Eureka Acceleration Tool: Algebra I
Module 2, Topic D

To become mathematically proficient, students **must** access on-grade-level content. This document aims to help teachers who use the Eureka curriculum to ensure readiness for students before and during on-grade-level work, creating opportunities for timely support directly connected to the new learning.

About this Topic

Focus Standards:

A1: S-ID.B.6: Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.★

a. Fit the 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 and quadratic models.*
b. Informally assess the fit of a function by plotting and analyzing residuals.
c. Fit a linear function for a scatter plot that suggests a linear association.

A1: S-ID.C.7: Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.★

A1: S-ID.C.8: Compute (using technology) and interpret the correlation coefficient of a linear fit.★

A1: S-ID.C.9: Distinguish between correlation and causation.★

Topic Overview per the Eureka Curriculum

In Topic D, students analyze relationships between two quantitative variables by using scatter plots and by summarizing linear relationships using the least squares regression line. Models are proposed based on an understanding of the equations representing the models and the observed pattern in the scatter plot. Students calculate and analyze residuals based on an interpretation of residuals as prediction errors.

Eureka Acceleration Tool: Algebra I
Module 2, Topic D

Overview

Eureka Acceleration Tools include:

1. a diagnostic assessment to help teachers determine the misunderstandings or gaps in mathematical knowledge related to a specific Topic in the Eureka curriculum
2. guidance for teachers to analyze student work on the diagnostic assessment
3. suggested materials for targeted remedial instruction

Note: The use of this guidance is not intended to delay students' engagement with on-grade-level learning. On-grade-level learning should be the focus of instructional time and be treated as an opportunity for students to "finish" learning previous skills and deepen conceptual understanding.

Diagnostic Assessment

The diagnostic assessment is designed to be administered to targeted students prior to beginning instruction on the given Topic. When appropriate, it is broken into parts (Part A, Part B, and so on); each part addresses a different prerequisite standard and contains three problems. If a student correctly answers at least 2 out of the 3 problems, it can be assumed that he/she is ready to engage with the new content of the Topic with little to no support needed prior to engaging with the Topic. The diagnostic assessment is designed in this way so that teachers can determine the "entry point" to remedial instruction and/or opportunities for unfinished learning within the context of the new learning. The entry points and opportunities for unfinished learning will vary between students.

Guidance for Acceleration

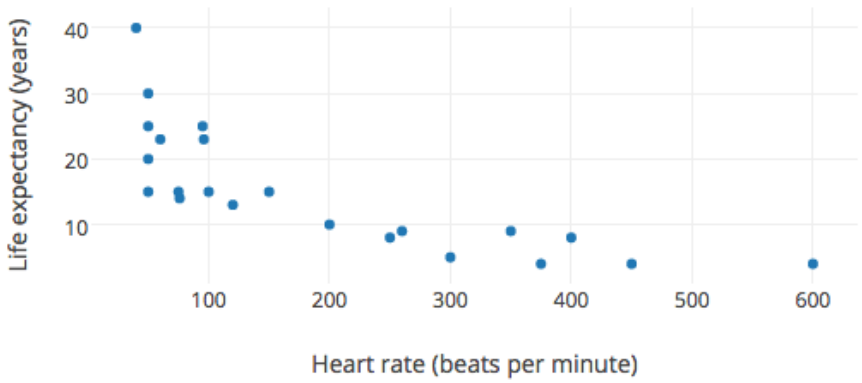
The Acceleration Guidance is designed for teacher use. It is also broken into parts (Part A, Part B, and so on) and correlates to the parts on the diagnostic assessment. Each part contains the following:

1. **The focus standard**: The focus standards are strategically chosen to address prerequisite skills and are purposefully arranged in the order that students typically master the skills and knowledge.
2. **Why this is important for current grade level work**: This section describes how the work of the prerequisite standard relates to the standard(s) addressed in the Topic of instruction.
3. **Using the diagnostic assessment to identify gaps**: This section identifies common errors students make on the diagnostic assessment items.
4. **Acceleration Resources for Targeted Instruction**: The resources pinpoint specific Eureka lessons and parts of lessons for teachers to use to address gaps in mathematical knowledge. Using Eureka materials to address acceleration ensures alignment to the standards, consistency in approach to learning, and similarities in strategies for solving problems.

