Lesson Title: Homework and Test Score Correlation <mark>HSS.ID.6.A</mark>
Unit Title: Unit 4
Teacher Candidate: Courtney Berger
Subject, Grade Level, and Date: High School Algebra 2, 11th Grade, 10/23/16

Placement of Lesson in Sequence and Lesson Rationale

This lesson will be at the end of a lesson series as a review of how to model and find regressions from data by using technology of an advanced graphing calculator. The lesson is placed at the end because it is a lesson that requires a large amount of previous knowledge, as well as a reflective mindset.

Central Focus and Purpose

The central focus of this lesson is for students to analyze a data set of past students' test and homework scores, by plotting the data, finding the best fit regression, and using that regression to find a function with their advanced graphing calculators. They will then examine the meaning of the information they found, and predict future test scores based on homework scores. Through this process, students will have practice of mathematically modeling data by plotting points, as well as calculating regressions. It also familiarizes students with using the technology of graphing calculators in a more advanced way of plotting the points and analyzing which regressions fit the model best, based on the information the calculator gives them, specifically the coefficient of determination (r^2). The idea behind this lesson was to get students involved with mathematical modeling and using technology. There is a large amount of research to show that teachers should be teaching mathematics by using mathematical modeling. One article on this, published by the American Scientist, is, "5 Reasons to Teach Mathematical Modeling," written by Rachel Levy. In this article, Levy goes into detail about these reasons, but broadly they are, modeling involves making genuine choices, has many possible justifiable answers, matters to the end-user who needs to understand something, presents problem solving as a creative, interactive process, and is inherently a team sport.

CCSS.MATH Content and Practice Standards

- CCSS.MATH.CONTENT.HSS.ID.A.3
  Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
- CCSS.MATH.CONTENT.HSS.ID.B.5
  Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.
- CCSS.MATH.CONTENT.HSS.ID.B.6
  Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
- CCSS.MATH.CONTENT.HSS.ID.B.6.A
  Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.
- CCSS.MATH.CONTENT.HSS.ID.C.9
  Distinguish between correlation and causation.

Prior Content Knowledge and Pre-Assessment

Prior knowledge required for this lesson is, knowing how to operate a graphing calculator similar to a TI-84 by plotting data points, calculating linear regressions, as well as understanding what the coefficient of determination (r^2) is and how it applies to finding a regression. The pre-assessment for this knowledge will be from the lessons leading up to this closing lesson, through in-class work and homework.

Learning Target(s) and Plan for Clarifying Intending Learning

For the learning target, students should be able to say, "I can find an accurate regression equation to a set of data points, understand how the equation applies to the data, and create a mathematical model of the regression and data by graphing." To clarify this learning target, I will write it on the board before the class begins, read it to the students, and have them write it down in their notebooks at the beginning of class.

Strategy for using assessments to guide student learning

The assessment for this lesson will be the work sheet that the students will fill out as they complete this lesson, which has them make a table from the data they are given, find a function that best fits the points by listing all possible regressions' coefficient of determination, graphing the points and function, and answering prompts about what they found. There is also an option for student who are more advanced to use the work sheet to create an essay

Success Criteria (criteria for interpreting student success of the learning target)	**Plan for providing feedback and students' monitoring of their own learning**
If students receive an average percentage of 75% or higher on the rubric for this assignment I will consider it successful, if less that this then I will spend some time discussing the assignment as a class, with a focus on the rubric sections that have the lowest scores.	Students will be monitor their learning while completing the work sheet in class through asking their peers and I questions. They will have feed back after this lesson through the comments I will make on their work sheets, and the scores they receive on each section.

Academic Language Demands

Language Function	Vocabulary & Symbols	Secondary Language Demand
The language functions for this lesson is: explain. Students will have the opportunity to explain their thinking at the beginning of the lesson through teacher led discussion, when answering the prompt questions, and then at the end of class when the students discuss their prompt answers.	- Coefficient of Determination - Mathematical Model - Regression - Correlation - Causation	**Mathematical Precision:** Students must be able to use the technology in a graphing calculator to plot data, find a regression, and create a model of what they found by graphing. **Syntax:** Students must plot the data points with the correct variables, chose the correct regression, write the function in correct function notation, and graph with an accurate representation of the function and points to match the data and regression.

