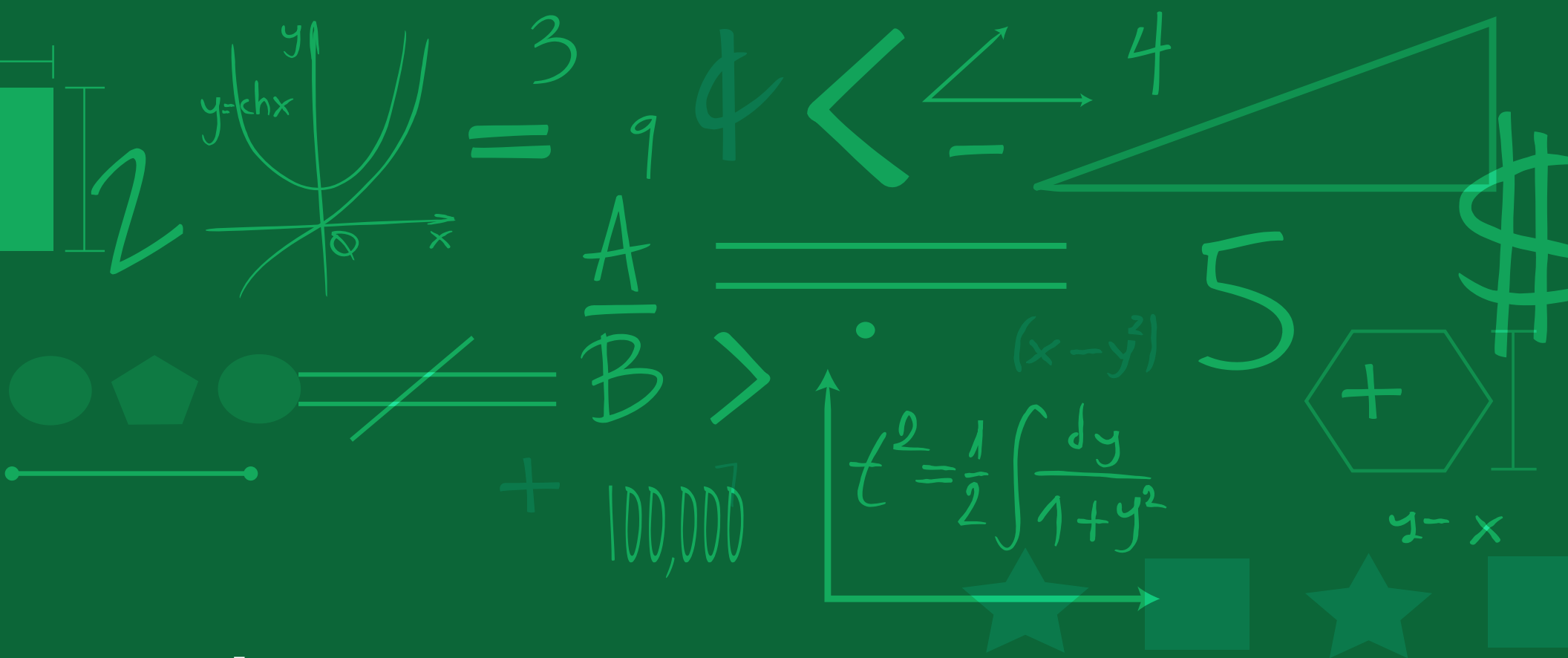

Mathematics TEKS
SUPPORTING INFORMATION

Statistics

Texas Education Agency

Statistics – Mathematics

TEKS	Supporting Information
(a) General requirements. Students shall be awarded one credit for successful completion of this course. Prerequisite: Algebra I.	The TEKS include descriptions of prerequisite coursework. Algebra I is a required prerequisite.
(b) Introduction. (1) The desire to achieve educational excellence is the driving force behind the Texas essential knowledge and skills for mathematics, guided by the college and career readiness standards. By embedding statistics, probability, and finance, while focusing on fluency and solid understanding, Texas will lead the way in mathematics education and prepare all Texas students for the challenges they will face in the 21st century.	A well-balanced mathematics curriculum includes the Texas College and Career Readiness Standards (CCRS). A focus on mathematical fluency and solid understanding allows for rich exploration of the key ideas of Statistics.
(b) Introduction. (2) The process standards describe ways in which students are expected to engage in the content. The placement of the process standards at the beginning of the knowledge and skills listed for each grade and course is intentional. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use mathematics efficiently and effectively in daily life. The process standards are integrated at every grade level and course. When possible, students will apply mathematics to problems arising in everyday life, society, and the workplace. Students will use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution. Students will select appropriate tools such as real objects, manipulatives, paper and pencil, and technology and techniques such as mental math, estimation, and number sense to solve problems. Students will effectively communicate mathematical ideas, reasoning, and their implications using multiple representations such as symbols, diagrams, graphs, and language. Students will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.	This paragraph occurs second in the TEKS, preceding the content descriptions. This highlights the emphasis of student use of the mathematical process standards to acquire and demonstrate mathematical understanding. This introductory paragraph includes generalization and abstraction in the text from S(1)(B). This introductory paragraph includes computer programs in the text from S(1)(C). This introductory paragraph states, “Students will use mathematical relationships to generate solutions and make connections and predictions,” instead of the text from S(1)(E).
(b) Introduction. (3) In Statistics, students will build on the knowledge and skills for mathematics in Kindergarten-Grade 8 and Algebra I. Students will broaden their knowledge of variability and statistical processes. Students will study sampling and experimentation, categorical and quantitative data, probability and random variables, inference, and bivariate data. Students will connect data and statistical processes to real-world situations. In addition, students will extend their knowledge of data analysis.	Specifics about Statistics mathematics content is summarized in this paragraph. This summary follows the paragraph about the mathematical process standards. This supports the notion that the TEKS should be learned in a way that integrates the mathematical process standards in an effort to develop fluency. The paragraph also connects the key concepts found in Statistics to prior content and the CCRS.
(b) Introduction. (4) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.	The State Board of Education approved the retention of some “such as” statements within the TEKS where needed for clarification of content. The phrases “including” and “such as” should not be considered as limiting factors for the student expectations (SEs) in which they reside.

Additional Resources are available online including

Vertical Alignment Charts

Texas Mathematics Resource Page

Texas College and Career Readiness Standards

TEKS: Mathematical Process Standards.	Supporting Information
