Algebra 1 – UNIT 3
Descriptive Statistics

Critical Area: Experience with descriptive statistics began as early as Grade 6. Students were expected to display numerical data and summarize it using measures of center and variability. By the end of middle school they were creating scatterplots and recognizing linear trends in data. This unit builds upon that prior experience, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe approximately linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

CLUSTERS	COMMON CORE STATE STANDARDS
(s)Summarize, represent, and interpret data on a single count or measurement variable. *In grades 6 – 8, students describe center and spread in a data distribution. Here they choose a summary statistic appropriate to the characteristics of the data distribution, such as the shape of the distribution or the existence of extreme data points.*	**Statistics and Probability - Interpreting Categorical and Quantitative Data** S.ID.1 Represent data with plots on the real number line (dot plots, histograms, and box plots). S.ID.2 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. S.ID.3 Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
(s)Summarize, represent, and interpret data on two categorical and quantitative variables. *Students take a more sophisticated look at using a linear function to model the relationship between two numerical variables. In addition to fitting a line to data, students assess how well the model fits by analyzing residuals.* *S.ID.6b should be focused on linear models, but may be used to preview quadratic functions in Unit 5 of this course.*	**Statistics and Probability - Interpreting Categorical and Quantitative Data** S.ID.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. S.ID.6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. 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 and exponential 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.
(s)Interpret linear models. *Build on students' work with linear relationships in eighth grade and introduce the correlation coefficient. The focus here is on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. The important distinction between a statistical*	**Statistics and Probability - Interpreting Categorical and Quantitative Data** S.ID.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. S.ID.8 Compute (using technology) and interpret the correlation coefficient of a linear fit. S.ID.9 Distinguish between correlation and causation.

relationship and a cause-and-effect relationship arises in S.ID.9.	
MATHEMATICS PRACTICES	
1. Make sense of problems and persevere in solving them. **2. Reason abstractly and quantitatively.** **3. Construct viable arguments and critique the reasoning of others.** **4. Model with mathematics.** **5. Use appropriate tools strategically.** 6. Attend to precision. **7. Look for and make use of structure.** 8. Look for and express regularity in repeated reasoning.	Emphasize Mathematical Practice 1, 2, 3, 4, 5, and 7 in this unit.
LEARNING PROGRESSIONS	
CDE Progress to Algebra K-8 www.cde.ca.gov/be/cc/cd/documents/updateditem12catt3.doc	

(m)Major Clusters – area of intensive focus where students need fluent understanding and application of the core concepts.

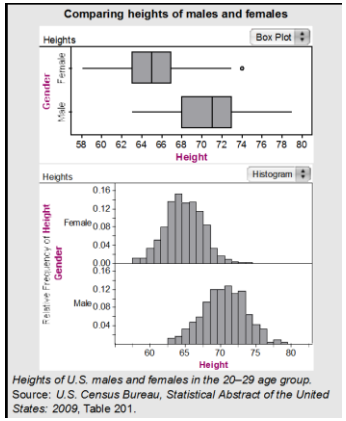
(s)Supporting/Additional Clusters – designed to support and strengthen areas of major emphasis/expose students to other subjects.

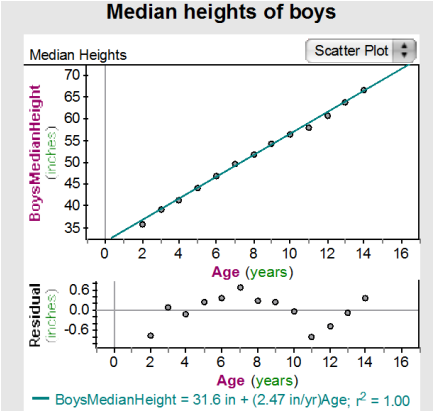
★Indicates a modeling standard linking mathematics to everyday life, work, and decision-making.

(+) Indicates additional mathematics to prepare students for advanced courses.