Discourse:
Students will have discussion of why the modeling lesson might be important or how it could be applied, and discuss the answers to their prompts at the end of class. Discussion will be between the teacher and students as well as from student to student.

Language Support (instructional and assessment strategies)		
Language Instruction	**Guided Practice**	**Independent Practice**
In this lesson, the language instruction will mainly be introducing the lesson and work sheet, as well as asking students questions to deepen their understanding.	Students will have guided practice time as they work on the work sheet by plotting data, finding regressions, and modeling portions of the work sheet. The work sheet will guide them through he steps of plotting points, finding the regression that is the most accurate, creating a model, and then explaining their outcomes. This order gives students direction as to what steps to take and when as they go through this process. Students will have most of the control over how much guidance they receive based on if they choose to ask questions or not, considering this is review.	The independent practice in this lesson will be when the students write down their answers the prompts to the questions about the model that they created. The questions asked here are: • Are there any outliers in this data set compared to the regression? • Should we get rid of them? Why would we? Why would we not? • What does the regression function tell us? • What conclusions can we draw about the data, based on the regression function? • Based on our model, if a student had an average homework percentage of 25%, what could their test score be? 50%? 75%? 85%? 95%? • Is homework important? • Is the pattern we see in the model likely correlation or causation? Why? • Why do you think the regression model is

		shaped how it is? • Why would we want to know how to make models like this one? How can we use this in the real world? This will be individual time for evaluation, reflection, and analyzing of what they found.

Differentiation, Cultural Responsiveness, and Accommodation for Individual Differences

This lesson can be taught in many different ways to accommodate for many types of students. To make this lesson simpler, a teacher could choose the data that they give to the students to represent only a linear regression, or give them a lesser amount of points to model, no less than 4 so there is still a more visible relationship. For students who are more advanced, this lesson could require an essay to report the information they found, along with the answers to the prompts. This essay should have the same standards as an English class, and require even deeper discussion on the findings so it can be presented in paragraph format. Since the students are more advanced that would be doing this, they should be allowed some academic freedom of what to include in each paragraph as long as they know the work sheet information should be included. Depending on the class atmosphere, this lesson could become a take home project, or a group project where a group of somewhere between 2 and 4 students work on the same work sheet and all turn in one sheet together. A teacher could also choose different data to model that was more fitting for the cultures and interests of that classroom, such as football statistics and practice time, product output rates of clothing to profit, or money spent on creating a videogame compared to the amount of copies sold. For students with varying needs such as ELL students, the work sheet that goes with this lesson could be modified to include the vocabulary words with definitions, instructions in terms that are more common (other than the vocabulary words), and prompt requirements based on discussion more than writing.

Materials – Instructional and Technological Needs (attach worksheets used)

Technology:
• Advance graphing calculators with regression abilities similar to a TI-84
Work Sheet:

Name and Date_____

# Homework and Test Score Modeling Work Sheet

1. Fill out the table based on the data provided on the screen:

Homework Score	Test Score

2. Plot these points into the calculator and find the most accurate regression based on the coefficient of determination and write the corresponding function.
   - Linear Regression, r^2:_____
   - Quadratic Regression, r^2:_____
   - Cubic Regression, r^2:_____
   - Quartic Regression, r^2:_____

