New Mexico Instructional Scope

Algebra 1 Interpreting Categorical and Quantitative Data Guide

The purpose of this tool is to help educators understand each of the grade level standards and how those standards connect to the students' overall preparation for college and career readiness.

The NMIS is a teacher-influenced tool, designed to provide instructional planning support at the programmatic level for districts and instructional level for teachers. Its foundation stems from the vision and mission of the PED and came into existence to assure that students in NM will be engaged in a culturally and linguistically responsive educational system that meets the social, emotional, and academic needs of ALL students. This is also rooted in the belief that all students must have access to on-grade-level standards, focusing on acceleration. The purpose of this tool is to help educators understand each of the grade level standards and how those standards connect to the students' overall preparation for college and career readiness.

Standards are defined as the most critical prerequisite skills and knowledge. This document is color-coded to reflect both anchor and priority standards. Though previous emphasis was placed on priority standards to address lost learning due to COVID-19, New Mexico teachers should note that moving forward, while priority standards allow for acceleration of learning, all standards should be addressed in instruction throughout the school year.

In this guide you will find:

- A breakdown of each of the grade level standards within the cluster, including:
  - Standards of Mathematical Practice
  - Common Misconceptions
  - Identification of Priority Standards, as identified by NMPED.
  - Level of Rigor Identification
- Sample aligned assessment items
- Suggested Student Discourse Guide
- A multilayered system of supports (MLSS) and culturally and linguistically responsive instruction (CLR) guide

New Mexico Instructional Scope

Algebra 1 Interpreting Categorical and Quantitative Data Guide

Key		
	Priority Standard	Priority standards, as identified by NMPED, are denoted with red highlighting. Priority standards are the most critical prerequisite skills and knowledge a student needs. This does not mean that these are only standards required to be taught, just these are the standards that will allow for the acceleration the students of New Mexico need during this time.
	*Conceptual Understanding*	Conceptual Understanding standards help students build a deep understanding of the **how** and **why** of mathematics.
	*Application*	Application standards help students identify the appropriate concepts and skills to tackle **novel real-world problems.**
	*Procedural Skill and Fluency*	Procedural standards help students develop **efficiency** and **accuracy** in computations.

Standards Breakdown

- Summarize, represent, and interpret data on a single count or measurement variable
  - HSS.ID. A.1
  - HSS.ID. A.2
  - HSS.ID. A.3
- Summarize, represent, and interpret data on two categorical and quantitative variables
  - HSS.ID.B.5
  - HSS.ID.B.6
- Interpret linear models
  - HSS.ID.C.7
  - HSS.ID.C.8
  - HSS.ID.C.9

New Mexico Instructional Scope

Algebra 1 Interpreting Categorical and Quantitative Data Guide

Grade	*CCSS Domain*	*CCSS Cluster*
A1	**Interpreting Categorical & Quantitative Data**	**Summarize, represent, and interpret data on a single count or measurement variable**

Cluster Standard: HSS.ID. A.1

Standard	Standards for Mathematical Practice
Represent data with plots on the real number line (dot plots, histograms, and box plots).	• **SMP 1:** Make sense of problems and persevere in solving them. • **SMP 3:** Construct viable arguments and critique the reasoning of others.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students should not only be able to construct each of these plot types but be able to do so in a way that shows the data in a meaningful way considering things like spread and center. For example, making bins of appropriate width when making a histogram or appropriate spacing on a number line for a dot plot or a box plot. Students should know that a dot plot is a diagram that represents a data set using dots over the number line. A histogram is a diagram that shows a data set as a series of rectangles that shows how often data occur within a given interval. A box plot, also called a box and whisker plot, is a diagram that shows a data set as a distribution along the number line, divided into four equal parts using the median (the middle data value) and the upper and lower quartiles (median of upper and lower half of data, respectively).	• Summarize data using a dot plot. • Summarize data using a histogram. • Summarize data using a box plot. • Know when each of these is appropriate to be used
DOK	**Blooms**
1-2	Understand, Apply, Analyze

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Algebra 1 Interpreting Categorical and Quantitative Data Guide

Grade	*CCSS Domain*	*CCSS Cluster*
A1	**Interpreting Categorical & Quantitative Data**	**Summarize, represent, and interpret data on a single count or measurement variable**

Cluster Standard: HSS.ID.A.2

Standard	Standards for Mathematical Practice
Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.	• **SMP 2:** Reason abstractly and quantitatively. • **SMP 3:** Construct viable arguments and critique the reasoning of others.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students should use statistics appropriately to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. Students should know that the center of data can give us a good sense of the data set overall. The center of the data is exactly what it sounds like: a representation of the middle of the data, or a typical value. It gives us a good first guess as to where on the number line the data will fall. Students should know the two types of centers of data: mean and median. The mean, or average, is the sum of all the data points divided by the number of data points, while the median is the value that splits the data into two intervals.	• Calculate the median, mean, interquartile range, and standard deviation of a set of data. • Identify and describe differences in two sets of data based on these calculations. • Identify and describe the shape of a set of data (skewness, symmetric, bimodal, normal).
DOK	**Blooms**
1-2	Understand, Apply, Analyze

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Algebra 1 Interpreting Categorical and Quantitative Data Guide

Grade	*CCSS Domain*	*CCSS Cluster*
A1	**Interpreting Categorical & Quantitative Data**	**Summarize, represent, and interpret data on a single count or measurement variable**