S(1)(A) **Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. **The student is expected to apply mathematics to problems arising in everyday life, society, and the workplace.**	This SE emphasizes application. The opportunities for application have been consolidated into three areas: everyday life, society, and the workplace. This SE, when paired with a content SE, allows for increased relevance through connections within and outside mathematics. *Example*: When paired with S(2)(E), the student may be asked to formulate questions that address school or community concerns.
S(1)(B) **Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. **The student is expected to use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution.**	This process standard applies the same problem-solving model and is included in the TEKS from kindergarten through grade 12. This is the traditional problem-solving process used in mathematics and science. Students may be expected to use this process in a grade-appropriate manner when solving problems that can be considered difficult relative to mathematical maturity.
S(1)(C) **Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. **The student is expected to select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems.**	The phrase "as appropriate" indicates that students are assessing which tools and techniques to apply rather than trying only one or all of those listed. *Example:* When paired with S(7)(C) and S(7)(D), students may be expected to determine which technique for creating a linear model will provide the best fit for a given data set.
S(1)(D) **Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. **The student is expected to communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate.**	Students may be expected to address three areas: mathematical ideas, reasoning, and implications of these ideas and reasoning. Communication can be through the use of symbols, diagrams, graphs, or language. The phrase "as appropriate" implies that students may be expected to assess which communication tool to apply rather than trying only one or all of those listed. The use of multiple representations includes translating and making connections among the representations. *Example*: When paired with S(2)(F) and S(1)(G), students may be expected to determine the best representation for their data to support their conclusions.
S(1)(E) **Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. **The student is expected to create and use representations to organize, record, and communicate mathematical ideas.**	The expectation is that students use representations for three purposes: to organize, record, and communicate mathematical ideas. Representations include verbal, graphical, tabular, and algebraic representations. As students create and use representations, they will evaluate the effectiveness of the representations to ensure that those representations are communicating mathematical ideas with clarity. *Example*: When paired with S(2)(E), students may be expected to organize data collected in a reasonable fashion to enable them to draw a conclusion.
S(1)(F) **Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. **The student is expected to analyze mathematical relationships to connect and communicate mathematical ideas.**	Students may be expected to analyze relationships and form connections with mathematical ideas. Students may form conjectures about mathematical representations based on patterns or sets of examples and non-examples. Forming connections with mathematical ideas extends past conjecturing to include verification through a deductive process. *Example*: When paired with S(6)(E), students may be expected to describe the implications of a confidence interval when looking at a confidence interval from a media report.
S(1)(G) **Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. **The student is expected to display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.**	The expectation is that students speak and write with precise mathematical language to explain and justify their work. This includes justifying a solution. *Example*: When paired with S(6)(J), the student may be expected to explain the implications of a type I or type II error for a given situation.

