

Working Hard or Hardly Working?

ID: 12724

Time required
20 minutes

Activity Overview

Students will analyze univariate and bivariate data. Questions are posed for discussion, further research, and algebraic problem solving.

Topic: Data analysis and linear functions

- Students will analyze a box plot.
- Students will analyze a histogram.
- Students will use a scatter plot to generate a 'best fit' line.
- Students will use a linear regression equation to answer questions.

Teacher Preparation and Notes

- It is expected that students have already encountered box plots, histograms, and scatter plots. The concepts of median, frequency, and mean are called upon in this activity.
- Students will manipulate a movable line on the scatter plot to obtain their best visual fit for the data, and will use it to answer questions.
- Students will also create the linear regression and use it to evaluate and to solve problems. The teacher has the option of whether students may use the numeric solve feature, or solve the problems by hand.
- **To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter "12724" in the quick search box.**

Associated Materials

- *HardWork_Student.doc*
- *HardWork.tns*
- *HardWork_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.

- *Slopes with Starburst (TI-Nspire technology)* — 11006
- *Olympic Gold (Regression Wisdom) (TI-Nspire technology)* — 11892
- *Burger King Regressions (TI-Nspire technology)* — 11886
- *CSI – How Tall are the Victims? (TI-Nspire CAS technology)* — 8953
- *Box Plots & Histograms (TI-Nspire technology)* — 9843

Problem 1 – Histograms and Box Plots

On page 1.2, students are given the average commute time for workers in 20 US cities. Students will examine this data as a histogram and a box plot.

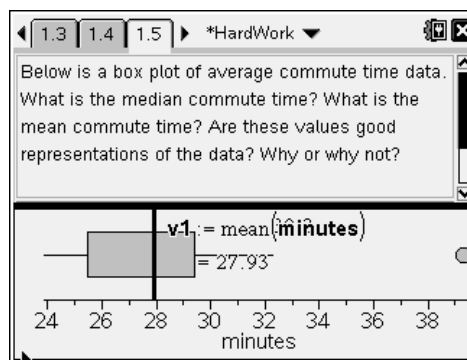
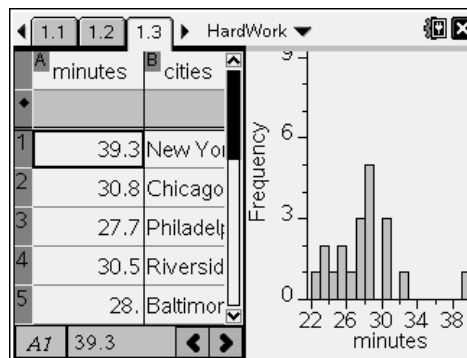
For more data on commute times and other facts, go to <http://factfinder.census.gov>.

To take the data further, have students do a survey of employees in the building of their commute times. Have students compare this information to the data given in the TI-Nspire document.

To find the mean commute time while on page 1.5, students can use the Plot Value feature (**MENU > Analyze > Plot Value**) and plot the value **mean(minutes)**.

Discussion Question

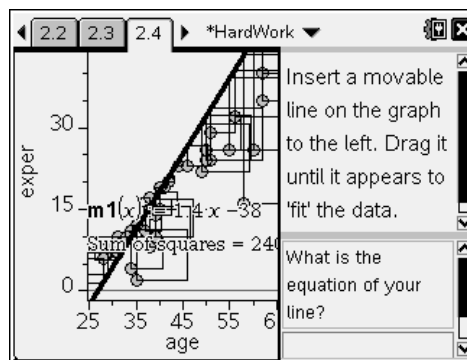
- *What factors may affect the commute times? [population density, public transportation, carpooling, weather, etc.]*



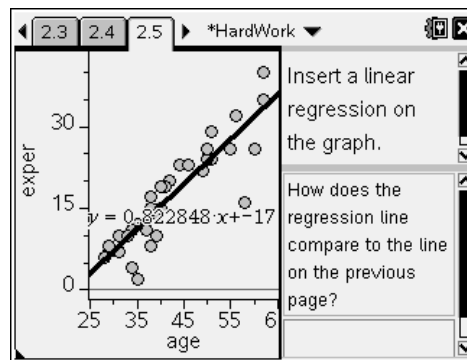
Problem 2 – Bivariate Data

Students will examine data from a survey about teachers' age and number of years experience teaching. Students should be able to mention the ideas of linear behavior, an increasing or positive slope, a strong or weak *correlation*. Some students may mention that there are some dots that appear to be farther away from the general shape of the distribution. These special cases can be discussed. For example, a woman who stayed at home while her children were young and then returned to teaching. Or a person who was unhappy in a corporate job or a research position and came back to education after that work experience.

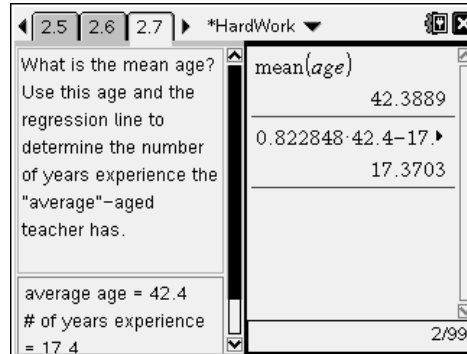
Students will use a movable line on page 2.4 to find the equation of a line that appears to 'fit' the data best. If students have already learned about residuals and residual squares, then you may want students to turn on either the residual squares (**MENU > Analyze > Residuals > Show Residual Squares**) and have students try to minimize the sum of the residual square to find the best line.



Next, students will display the linear regression of the data (**MENU > Analyze > Regression > Show Linear (mx + b)**). It is assumed that the students have performed a regression at this point. Rich discussion can take place now that students understand the slope (change in years of experience for each year older) of linear functions. Correlation is not shown as part of this task.



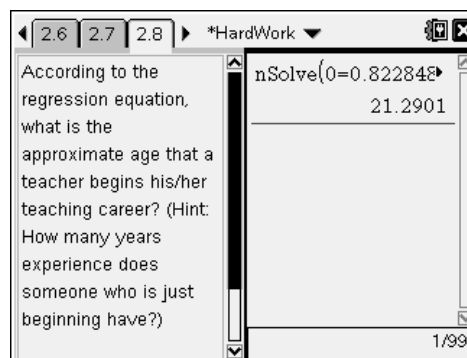
Be sure to show students how to perform the associated algebra for solving the next few problems. To find the mean age, students can type **mean(age)** on the *Calculator* screen.



Students should remember, in the form $y = mx + b$, x represents age. So, students will substitute the mean age for the variable x in the regression equation and simply evaluate the right side. Their answer will be the corresponding number of years of teaching experience.

Then, students will solve to find at what age the typical teacher begins his or her career and at what age a teacher is about to retire. This may be surprising to some students!

You choose how you wish for students to solve these problems. One option is the **Numeric Solve** command in the Algebra menu. The syntax for the **Numeric Solve** command is **nSolve(0=0.8228x-17,x)**.



If you wish for students to solve step-by-step and they are using CAS technology, have students enter **0=0.8228x-17** and press **(enter)**. Next, they should press **+17** and **(enter)**. Then, divide by 0.8228 and **(enter)**. This is an artificial means of students “showing” work. They must know what step comes next and allow the calculator to perform the step for them.