Cluster Standard: HSS.ID.A.3

Standard	Standards for Mathematical Practice
Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	• **SMP 2:** Reason abstractly and quantitatively. • **SMP 6:** Attend to precision.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students understand and use the context of the data to explain why its distribution takes on a shape (e.g., Is the data skewed? Are there outliers?). Students understand that the higher the value of a measure of variability, the more spread out the data set is. Measures of variability are range (100% of data), standard deviation (68-95-99.7% of data), and interquartile range (50% of data). Students explain the effect of any outliers on the shape, center, and spread of the data sets.	• Describe how the presence or removal of an outlier changes the shape, center and spread of a data set. • Explain why some data sets will tend towards skewness (e.g., tests scores with an upper limit that students do well on tend to be left skewed while heights tend to be more normally distributed). • Recognize that the shape of the data is usually connected to the relative positions of the mean and median (e.g., left skewed data has a mean that is lower than the median).
DOK	**Blooms**
1-2	Understand, Apply, Analyze

Common Misconceptions

- Students may forget to arrange the data in numerical order before finding key numbers needed for creating a box plot.
- When doing normal distribution calculations, students often report the area to the left of a boundary when they are asked about the area to the right of the boundary.

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Algebra 1 Interpreting Categorical and Quantitative Data Guide

Grade	*CCSS Domain*	*CCSS Cluster*
A1	**Interpreting Categorical & Quantitative Data**	**Summarize, represent, and interpret data on two categorical and quantitative variables**

Cluster Standard: HSS.ID.B.5

Standard	Standards for Mathematical Practice
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.	• **SMP 2:** Reason abstractly and quantitatively. • **SMP 6:** Attend to precision.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
	• Summarize data by creating a two-way frequency table for two categories of data. • Calculate relative frequencies in the context of data. • Identify and describe correlations in relative frequencies that could signify possible causation.
DOK	**Blooms**
1-2	Understand, Apply, Analyze

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Algebra 1 Interpreting Categorical and Quantitative Data Guide

Grade	*CCSS Domain*	*CCSS Cluster*
A1	**Interpreting Categorical & Quantitative Data**	**Summarize, represent, and interpret data on two categorical and quantitative variables**

Cluster Standard: HSS.ID.B.6

Standard	Standards for Mathematical Practice
Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. • 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. • HSS.ID.B.6.B: Informally assess the fit of a function by plotting and analyzing residuals. • HSS.ID. B.6.C: Fit a linear function for a scatter plot that suggests a linear association.	• **SMP 4:** Model with mathematics. • **SMP 5:** Use appropriate tools strategically.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students represent data on two quantitative variables on a scatter plot, and describe how the variables are related. Students will 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. (Emphasis is on linear and quadratic models.) Students will also informally assess the fit of a function by plotting and analyzing residuals and fit a linear function for a scatter plot that suggests a linear association.	• Summarize data by creating a scatter plot for two quantitative variables. • Identify and describe how these two variables are related (e.g., positive, negative or no correlation). • Explain how strongly or negatively correlated two variables are. • Determine what type of curve is most appropriate to represent a given set of data. • Create a residual graph. • Determine if a curve is an appropriate model based on the residual graph. • Estimate a line of best fit for a scatterplot of data that is linearly related.

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Algebra 1 Interpreting Categorical and Quantitative Data Guide

DOK	Blooms
1-2	Understand, Apply, Analyze

Common Misconceptions

- Students may not consider outliers when analyzing data and determining the best fit of a function.
- Students often have difficulty separating causation and association with contextual data sets.

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Algebra 1 Interpreting Categorical and Quantitative Data Guide

Grade	*CCSS Domain*	*CCSS Cluster*
A1	**Interpreting Categorical & Quantitative Data**	**Interpret linear models**

Cluster Standard: HSS.ID.C.7

Standard	**Standards for Mathematical Practice**
Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	• **SMP 2:** Reason abstractly and quantitatively. • **SMP 7:** Look for and make use of structure.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students interpret the slope (rate of change) and the *y*-intercept (constant term) of a linear model in the context of the data. Students may use graphing calculators or software to create representations of data sets, create linear models, and to assist them in interpreting the data. Students should know that all linear models take the form $y = mx + b$ where m is the slope and b is the *y*-intercept.	• Explain the slope and intercept of a linear model in the context of data from a visual model. • Explain the slope and intercept of a linear model in the context of data from written notation.
DOK	**Blooms**
1-2	Understand, Apply, Analyze

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Algebra 1 Interpreting Categorical and Quantitative Data Guide

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Grade	*CCSS Domain*	*CCSS Cluster*
A1	**Interpreting Categorical & Quantitative Data**	**Interpret linear models**

Cluster Standard: HSS.ID.C.8

Standard	**Standards for Mathematical Practice**
Compute (using technology) and interpret the correlation coefficient of a linear fit.	• **SMP 2:** Reason abstractly and quantitatively. • **SMP 5:** Use appropriate tools strategically.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students should compute (using technology) and interpret the correlation coefficient of a linear fit and use it to understand the strength of a linear relationship. Students should match the correlation coefficient to its appropriate scatter plot and linear model. Students should use the correlation coefficient to determine the goodness of fit for a linear model. Students should know that it has the symbol *r* and that it ranges from -1 to 1. A coefficient equal to 1.0 suggests a positive correlation between the data. This means that as the independent variable (*x*) increases so does the dependent variable (*y*). A correlation coefficient equal to -1.0 suggests a negative correlation between the data, or as the independent variable (*x*) increases, the dependent variable decreases. If the coefficient equals 0, there is no linear correlation. However, just because the linear correlation coefficient equals 0 doesn't mean there is not another type of correlation between the data. Students should also know that in addition to being positive or negative, the correlation coefficient can be weak or strong. The closer the correlation is to -1 or	• Find the correlation coefficient using technology. • Describe the meaning of the correlation coefficient of a given set of data in the context of the problem