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS	KEY VOCABULARY
• A linear function can be used to model the relationship between two numerical variables. • The strength of a relationship and appropriateness of the model used can be determined by analyzing residuals. • A statistical relationship, such as correlation coefficient, is not necessarily the same as a cause-and-effect relationship. • The correlation coefficient will be understood and the focus will be on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship. • A deeper look at bivariate data can be taken to describe categorical associations and how to fit models to quantitative data.	How would you analyze bivariate data using your knowledge of proportions? How would you describe categorical variables? How would you use your knowledge of functions to fit models to quantitative data? How would you interpret the parameters of a linear model in the context of data that it represents? How can you compute correlation coefficients using technology and interpret the value of the coefficient? How do analysis of bivariate data and knowledge of proportions intersect with each other?	association bivariate data box plots categorical variables causation correlation correlation coefficient dot plots histogram intercept linear model line of best fit mean, median outlier quantitative variables scatter plot

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS	KEY VOCABULARY
		slope (rate of change) standard deviation

RESOURCES	INSTRUCTIONAL STRATEGIES	ASSESSMENT
LAUSD Adopted Textbooks and Programs • Big Ideas Learning - Houghton Mifflin Harcourt, 2015: Big Ideas Algebra I • College Preparatory Mathematics, 2013: Core Connections, Algebra I • The College Board, 2014:Springboard Algebra I **NCTM Illuminations** • Line of Best Fit : S.ID.6 • Linear Regression **Illustrative Mathematics** Haircut Costs:S.ID.1-3 **Mathematics Assessment Project – MARS Tasks** • Devising a Measure for Correlation – S.ID : **Statistics Online Computational Resource (SOCR)** http://www.socr.ucla.edu/	Use graphs such as the one below to show two ways of comparing height data for males and females in the 20-29 age group. Both involve plotting the data or data summaries (box plots or histograms) on the same scale, resulting in what are called parallel (or side-by-side) box plots and parallel histograms (S-ID.1). The parallel histograms show the distributions of heights to be mound shaped and fairly symmetrical (approximately normal) in shape. The data can be described using the mean and standard deviation. Have students sketch each distribution and answer questions about it just from knowledge of these three facts (shape, center, and spread). They also observe that the two measures of center, median and mean, tend to be close to each other for symmetric distributions.  *Heights of U.S. males and females in the 20–29 age group.* Source: *U.S. Census Bureau, Statistical Abstract of the United States: 2009*, Table 201. Have students learn how to take a careful look at scatter plots, as sometimes the "obvious" pattern does not tell the whole story, and can even be misleading. The graphs	LAUSD ASSESSMENT The district will be using the SMARTER Balanced Interim Assessments. Teachers would use the Interim Assessment Blocks (IAB) to monitor the progress of students. Each IAB can be given twice to show growth over time. STATE ASSESSMENT California will be administering the SMARTER Balance Assessment as the end of course for grades 3-8 and 11. There is no assessment for Algebra 1. The 11th grade assessment will include ítems from Algebra 1, Geometry, and Algebra 2 standards. For examples, visit the SMARTER Balance Assessment at: SBAC - http://www.smarterbalanced.org/

RESOURCES	INSTRUCTIONAL STRATEGIES	ASSESSMENT
	show the median heights of growing boys through the ages 2 to 14. The line (least squares regression line) with slope 2.47 inches per year of growth looks to be a perfect fit (S-ID.6c). But, the residuals, the differences between the corresponding coordinates on the least squares line and the actual data values for each age, reveal additional information (such as a teacher think-aloud). Sample questions to facilitate student discussion and understanding: What does this scatter plot/histogram show? How do you know? Pick any point on the histogram and explain what it means. What does it mean in relation to the other plots on the histogram? Does anyone have another way to explain it? 	

LANGUAGE GOALS for **low achieving, high achieving, students with disabilities and English Language Learners**
• Students will be able to explain the process of analyzing bivariate data. (Orally and in writing) • Students will be able to describe categorical associations using knowledge of functions in quantitative data.

- Students will be able to interpret the parameters of linear model in the context of data it represents and write the interpretation using complex sentences.
- Students will be able to describe the process of computing correlation coefficients.