   Function of most accurate regression:_____

3. Create a Mathematical Model of the data and function by graphing:
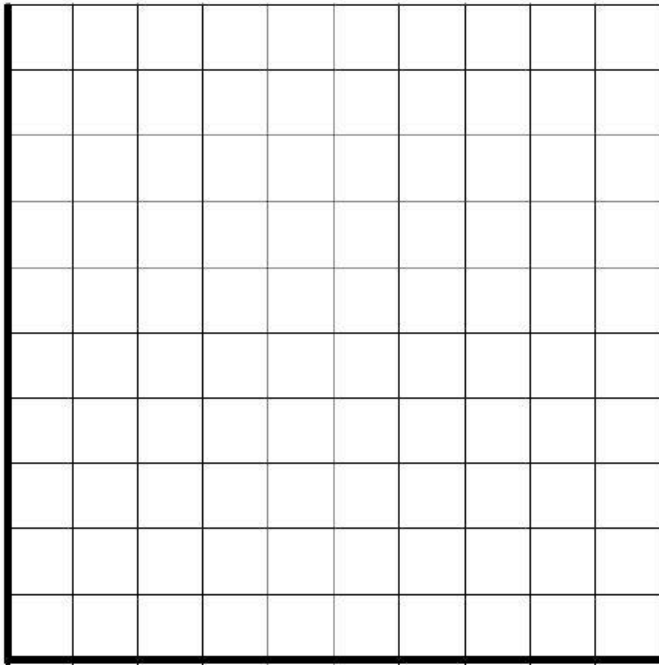
4. Answer the following prompts on a separate sheet of paper and ==explain== your thinking:
    a) Are there any outliers in this data set compared to the regression?
    b) Should we get rid of them? Why would we? Why would we not?
    c) What does the regression function tell us?
    d) What conclusions can we draw about the data, based on the regression function?
    e) Based on our model, if a student had an average homework percentage of 25%, what could their test score be? 50%? 75%? 85%? 95%?
    f) Is homework important?
    g) Is the pattern we see in the model likely correlation or causation? Why?
    h) Why do you think the regression model is shaped how it is?
    i) ==Why would we want to know how to make models like this one? How can we use this in the real world?==

Homework and Test Score Modeling Work Sheet Rubric

Section	Points					
1			**3** All points filled in and all correct	**2** Points mostly filled in and correct	**1** Some points filled in and some correct	**0** No points filled in or correct	
2			**3** All r^2 and function filled in and correct	**2** r^2 and function are all filled in and mostly correct, or mostly filled in and all correct	**1** Some r^2 and function are correct	**0** Either all incorrect or blank	
3			**5** Function and points are all showing, correct, and the graph is labeled in a mathematical fashion	**3** Function and points are mostly correct but missing some parts	**1** Function and points are mostly incorrect but still some correct parts	**0** No function and points, or all incorrect	
4	**10** All questions are answered with explanation, and correct	**8** All questions are answered with some explanation and mostly correct	**6** Most questions are answered with little explanation or correct answers	**4** Little questions answered with little explanation or correct answers	**2** Little questions answered with no explanation and little correct answers	**0** No questions answered

Instructional Plan (detailed explanation for thing the lesson)		
Pacing	**Teacher Activities**	**Student Activities**
10min	Introduce the lesson by first going over the learning target by reading it out loud and having students write it in their notebooks. Then ask students if they think that homework is important to obtain a high test-score, have them explain their thinking, present the students with data from the previous year on average homework and test percentages (not disclosing names), and then briefly explain what is on the work sheet.	Students will be participating by writing the learning target down, and be involved in discussion of if they think homework scores affect test scores, as well as listening to instructions and asking for clarification as the teacher explains.
30min	Walk around the room and ask students about the answers they are getting, monitor student focus, and formatively assess student understanding.	Students will be filling out the work sheet by filling out the data table, calculating the coefficient of determination for each regression, finding the function for the most accurate regression, creating a model for the data and function that they found, and answering the writing prompts.
10min	Lead students in a class room discussion about the writing prompts and have a focus on them explaining their thinking as well as responding to their peers and allowing their peers to ask them questions. Make a point to discuss why knowing how to do this is important and where it can be applied.	Students will be sharing their prompt answers with the class, asking questions of each other, and expanding on their thinking by answering the teacher's questions to expand.