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1, the stronger the correlation.	
DOK	**Blooms**
1-2	Understand, Apply, Analyze

Grade	*CCSS Domain*	*CCSS Cluster*
A1	**Interpreting Categorical & Quantitative Data**	**Interpret linear models**

Cluster Standard: HSS.ID.C.9

Standard	**Standards for Mathematical Practice**
Distinguish between correlation and causation.	• **SMP 2:** Reason abstractly and quantitatively. • **SMP 3:** Construct viable arguments and critique the reasoning of others.
Clarification Statement	**Students Who Demonstrate Understanding Can...**
• Students should be able to do more than just give the definition of correlation and causation. This should be developed as a skill of critical thinking where students are expected to first look at every set of data to determine if it is appropriate to be making comparisons between them. Students need to remember that correlation does not imply causation. For example, let's say we find that there's a strong positive linear correlation between the age of a tree and how many apples it produces. In fact, this correlation is so strong that $r = 0.99$. Does that mean the age of the tree causes more apples to grow? Can there be other factors? (e.g., What about rainfall? Did the farmer use fertilizer? Did he prune the trees? What were the summer and winter temperatures? Any one	• Explain the difference between correlation and causation. • Give examples of variables that are correlated, but have no logical causal connection (e.g., number of bee stings and ice cream sales both go up in the summer but there isn't a causal link between the two). • Give examples of variables that have both correlation and a high likelihood of causation (e.g., the amount of time spent studying for an exam and the score on the exam). • Give examples of variables that are neither correlated nor have a causal link (e.g., the number of shoes you own and how many students are in your third period class).

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of these factors may have influenced the number of apples.)	
DOK	**Blooms**
1-2	Understand, Apply, Analyze

Common Misconceptions

- Students do not always know that slope, rate of change, and steepness are interchangeable.
- Students may try to determine the appropriateness of a line of best fit based only on the value of *r*.

Student Discourse Guide

- **Purposeful, rich classroom discourse offers students the opportunity to express their ideas, thinking, and to critique the reasoning of others in a variety of ways (writing, drawing, verbal). Purposeful implementation of classroom discourse allows students to activate funds of knowledge and to refine their mathematical understanding. When students have frequent opportunities for discourse they find various paths to solutions and reveal knowledge or misunderstandings to educators. The process also allows educators to honor students' culture, lived experiences and evolving math identities.**
- **Discourse that focuses on tasks that promote reasoning and problem solving is a primary mechanism for developing conceptual understanding and meaningful learning of mathematics (Michaels, O'Connor, and Resnick, 2008)**

Domain: **Interpreting Categorical & Quantitative Data**	Strand: **Summarize, represent, and interpret data on a single count or measurement variable**

Suggested Student Discourse Questions

• In what ways do _____ (mean, median, compare with (interquartile range, standard distribution) ? • Turn and talk - which strategy to identify	• How can a graph be used to identify outliers in the data? A table of values? An equation? How are these strategies similar? How do they differ?

outliers in the data works best for you? Which one works best for your partner?	• Identify the outliers in this data (population over time, home runs in a season, cost of milk vs cost of gas over time, childcare cost vs region of NM, rainfall in different NM regions). What would be an explanation of why the outlier(s) occur? Do you agree or disagree with your peers' explanations?

Domain: **Interpreting Categorical & Quantitative Data**	Strand: **Summarize, represent, and interpret data on two categorical and quantitative variables**
Suggested Student Discourse Questions	
• How does the residual data give you information on the line of best fit? • How is your line of best fit different from your partner's? How is it the same? Which line of best fit best represents the data? Why?	• Which strategy (graph, equation, table of values) is the most effective way to display the data? • How would you use this scatter plot (hours of sleep needed vs age, a person's weight vs their height, time spent working out vs performance on the field, hours spent at work vs money in the bank, age started vaping vs life expectancy) to make personal choices for your own life?

Domain: **Interpreting Categorical & Quantitative Data**	Strand: **Interpret linear models**
Suggested Student Discourse Questions	
• How is _____(rate of change, intercept, correlation coefficient, line of best fit) of the data modeled on this graph? • Turn and talk. Which technology (Desmos or graphing calculator) is most efficient for you to find the correlation coefficient? How is this different from your partner's strategy?	• How can you determine graphically, algebraically, and using a table, the slope (rate of change) of the line of best fit? Which strategy works best for you? • What are some examples of when there is a correlation between two sets of data, but not necessarily a causation between the two

	sets?

