Analyze menu. A line with a positive slope will appear. Its equation will also appear on the screen.

Discuss the properties of a line of best fit. Have students propose what they believe the line should do. At the end of the discussion the list should include:

- Positive association > positive slope
- Negative association > negative slope
- Equal number of data points above and below line.
- As many points as possible should be on the line, but the previous guidelines are more important.
- The points above the line should not be concentrated at one end, nor should the points below the line.

Have students transform the line to become the line of best fit. They can change the *y*-intercept by grabbing the middle of the line or change the slope by grabbing either end of the line. Pressing the keys (esc) or 🖱 will release the line.

Allow students to find their "line of best fit". They will need to toggle between the two cursors to put the line where they would like it. Have several students to plug their calculator into the overhead panel and explain why they believe their line is fits the data.

A sample answer is given at the right.

Discuss with students what the equation of the line means. Since the slope of the line is very close to 1, it means that the height and wingspan are nearly equal to each other. The data and line suggest that there is a correlation between height and wingspan.
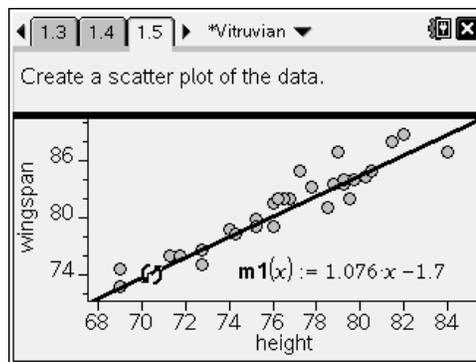
Extension – The regression line

This activity can be extended (or continued the next day) to find calculator generated lines of best fit including the linear regression line and the median-median line.

On a *Data & Statistics* page, the commands for either line can be found by pressing **MENU > Analyze > Regression**.

Both lines are considered a best fit model, even though their equations are different. Discuss with students as to how each line is determined and how the lines compare to the students' lines of best fit.

On both of the screenshots to the right, the thin line represents the line of best fit found with the moveable line.