TEKS: Statistical process sampling and experimentation.	Supporting Information
S(2)(A) **Statistical process sampling and experimentation**. The student applies mathematical processes to apply understandings about statistical studies, surveys, and experiments to design and conduct a study and use graphical, numerical, and analytical techniques to communicate the results of the study. **The student is expected to compare and contrast the benefits of different sampling techniques, including random sampling and convenience sampling methods.**	Different sampling techniques may include simple random, cluster, stratified, systematic, convenience, or volunteer sampling techniques.
S(2)(B) **Statistical process sampling and experimentation**. The student applies mathematical processes to apply understandings about statistical studies, surveys, and experiments to design and conduct a study and use graphical, numerical, and analytical techniques to communicate the results of the study. **The student is expected to distinguish among observational studies, surveys, and experiments.**	When paired with S(1)(A) and S(2)(G), students may be expected to determine whether the published data was gathered through an observational study, a survey, or an experiment.
S(2)(C) **Statistical process sampling and experimentation**. The student applies mathematical processes to apply understandings about statistical studies, surveys, and experiments to design and conduct a study and use graphical, numerical, and analytical techniques to communicate the results of the study. **The student is expected to analyze generalizations made from observational studies, surveys, and experiments.**	When paired with S(1)(A) and S(2)(G), students may be expected to analyze claims from published studies.
S(2)(D) **Statistical process sampling and experimentation**. The student applies mathematical processes to apply understandings about statistical studies, surveys, and experiments to design and conduct a study and use graphical, numerical, and analytical techniques to communicate the results of the study. **The student is expected to distinguish between sample statistics and population parameters.**	Students first see the relationship between a sample and the population from which it was taken in grade 7 [7(6)(F); 7(12)(B) and (C)].
S(2)(E) **Statistical process sampling and experimentation**. The student applies mathematical processes to apply understandings about statistical studies, surveys, and experiments to design and conduct a study and use graphical, numerical, and analytical techniques to communicate the results of the study. **The student is expected to formulate a meaningful question, determine the data needed to answer the question, gather the appropriate data, analyze the data, and draw reasonable conclusions.**	This SE specifies the steps included in a statistical study.
S(2)(F) **Statistical process sampling and experimentation**. The student applies mathematical processes to apply understandings about statistical studies, surveys, and experiments to design and conduct a study and use graphical, numerical, and analytical techniques to communicate the results of the study. **The student is expected to communicate methods used, analyses conducted, and conclusions drawn for a data-analysis project through the use of one or more of the following: a written report, a visual display, an oral report, or a multi-media presentation.**	When paired with S(1)(B), students may be expected to determine the reasonableness of the conclusions.
S(2)(G) **Statistical process sampling and experimentation**. The student applies mathematical processes to apply understandings about statistical studies, surveys, and experiments to design and conduct a study and use graphical, numerical, and analytical techniques to communicate the results of the study. **The student is expected to critically analyze published findings for appropriateness of study design implemented, sampling methods used, or the statistics applied.**	When paired with S(1)(G), students may be expected to explain how the conclusions were drawn from the published findings. When paired with S(1)(B), students may be expected to determine the reasonableness of the conclusions.

TEKS: Variability.	Supporting Information
S(3)(A) **Variability.** The student applies the mathematical process standards when describing and modeling variability. **The student is expected to distinguish between mathematical models and statistical models.**	This SE introduces students to the concept of a statistical model. Students are introduced to mathematical models as early as grade 6 [6(10)(A)].
S(3)(B) **Variability.** The student applies the mathematical process standards when describing and modeling variability. **The student is expected to construct a statistical model to describe variability around the structure of a mathematical model for a given situation.**	Variability in this context (i.e. sampling variability) is not to be confused with the measurement of variance.
S(3)(C) **Variability.** The student applies the mathematical process standards when describing and modeling variability. **The student is expected to distinguish among different sources of variability, including measurement, natural, induced, and sampling variability.**	When paired with S(1)(G), students may be expected to explain the difference between types of variability.
S(3)(D) **Variability.** The student applies the mathematical process standards when describing and modeling variability. **The student is expected to describe and model variability using population and sampling distributions.**	Students are introduced to statistical variability in grade 6 [6(13)(B)].