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Algebra 1 Interpreting Categorical and Quantitative Data Guide

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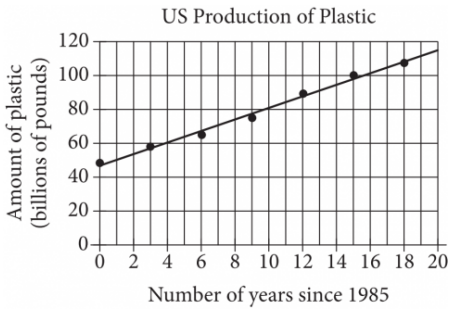
ASSESSMENT GUIDE

- Summarize, represent, and interpret data on a single count or measurement variable
- Summarize, represent, and interpret data on two categorical and quantitative variables
- Interpret linear models

Grade	*CCSS Domain*	*CCSS Strand*
A1	**Interpreting Categorical & Quantitative Data**	**Summarize, represent, and interpret data on a single count or measurement variable**

Sample Task #1 (Constructed Response)

Between 1985 and 2003, data were collected every three years on the amount of plastic produced annually in the United States, in billions of pounds. The graph below shows the data and a line of best fit. The equation of the line of best fit is $y = 3.39x + 46.89$, where x is the number of years since 1985 and y is the amount of plastic produced annually, in billions of pounds.



What is the best interpretation of the number 3.39 in the context of the problem?

***Convert to Constructed Response**

Rationale

Choice D is correct. The number 3.39 in the equation $y = 3.39x + 46.89$ is the slope, which is the change in y per unit change in x. Because y represents the amount of plastic produced annually, in billions of pounds, and x represents the number of years since 1985, the number 3.39 represents the rate of change of the amount of plastic produced with respect to time, in units of billions of pounds per year. The change is an

increase since 3.39 is positive, and it is described as an average change because the data show increases that are sometimes more and sometimes less than 3.39.

Choice A is incorrect. It is the interpretation of the number 46.89 in the line of best fit equation, $y = 3.39x + 46.89$. Choices B and C are incorrect because they are expressed in the wrong units. The number 3.39 has units of billions of pounds per year, but choice B has units of years and choice C has units of billions of pounds.

SAT, #1474174

Sample Task #2 (Multiple Choice)

Kathy is a repair technician for a phone company. Each week, she receives a batch of phones that need repairs. The number of phones that she has left to fix at the end of each day can be estimated with the equation $P = 108 - 23d$, where P is the number of phones left and d is the number of days she has worked that week. What is the meaning of the value 108 in this equation?

A. Kathy will complete the repairs within 108 days.
B. Kathy starts each week with 108 phones to fix.
C. Kathy repairs phones at a rate of 108 per hour.
D. Kathy repairs phones at a rate of 108 per day

Rationale

Choice B is correct. The value 108 in the equation is the value of $P = 108 - 23d$ when $d = 0$. When $d = 0$ Kathy has worked 0 days that week. In other words, 108 is the number of phones left before Kathy has started work for the week. Therefore, the meaning of the value 108 in the equation is that Kathy starts each week with 108 phones to fix.

Choice A is incorrect because Kathy will complete the repairs when $P = 0$. Since $P = 108 - 23d$, this will occur when $0 = 108 - 23d$ or when $d = \frac{108}{23}$, not when $d = 108$. Therefore, the value 108 in the equation does not represent the number of days it will take Kathy to complete the repairs. Choices C and D

	are incorrect because the number 23 in $P = 108 - 23d$ indicates that the number of phones left will decrease by 23 for each increase in the value of d by 1; in other words, Kathy is repairing phones at a rate of 23 per day, not 108 per hour (choice C) or 108 per day (choice D). SAT, #19106

Grade	*CCSS Domain*	*CCSS Strand*
A1	**Interpreting Categorical & Quantitative Data**	**Summarize, represent, and interpret data on two categorical and quantitative variables**
	Sample Task #1 (Constructed Response)	

Several students at Rufus King High School were debating whether males or females were more involved in after-school activities. There are three organized activities in the after-school program—intramural basketball, chess club, and jazz band. Due to budget constraints, a student can only select one of these activities. The students were not able to ask every student in the school whether they participated in the after-school program or what activity they selected if they were involved.

1. Write questions that could be included in the survey to investigate the question the students are debating. Questions that could be used for this study include the following:

2. Rufus King High School has approximately 1,500 students. Sam suggested that the first 100 students entering the cafeteria for lunch would provide a random sample to analyze. Janet suggested that they pick 100 students based on a school identification number. Who has a better strategy for selecting a random sample? How do you think 100 students could be randomly selected to complete the survey?

3. Consider the following results from 100 randomly selected students:
   - Of the 60 female students selected, 20 of them played intramural basketball, 10 played chess, and 10 were in the jazz bland. The rest of them did not participate in the after-school program.
   - Of the male students, 10 did not participate in the after-school program, 20 played intramural basketball, 8 played in the jazz band, and the rest played chess.

   A two-way frequency table to summarize the survey data was started. Indicate what label is needed in the table cell identified with a ???.

	Intramural Basketball	Chess Club	Jazz Band	???	Total
Female					
Male					
Total					

4. Complete the above table for the 100 students who were surveyed.

5. The table shows the responses to the after-school activity question for males and females. Do you think there is a difference in the responses of males and females? Explain your answer.

Engage NY - Algebra 1
Module 2, Student, Lesson #9

Sample Task #2 (Multiple Choice)

	To Fly	Freeze Time	Invisibility	Super Strength	Telepathy	Total
Females	49	60	48	1	70	228
Males	51	71	27	25	48	222
Total	100	131	75	26	118	450

Use the frequency counts from the above table to calculate the missing row of conditional relative frequencies. Round the answers to the nearest thousandth.