PERFORMANCE TASKS

ILLUSTRIVE MATHEMATICS

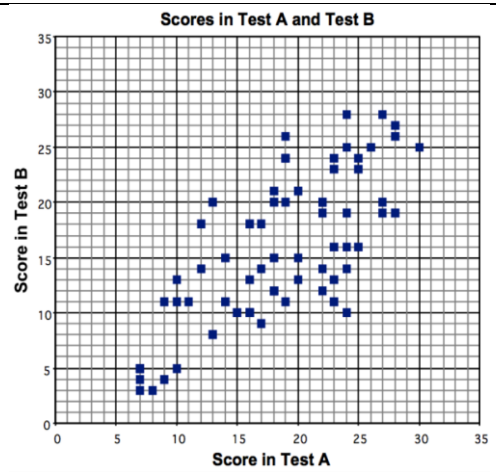
- Speed Trap – S.ID.1, 2, 3:
- Coffee and Crime – S.ID.6-9:
- Olympic Men's 100-meter dash – S.ID.6a, 7:
- Used Subaru Foresters I – S.ID.6a:
- Texting and Grades II – S.ID.7 :

Mathematics Assessment Project (MARS Tasks):

- Representing Data 1: Using Frequency Graphs – S.ID 1-3, 5:
- Representing Data Using Box Plots – S.ID. 1-3, 5, 6 a- c:
- Interpreting Statistics: A Case of Muddying the Waters – S.ID 7-9

DIFFERENTIATION

UDL/FRONT LOADING	ACCELERATION	INTERVENTION
• Use graphs of experiences that are familiar to students to increase accessibility and supports understanding and interpretation of proportional relationship. Students are expected to both sketch and interpret graphs including scatter plot. • Students create an equation with given information from a table, graph, or problem situation. • Engage students in interpreting slope and intercept using real world applications (e.g. bivariate data).	Students will explore how the residuals, the differences between the corresponding coordinates on the least squares line and the actual data values for each age, reveal additional information. Students should be able to sketch each distribution and answer questions about it just from knowledge of these three facts (shape, center, and spread). Have students design an experiment (project) where they would collect data from different sources, make a scatter plot of the data, draw a line of best fit modeling the data. From the plot, students would write the regression coefficient and the residual to explain the strength of the association.	Have the students work in groups to generate data from the internet, such as the CST scores and other data. Have them construct a table based on the pattern and then graph the values and explain the relationship observed on the graph (association). Example: Certain students took two different tests (Test A and Test B). In the scatter diagram, each square represents one student and shows the scores that student got in the two tests.

		 Draw a line of best fit on the scatter diagram and answer some questions regarding the data.

References:

1. National Governors Association Center for Best Practices, Council of Chief State School Officers. (2010). *Common Core State Standards (Mathematics)*. Washington D.C.: National Governors Association Center for Best Practices, Council of Chief State School Officers.
2. McCallum, W., Zimba, J., Daro, P. (2011, December 26 Draft). *Progressions for the Common Core State Standards in Mathematics*. Cathy Kessel (Ed.). Retrieved from http://ime.math.arizona.edu/progressions/#committee.
3. Engage NY. (2012). New York Common Core Mathematics Curriculum. Retrieved from http://www.engageny.org/resource/high-school-algebra-i.
4. Mathematics Assessment Resource Service, University of Nottingham. (2007 - 2012). Mathematics Assessment Project. Retrieved from http://map.mathshell.org/materials/index.php.
5. Smarter Balanced Assessment Consortium. (2012). Smarter Balanced Assessments. Retrieved from http://www.smarterbalanced.org/.
6. Partnership for Assessment of Readiness for College and Career. (2012). PARCC Assessments. Retrieved from http://www.parcconline.org/parcc-assessment.
7. California Department of Education. (2013). Draft Mathematics Framework Chapters. Retrieved from http://www.cde.ca.gov/be/cc/cd/draftmathfwchapters.asp.
8. National Council of Teachers of Mathematics (NCTM) Illuminations. (2013). Retrieved from http://illuminations.nctm.org/Weblinks.aspx.
9. The University of Arizona. (2011-12). Progressions Documents for the Common Core Math Standards. Retrieved from http://ime.math.arizona.edu/progressions.