Part A: 8.SP.A.1

1. Use the scatter plot to answer the questions below.

Mammal Heart Rate vs. Life Expectancy

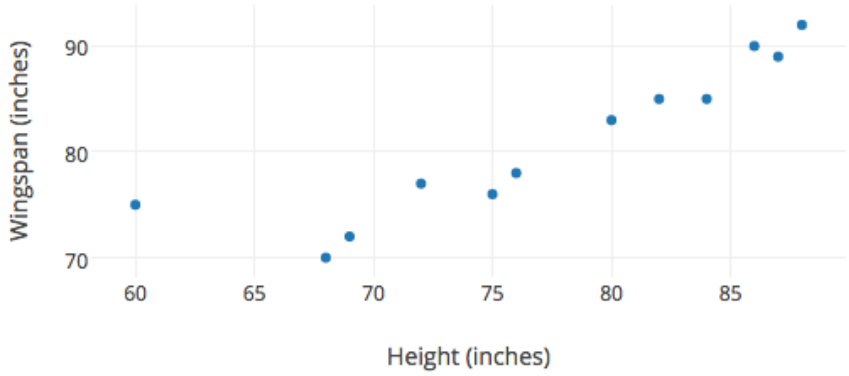


a. Does there appear to be an association between mammal heart rate and life expectancy? Explain.

b. If an association exists, is it positive or negative? Linear or nonlinear? Explain.

2. Use the scatter plot to answer the questions below.

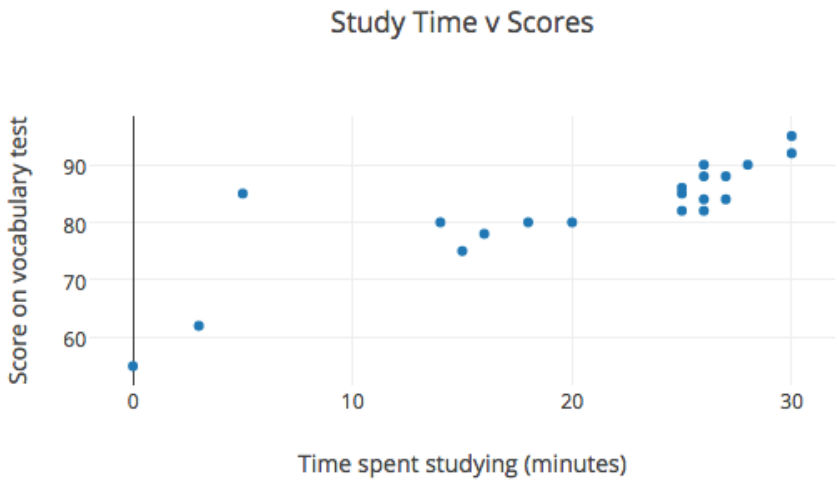
Basketball Players: Height v Wingspan



a. Does there appear to be an association between a basketball player's height and his/her wingspan? Explain.

b. If an association exists, is it positive or negative? Linear or nonlinear? Explain.

3. Use the scatter plot to answer the questions below.

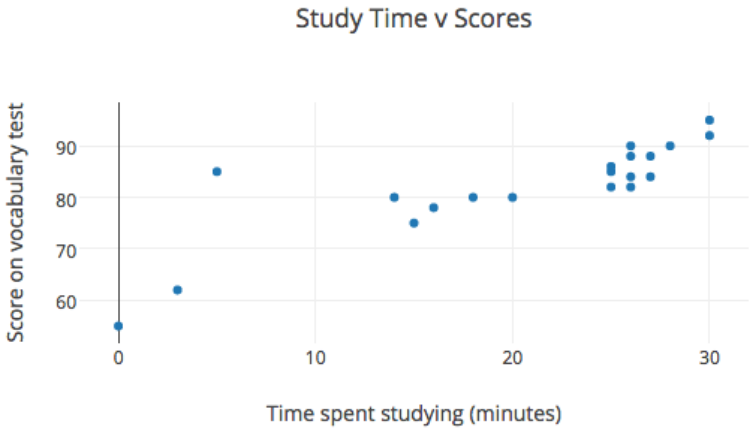


   a. Does there appear to be an association between time spent studying and the score earned on the vocabulary test? Explain.