	To Fly	Freeze Time	Invisibility	Super Strength	Telepathy	Total
Females			$\frac{48}{228} \approx 0.211$			
Males	$\frac{51}{222} \approx 0.230$					$\frac{222}{222} = 1.000$
Total						

Suppose that a student is selected at random from those who completed the survey. If the selected student

	is female, what do you think was her response to the selection of a favorite superpower? ***Convert to Multiple-Choice** Engage NY- Algebra 1 Module 2, Student, Lesson 11

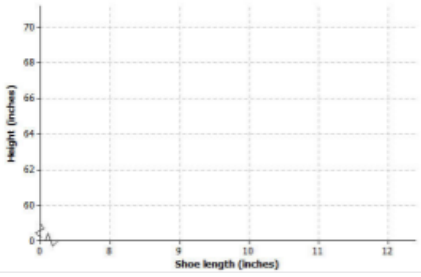
Grade	*CCSS Domain*	*CCSS Strand*
A1	**Interpreting Categorical & Quantitative Data**	**Interpret linear models**

Sample Task #1 (Constructed Response)

Kendra wondered if the relationship between shoe length and height might be different for men and women. To investigate, she also collected data on shoe length (in inches) and height (in inches) for 12 women.

x (Shoe Length of Women)	y (Height of Women)
8.9	61
9.6	61
9.8	66
10.0	64
10.2	64
10.4	65
10.6	65
10.6	67
10.5	66
10.8	67
11.0	67
11.8	70

1. Construct a scatter plot of these data.
2. Is there a relationship between shoe length and height for these 12 women?
3. Find the equation of the least squares line. (Round values to the nearest hundredth.)



Sample Task #2 (Multiple Choice)

Which of the three scatter plots below shows the strongest linear relationship? Which shows the weakest linear relationship?

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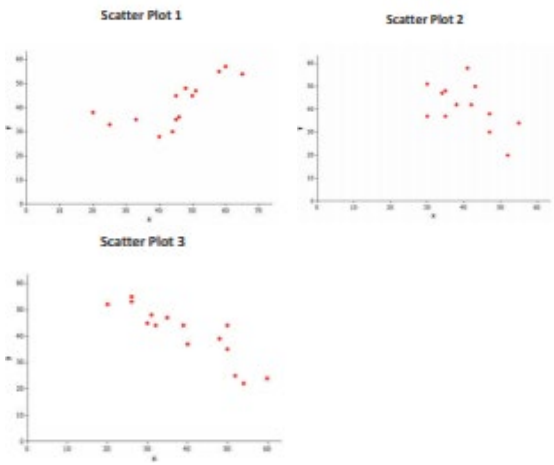

***Convert to Multiple-Choice**
Engage NY- Algebra 1
Module 2, Student, Lesson 20

MLSS AND CLR GUIDE

- Summarize, represent, and interpret data on a single count or measurement variable
- Summarize, represent, and interpret data on two categorical and quantitative variables
- Interpret linear models

CCSS Domain	*CCSS Cluster*
Interpreting Categorical and Quantitative Data	**Summarize, represent, and interpret data on a single count or measurement variable**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on summarizing, representing and interpreting data in a single variable, consider options for learning from your families and communities the cultural and linguistic ways mathematics exists outside of school to create stronger home to school connections for students. For example, using data that is relevant to the community and the summary of the data provides useful information to students regarding their families, culture and community.

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Cross-Curricular Connections	Social Studies: In high school the New Mexico Social Studies Standards state students should "explain how to use technological tools to research data, verify facts and information, and communicate findings." Consider providing a connection for students to write a report describing and analyzing a specific set of data.	
Validate/Affirm/Build/Bridge	• *How can you design your mathematics classroom to intentionally and purposefully legitimize the home culture and languages of students and reverse the negative stereotypes regarding the mathematical abilities of students of marginalized cultures and languages?* • *How can you create connections between the cultural and linguistic behaviors of your students' home culture and language, the culture and language of school mathematics to support students in creating mathematical identities as capable mathematicians that can use mathematics within school and society?*	• Posing Purposeful Questions: CLRI requires intentional planning around the questions posed in a mathematics classroom. It is critical to consider "who is being positioned as competent, and whose ideas are featured and privileged" within the classroom through both the types of questioning and who is being questioned. Mathematics classrooms traditionally ask short answer questions and reward students that can respond quickly and correctly. When questioning seeks to understand students' thinking by taking their ideas seriously and asking the community to build upon one another's ideas a greater sense of belonging in mathematics is created for students from marginalized cultures and languages. For example, when studying data on a single variable the pattern of questions within the classroom is critical because teachers use open-ended questions to scaffold the information that students can summarize and interpret from the data set. Students explore different perspectives of interpreting the data and its implication.

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	*Current Learning*	*Future Learning*

• Connect to plotting points on a coordinate grid. **(5.G.1-2)** • Connect to plotting data on dot plots and boxplot. **(6.SP.4)** • Connect to describe center and spread in a data distribution. **(6.SP.5)**	• Connect to how outliers can affect data and skew data. • Connect to classroom test scores or heights of students (something relevant to them)	• Connect to using a standard deviation to make conclusions about a set of data. **(HSS.IS.4)** • Investigate normal distributions within a context. **(HSS.IS.4)** • Calculate confidence intervals based on a normal curve, mean and standard deviation. **(HSS.IC.4)**

Suggested Instructional Strategies

Pre-Teach

Level of Intensity	***Essential Question***	***Examples***
Targeted	*What pre-teaching will prepare students to productively struggle with the mathematics for this cluster within your HQIM?*	Some learners may benefit from targeted pre-teaching that focuses on the center, spread and overall shape of the data sets because students need to understand the conceptual knowledge of center and spread in the context of the problems. Students need to interpret the information numerically and graphically.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	6.SP.A.2 and 6.SP.B.5: This standard provides a foundation for work with interpreting the center and spread of the data sets because students use their prior knowledge to compare the center and spread of different data sets and make implication in the context of the problems. If students have unfinished learning within this standard, based on assessment data, consider ways to provide intensive pre-teaching support prior to the start of the unit to ensure students are ready to access grade level instruction and assignments.

Universal Support Framework

		Potential Scaffolds

• How to choose the appropriate plot, given a set of data, based on what one wants to take away from the data.
• Symmetric data is best described by mean and standard deviation and non-symmetric data is best described by the median and interquartile range.
• How to find an outlier, what it represents in a data set, and how it affects the mean in a data set.
	• Plot data using dot plots, histograms, and box plots by hand and using technology.
	• Describe data sets in terms of shape, center, and spread.
	• Interpret the shape, center, and spread of a data set in the context of a situation.
	• Explain the impact of an outlier on the shape, center, and spread of a data set.
		• Build on students' experience with the following skills:
		  ○ Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation) (6.SP.B.5.C)
		  ○ Graphing points on the coordinate plane (6.NS.C.8)
		  ○ Construct and interpret data plot (8.SP.A.1)
		  ○ Construct a function to model a linear relationship (8.F.B.4)
		  ○ Understanding, constructing, interpreting and using patterns of association in bivariate categorical data by displaying frequencies in a two-way table. (8.SP.A.4)
		• Cognitive Strategies
		  ○ Repeatedly model the strategies
		  ○ Monitor the students' use of the strategies
		  ○ Provide feedback to students
		  ○ Teach self-questioning and self-monitoring strategies
		  ○ Introduce multiple means of representation for mathematical ideas
		• Encourage students to use alternative tools to better access the grade level content. Examples include:
		  ○ Desmos.com
		  ○ Graphing calculator
		  ○ Sketch a graph
		  ○ Create a table of values
		  ○ Graphic organizers

Re-Teach		
Level of Intensity	***Essential Question***	***Examples***

Targeted	What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisited during a unit?	For example, students may benefit from re-engaging with content during a unit on interpretation of the center and the spread of the data sets by clarifying mathematical ideas and/or concepts through a short mini-lesson because students use different measures of center and spread to explain the meaning of center and spread in the context of the data set. Students use the interpretation of center and spread to compare two different data sets.
Intensive	What assessment data will help identify content needing to be revisited for intensive interventions?	For example, some students may benefit from intensive extra time during and after a unit interpreting the center and spread of the data sets graphically and numerically by addressing conceptual understanding because students need to interpret the center and spread of the data sets graphically and numerically. Students interpret and compare the center and spread of 2 data sets graphically.

Extension	
Essential Question	***Examples***
What type of extension will offer additional challenges to 'broaden' your student's knowledge of the mathematics developed within your HQIM?	Some learners may benefit from an extension such as the application of and development of abstract thinking skills when interpreting and predicting shape, center and spread of data sets. Students may justify possible bias of the sampling method by comparing the shape, center and spread of the data.

CCSS Domain	*CCSS Cluster*
Interpreting Categorical and Quantitative Data	**Summarize, represent, and interpret data on two categorical and quantitative variables**

Culturally and Linguistically Responsive Instruction

NEW MEXICO
Public Education Department

New Mexico Instructional Scope

Algebra 1 Interpreting Categorical and Quantitative Data Guide

Relevance to Families and Communities	During a unit focused on summarizing, representing and interpreting data on two variables, consider options for learning from your families and communities the cultural and linguistic ways mathematics exists outside of school to create stronger home to school connections for students. For example, using data that is relevant to the community and the summary of the data provides useful information to students regarding their families, culture and community.	
Cross-Curricular Connections	Social Studies: In high school the New Mexico Social Studies Standards state students should "explain how to use technological tools to research data, verify facts and information, and communicate findings." Consider providing a connection for students to determine the best fit of a function for a set of data and explain their choice.	
Validate/Affirm/Build/Bridge	• *How can you design your mathematics classroom to intentionally and purposefully legitimize the home culture and languages of students and reverse the negative stereotypes regarding the mathematical abilities of students of marginalized cultures and languages?* • *How can you create connections between the cultural and linguistic behaviors of your students' home culture and language, the culture and language of school mathematics to support students in creating mathematical identities as capable mathematicians that can use mathematics within school and society?*	• Supporting Productive Struggle in Learning Mathematics: The standard for mathematical practice, make sense of mathematics and persevere in solving them, is the foundation for supporting productive struggle in the mathematics classroom. "Too frequently, historically marginalized students are overrepresented in classes that focus on memorizing and practicing procedures and rarely provide opportunities for students to think and figure things out for themselves. When students in these classes struggle, the teacher often tells them what to do without building their capacity for persistence." Teachers need to provide tasks that challenge students and maintain that challenge while encouraging them to persist. This encouragement or "warm-demander" requires a strong relationship with students and an understanding of the culture of the students. For example, when studying data on two variables supporting productive struggle is critical because students may explore multiple ways of representing and interpreting two variable data sets. Students explore different functions to model the data set and defend their choice. When the function is not the best fit for the domain, students need to develop flexible solutions and define underlying assumptions about the math model used.