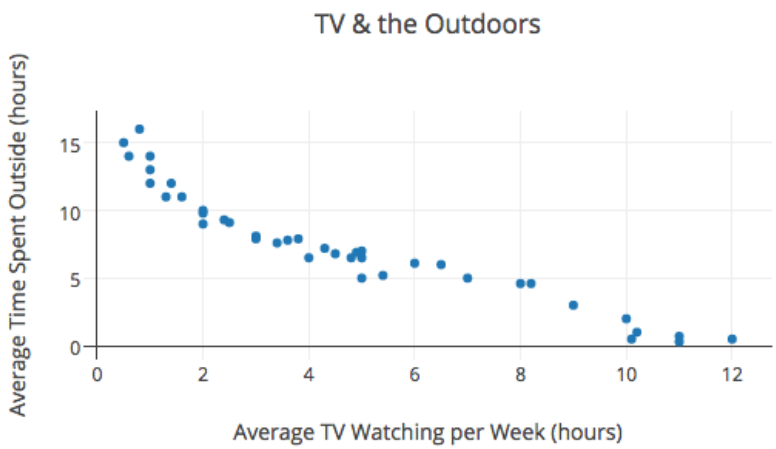
   b. If an association exists, is it positive or negative? Linear or nonlinear? Explain.

Part B: 8.SP.A.2

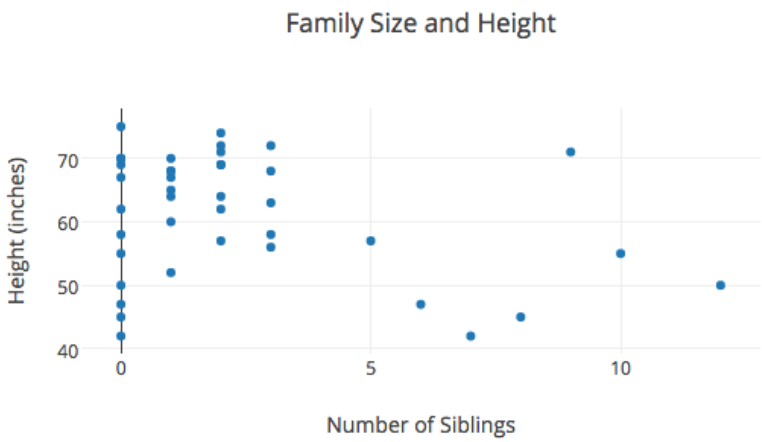
4. Determine if the data suggests a linear association and, if it does, draw a line of fit. Discuss how good of a fit the line is for the data.



5. Determine if the data suggests a linear association and, if it does, draw a line of fit. Discuss how good of a fit the line is for the data.



6. Determine if the data suggests a linear association and, if it does, draw a line of fit. Discuss how good of a fit the line is for the data.



Part C: 8.SP.A.3

7. Use the scatter plot and the line of best fit to answer the question.

Adria drew a line of fit for the data above and then calculated the slope and a y-intercept in order to be able to write an equation for the line. what does a slope of 1 mean? What does a y-intercept of close to 0 mean? Show your work and/or explain your answer.