New Mexico Instructional Scope

Algebra 1 Interpreting Categorical and Quantitative Data Guide

NEW MEXICO Public Education Department

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	*Current Learning*	*Future Learning*
• Connect to constructing and interpreting two-way tables using frequencies and relative frequencies. **(8.SP.4)** • Connect to using relative frequencies to describe a possible association between two variables. **(8.SP.4)** • Connect to constructing and interpreting scatterplots. **(8.SP.1)** • Connect to constructing an equation or a function to model a linear relationship and determine/interpret the slope and *y*-intercept. **(8.F.4)**	• Connect to writing functions for linear, quadratic, and exponential representations. **(HSA.CED.1-3)** • Connect to identifying representations as linear, quadratic and exponential models. **(HSF.B.4)** • Connect to constructing and comparing linear and exponential functions to solve problems. **(HSF.LE.1)**	• Connect to constructing and interpreting two-way frequency tables to determine independence. **(HSS.CP.4)** • Connect to constructing and interpreting two-way frequency tables to calculate conditional probabilities. **(HSS.CP.4)**

Suggested Instructional Strategies

Pre-Teach

Level of Intensity	*Essential Question*	*Examples*
Targeted	*What pre-teaching will prepare students to productively struggle with the mathematics for this cluster within your HQIM?*	Some learners may benefit from targeted pre-teaching that describes possible associations between bi-variate data. Students may benefit from a mini-lesson on the types of outcomes and examples of data (hot chocolate sales and temperature). Students may also benefit from a mini lesson on how to construct and analyze a two-way frequency table and how the frequency table can help determine possible associations.
Intensive	*What critical understandings will*	8.SP.4 provides a foundation for work with understanding patterns of association of bivariate data

	prepare students to access the mathematics for this cluster?	by displaying frequencies and relative frequencies in a two-way table. If students have unfinished learning with this standard, providing opportunities for students to analyze and discuss possible associations will provide them with the opportunity for on grade level learning. Also discussing the difference between causation and correlation will benefit students before attempting grade level work for this standard.
Universal Support Framework		
		Potential Scaffolds
• How to choose the appropriate plot, given a set of data, based on what one wants to take away from the data. • Symmetric data is best described by mean and standard deviation and non-symmetric data is best described by the median and interquartile range. • How to find an outlier, what it represents in a data set, and how it affects the mean in a data set.	• Plot data using dot plots, histograms, and box plots by hand and using technology. • Describe data sets in terms of shape, center, and spread. • Interpret the shape, center, and spread of a data set in the context of a situation. • Explain the impact of an outlier on the shape, center, and spread of a data set.	• Build on students' experience with the following skills: ○ Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation) (6.SP.B.5.C) ○ Graphing points on the coordinate plane (6.NS.C.8) ○ Construct and interpret data plot (8.SP.A.1) ○ Construct a function to model a linear relationship (8.F.B.4) ○ Understanding, constructing, interpreting and using patterns of association in bivariate categorical data by displaying frequencies in a two-way table. (8.SP.A.4) • Cognitive Strategies ○ Repeatedly model the strategies ○ Monitor the students' use of the strategies ○ Provide feedback to students ○ Teach self-questioning and self-monitoring strategies ○ Introduce multiple means of representation for mathematical ideas • Encourage students to use alternative tools to better access the grade level content. Examples

NEW MEXICO
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		include: ○ Desmos.com ○ Graphing calculator ○ Sketch a graph ○ Create a table of values ○ Graphic organizers
Re-Teach		
Level of Intensity	***Essential Question***	***Examples***
Targeted	What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisited during a unit?	For example, students may benefit from re-engaging with content during a unit on modeling the relation of the 2 variables with the appropriate mathematical model by revisiting student thinking through a short mini-lesson because students need to explain the features of the data sets or the graphs/plots. Students connect those features to the features of different functions.
Intensive	What assessment data will help identify content needing to be revisited for intensive interventions?	For example, some students may benefit from intensive extra time during and after a unit choosing the appropriate functions to model the 2 quantitative variables of the data by confronting student misconceptions because students need to use the functions model to make prediction and implication of the data. Students need to justify if the prediction and the implication make sense in the context of the data.
Extension		
Essential Question		***Examples***
What type of extension will offer additional challenges to 'broaden' your student's knowledge of the mathematics developed within your HQIM?		Some learners may benefit from an extension when representing the data with a function model because students explain the interval(s) when the function model fits the scatter plot. Students describe the possible situation when the function model does not fit the scatter plot and possible explanation.

New Mexico Instructional Scope

Algebra 1 Interpreting Categorical and Quantitative Data Guide

New Mexico Instructional Scope

Algebra 1 Interpreting Categorical and Quantitative Data Guide

CCSS Domain	*CCSS Cluster*
Interpreting Categorical and Quantitative Data	**Interpret linear models**

Culturally and Linguistically Responsive Instruction

Relevance to Families and Communities	During a unit focused on interpreting linear models of the data, consider options for learning from your families and communities the cultural and linguistic ways mathematics exists outside of school to create stronger home to school connections for students. For example, relate the mathematical models used to real-life data to interpret and predict the trend of data in order to provide useful information for decision-making in the community.	
Cross-Curricular Connections	Science: In high school the NMSS state students should "use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales." Consider providing a connection where students must analyze data and consider the relationship among various factors including boundaries, resources, climate, and competition. https://www.nextgenscience.org/topic-arrangement/hsinterdependent-relationships-ecosystems	
Validate/Affirm/Build/Bridge	• *How can you design your mathematics classroom to intentionally and purposefully legitimize the home culture and languages of students and reverse the negative stereotypes regarding the mathematical abilities of students of marginalized cultures and languages?* • *How can you create connections between the cultural and linguistic behaviors of your students' home*	• Facilitating Meaningful Mathematical Discourse: Mathematics discourse requires intentional planning to ensure all students feel comfortable to share, consider, build upon and critique the mathematical ideas under consideration. When student ideas serve as the basis for discussion, we position them as knowers and doers of mathematics. Using equitable talk moves students and the ways students talk about who is and isn't capable of mathematics. As a result, we can disrupt the negative images and stereotypes around mathematics of marginalized cultures and languages. "A discourse-based mathematics classroom provides stronger access for every student — those who have an immediate answer or approach to share, those who have begun to formulate a mathematical approach to a task but have not fully developed their thoughts, and those who may not have an approach but can provide feedback to others." For example, when interpreting

	culture and language, the culture and language of school mathematics to support students in creating mathematical identities as capable mathematicians that can use mathematics within school and society?	linear models for data, facilitating meaningful mathematical discourse is critical because students might use different linear models to represent the data sets. Students interpret and summarize the data differently using their linear models. Students compare the conclusion and defend the solution by constructing viable arguments.

Planning for Multi-Layered System of Supports

Vertical Alignment

Previous Learning	*Current Learning*	*Future Learning*
• Connect to plotting points in a coordinate grid and constructing an equation or a function to model the linear relationship. **(5.G.1-2)** • Connect to constructing and interpreting scatterplots. **(8.SP.1)** • Connect to constructing an equation or a function to model a linear relationship and determining/ interpreting the slope and *y*-intercept. **(8.F.4)**	• Connect to explaining the slope and *y*-intercept as they relate to the context of the original problem. **(HSF.IF.4)** • Connect to creating linear functions and using them to solve problems. **(HSA.CED.1-3)** • Connect to interpreting key features of graphs and functions. **(HSF.IF.4)**	• Connect to determining which function fits the data. (linear, exponential, quadratic).

Suggested Instructional Strategies

Pre-Teach

Level of Intensity	*Essential Question*	*Examples*

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Targeted	*What pre-teaching will prepare students to productively struggle with the mathematics for this cluster within your HQIM?*	Some learners may benefit from targeted pre-teaching on representing linear functions because students need to understand the features of the linear model and the meaning of the features. Students need to rehearse different ways of writing the linear model.
Intensive	*What critical understandings will prepare students to access the mathematics for this cluster?*	8.F.8.4: This standard provides a foundation for work with constructing a function to model a linear relationship between 2 quantities because students need to know the information needed to model the linear function. If students have unfinished learning within this standard, based on assessment data, consider ways to provide intensive pre-teaching support prior to the start of the unit to ensure students are ready to access grade level instruction and assignments.

Universal Support Framework

		Potential Scaffolds

• How to choose the appropriate plot, given a set of data, based on what one wants to take away from the data.
• Symmetric data is best described by mean and standard deviation and non-symmetric data is best described by the median and interquartile range.
• How to find an outlier, what it represents in a data set, and how it affects the mean in a data set.
	• Plot data using dot plots, histograms, and box plots by hand and using technology.
	• Describe data sets in terms of shape, center, and spread.
	• Interpret the shape, center, and spread of a data set in the context of a situation.
	• Explain the impact of an outlier on the shape, center, and spread of a data set.
		• Build on students' experience with the following skills:
		  ○ Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation) (6.SP.B.5.C)
		  ○ Graphing points on the coordinate plane (6.NS.C.8)
		  ○ Construct and interpret data plot (8.SP.A.1)
		  ○ Construct a function to model a linear relationship (8.F.B.4)
		  ○ Understanding, constructing, interpreting and using patterns of association in bivariate categorical data by displaying frequencies in a two-way table. (8.SP.A.4)
		• Cognitive Strategies
		  ○ Repeatedly model the strategies
		  ○ Monitor the students' use of the strategies
		  ○ Provide feedback to students

		○ Teach self-questioning and self-monitoring strategies ○ Introduce multiple means of representation for mathematical ideas ● Encourage students to use alternative tools to better access the grade level content. Examples include: ○ Desmos.com ○ Graphing calculator ○ Sketch a graph ○ Create a table of values ○ Graphic organizers
Re-Teach		
Level of Intensity	***Essential Question***	***Examples***
Targeted	What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisited during a unit?	For example, students may benefit from re-engaging with content during a unit on modeling the scatter plot with a linear function by clarifying mathematical ideas and/or concepts through a short mini-lesson because students need to use the appropriate information to model the scatter plot with linear function. Students understand the connection of rate of change and intercept of the linear function in context of the data.
Intensive	What assessment data will help identify content needing to be revisited for intensive interventions?	For example, some students may benefit from intensive extra time during and after a unit representing the scatter plot with linear function by addressing conceptual understanding because students explain the implication of rate of change and intercepts of the linear function in the context of the data. Students use the rate of change and intercepts to predict the trend of the behavior and describe the correlation.
Extension		
Essential Question		***Examples***

What type of extension will offer additional challenges to 'broaden' your student's knowledge of the mathematics developed within your HQIM?	Some learners may benefit from an extension focused on modeling with linear functions and calculating the correlation coefficient because students will explain the similarities and differences of correlation and causation. Students describe and compare real-life data that has a correlation and real-life data that has causation.