8. Use the scatter plot and the line of best fit to answer the question.

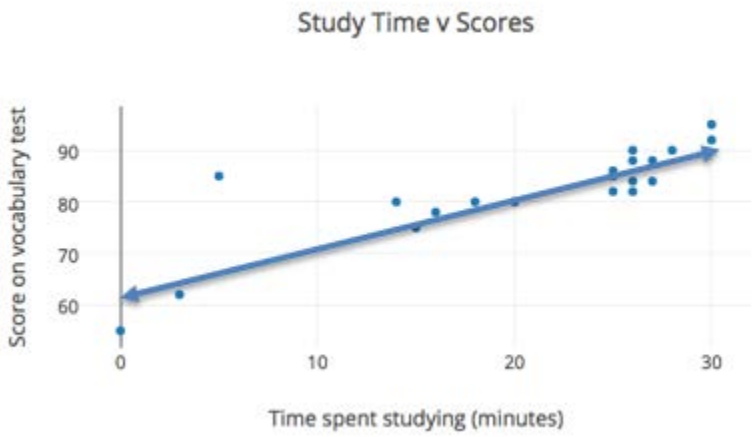
Aeson drew a line of fit for the data above. The equation for her line of fit is $y = 2x + 4$. If Aeson pays $12 for a trading figure, what should he predict the rarity rating to be? Show your work and/or explain your answer.

9. Use the scatter plot and the line of best fit to answer the question.

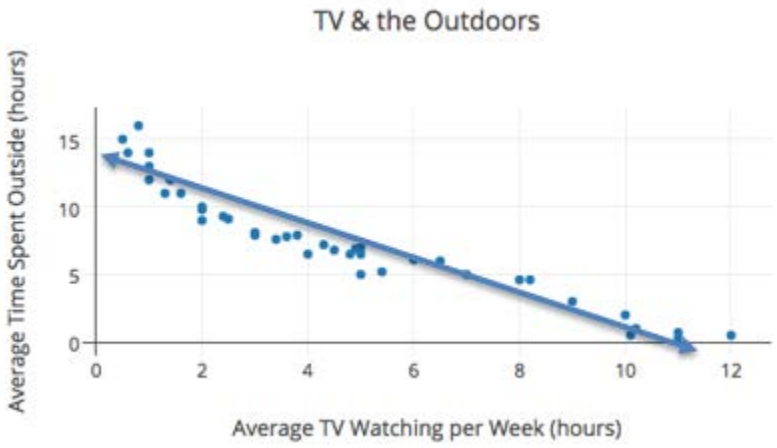
Arthur drew a line of fit for the data above. The equation for his line is $y = -\frac{13}{100}x + 440$. About how much can Arthur expect to pay for new windows if he wants this average monthly electric bill to be around $250? Show your work and/or explain your answer.

Solutions:

1. (sample) Yes, there appears to be a negative, nonlinear association between mammal heart rate and life expectancy. In general, as heart rate increases, life expectancy decreases, quickly at the beginning and slowly towards the end.
2. (sample) Yes, there appears to be a positive, linear association between a basketball player's height and his/her wingspan. In general, there is a steady increase of both height and wingspan.
3. (sample) Yes, there appears to be a positive, linear association between time spent studying and the score earned on the vocabulary test. In general, there is a steady increase of both time spent studying and score.
4. The fit of the line is good because most points are fairly close to the line.



5. The fit of the line is good because most points are fairly close to the line.



6. No linear association.
7. (sample) A slope of 1 means that, in general, as height increases by an inch so does wingspan. A y-intercept of close to 0 means that, if a person has no height, they also have no wingspan.
8. The rarity rating for a $12 figure should be around 28.
9. Arthur can expect to pay around $1,461.54 for new windows.

Part A Focus: 8.SP.A.1: Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

Why this is important for current grade level work:
In Algebra I, students will not only informally analyze the relationship between two variables using a scatter plot, but will model that relationship using linear equations when appropriate. In 8th grade, students constructed scatter plots and made informal generalizations about the relationships – work that directly precedes and supports the more formal work in Algebra I. Students should know vocabulary to describe what they are seeing and should be able to describe the relationship as having a positive or negative association. Students should be able to articulate a relationship between the two variables as suggested by the scatter plot. Then, when writing the equation for a line of best fit, they can make the connection to the value of the slope. In addition, students should recognize when the relationship does not appear to be linear.

Using the Diagnostic Assessment to identify gaps:

Problem 1:
Students should recognize immediately that there is a negative association – the y values are decreasing as x values increase. Students should be able to state this clearly. Students should also recognize that the data is not linear since there is a fairly dramatic decrease at first. Look for students who do not read the graph from left to right and cannot interpret the graph as giving information about the relationship between the two variables (labeled on the axes).

Problem 2:
Look for students who think the relationship is nonlinear due to the first point (60, 75) as this shows a gap in understanding of the effects of extreme data points.

Problem 3:
Similar to problem 2, look for students who think the relationship is nonlinear due to the point located around (5, 85) as this shows a gap in understanding of the effects of extreme data points.

Acceleration Resources for Targeted Instruction:

8th Grade, Module 6, Topic B, Lesson(s) 6 – 7

Use the Classwork portion of each Lesson and a sampling of problems from the Problem Set focused on conceptual understanding.

Part B Focus: 8.SP.A.2: Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

Why this is important for current grade level work:
Before students can write and use the equation for a line of best fit, they must be able to "eyeball" a line that shows the trend in the data. Students should be able to determine if a drawn line is a good fit by determining the closeness of the data points to that line, while ignoring an outlier, if necessary. In the target Topic, students will actually calculate the residuals to determine how close of a fit the line is. Students also must realize that the line is meant to show the trend, but once an equation is written, it can be used to predict future values based on new information. Therefore, students entering Algebra I should be able to determine if a set of data looks linear enough to draw a line. They will learn more about this in the Algebra I course.

Using the Diagnostic Assessment to identify gaps:

Problem 4:
Look for students who connect the points as this shows they do not realize that a line of fit is meant to show a general trend or relationship between the two variables. Students should make a good effort to draw a straight line through the middle of the data and should be able to say how closely their line fits the data by describing how many points are "far off" from the line.

Problem 5:
Look for students who draw a curved line, attempting to stay in the "middle" of the data points as they move left to right as this shows a gap in understanding around linear models.

Problem 6:
Because of the points at 0, 1, 2 and 3, some students may try to draw vertical lines or multiple lines. This shows they are not taking in the full picture of what the scatter plot is saying. They should also make sense of why those lines are appearing (many people have 0-3 siblings). Students should express that there is not a linear relationship shown.

Acceleration Resources for Targeted Instruction:

8th Grade, Module 6, Topic B, Lesson 8

Use the Classwork portion of the Lesson and a sampling of problems from the Problem Set focused on conceptual understanding.

Part C Focus: 8.SP.A.3: Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 c m/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*

Why this is important for current grade level work:
In 8th Grade students worked extensively with scatter plots, but did not formally write the equations for the lines of best fit. Students were able to discuss the association between the variables, if there was one and determine if the association was linear or not. In the target Topic, students will write an equation for the line of best fit, as well as use it with new values. Their precision with this work depends on a deep understanding of a scatter plot as a representation of a potential association between two variables. Each point in a scatter plot is "an instance" of what is being measured, but together the set of data can reveal a trend. The slope of the trend line, therefore, can show how the variables are changing in relation to one another. In order to make sense of the equation and use it properly, students need to have a firm grasp on what the slope and y-intercept say about the relationship shown in a scatter plot.

Using the Diagnostic Assessment to identify gaps:

Problem 7:
Interpreting slope and y-intercept in terms of the data can be challenging. Look for students who only answer with numerical answers or refer to the mathematical meaning of slope but not the context of this situation. For example, some students may say, "A slope of 1 means up 1, over 1." Students may also struggle since the slope is a whole number. Look for students who switch the order of the wording.

Problem 8:
Look for students who perform the correct calculations but fail to interpret their numerical answer in the context of the data. Algebraic skills are not enough to prepare students for the new learning of the target Topic.

Problem 9:
Look for students who incorrectly substitute the given value, thinking they were given the input as opposed to the output. Again, algebraic skills are not enough to prepare students for the new learning of the target Topic. Students must be able to understand and use the context of the data to guide their thinking.

Acceleration Resources for Targeted Instruction:

8th Grade, Module 6, Topic C, Lesson(s) 9 – 11

Use the Classwork portion of each Lesson and a sampling of problems from the Problem Set focused on conceptual understanding and/or application.