TEKS: Categorical and quantitative data.	Supporting Information
S(4)(A) **Categorical and quantitative data.** The student applies the mathematical process standards to represent and analyze both categorical and quantitative data. **The student is expected to distinguish between categorical and quantitative data.**	Students are expected to summarize both numerical and categorical data in grade 6 [6(12)(C) and (D)].
S(4)(B) **Categorical and quantitative data.** The student applies the mathematical process standards to represent and analyze both categorical and quantitative data. **The student is expected to represent and summarize data and justify the representation.**	Students may be expected to determine which graphical representation is most appropriate for a given data set. For example, a pie chart is normally associated with categorical data.
S(4)(C) **Categorical and quantitative data.** The student applies the mathematical process standards to represent and analyze both categorical and quantitative data. **The student is expected to analyze the distribution characteristics of quantitative data, including determining the possible existence and impact of outliers.**	This SE introduces analysis to the middle school skills of creating and reading graphs of quantitative data. Students are expected to recognize outliers in grade 6 [6(12)(A), (B), and (C)].
S(4)(D) **Categorical and quantitative data.** The student applies the mathematical process standards to represent and analyze both categorical and quantitative data. **The student is expected to compare and contrast different graphical or visual representations given the same data set.**	When paired with S(1)(G), students may be expected to explain the difference in information from various graphical or visual representations.
S(4)(E) **Categorical and quantitative data.** The student applies the mathematical process standards to represent and analyze both categorical and quantitative data. **The student is expected to compare and contrast meaningful information derived from summary statistics given a data set.**	Summary statistics may include variance or standard deviation as appropriate. When paired with S(1)(C), students may be expected to use technology to determine the summary statistics for a given data set.
S(4)(F) **Categorical and quantitative data.** The student applies the mathematical process standards to represent and analyze both categorical and quantitative data. **The student is expected to analyze categorical data, including determining marginal and conditional distributions, using two-way tables.**	Students are expected to determine conditional probabilities in Geometry [G(13)(D)].

TEKS: Probability and random variables.	Supporting Information
S(5)(A) **Probability and random variables.** The student applies the mathematical process standards to connect probability and statistics. **The student is expected to determine probabilities, including the use of a two-way table**.	Students determine probability in grade 7 [7(6)(B), (C), (D), (E), (H), and (I)] and Geometry [G(13)(B), (C), (D), and (E)].
S(5)(B) **Probability and random variables.** The student applies the mathematical process standards to connect probability and statistics. **The student is expected to describe the relationship between theoretical and empirical probabilities using the Law of Large Numbers.**	Students are expected to determine both theoretical and experimental probability in grade 7 [7(6)(C), (D), and (I)].
S(5)(C) **Probability and random variables.** The student applies the mathematical process standards to connect probability and statistics. **The student is expected to construct a distribution based on a technology-generated simulation or collected samples for a discrete random variable.**	Students are introduced to simulations in middle school [7(6)(B) and 8(11)(C)]. This SE is the introduction to discrete random variables and the creation of a distribution.
S(5)(D) **Probability and random variables.** The student applies the mathematical process standards to connect probability and statistics. **The student is expected to compare statistical measures such as sample mean and standard deviation from a technology-simulated sampling distribution to the theoretical sampling distribution.**	Normally, sample mean is represented by $\bar{x}$, and sample standard deviation is represented by s.

TEKS: Inference.	Supporting Information
S(6)(A) **Inference.** The student applies the mathematical process standards to make inferences and justify conclusions from statistical studies. **The student is expected to explain how a sample statistic and a confidence level are used in the construction of a confidence interval.**	This SE introduces the concept of confidence interval.
S(6)(B) **Inference.** The student applies the mathematical process standards to make inferences and justify conclusions from statistical studies. **The student is expected to explain how changes in the sample size, confidence level, and standard deviation affect the margin of error of a confidence interval.**	This SE builds on the calculation of the confidence interval as students examine how changes to its parameters may affect decisions based on the confidence interval.
S(6)(C) **Inference.** The student applies the mathematical process standards to make inferences and justify conclusions from statistical studies. **The student is expected to calculate a confidence interval for the mean of a normally distributed population with a known standard deviation.**	When paired with S(1)(C), students may be expected to determine the confidence interval with the assistance of technology. When paired with S(1)(G) and S(6)(D), students may be expected to compare and contrast the use of confidence intervals for the mean of a normally distributed population with a population proportion.
S(6)(D) **Inference.** The student applies the mathematical process standards to make inferences and justify conclusions from statistical studies. **The student is expected to calculate a confidence interval for a population proportion.**	When paired with S(1)(C), students may be expected to determine the confidence interval with the assistance of technology. When paired with S(1)(G) and S(6)(C), students may be expected to compare and contrast the use of confidence intervals for a population proportion with the use of the mean for a normally distributed population.
S(6)(E) **Inference.** The student applies the mathematical process standards to make inferences and justify conclusions from statistical studies. **The student is expected to interpret confidence intervals for a population parameter, including confidence intervals from media or statistical reports.**	When paired with S(1)(B), students may be expected to determine the reasonableness of the claims made in the media or statistical reports.
S(6)(F) **Inference.** The student applies the mathematical process standards to make inferences and justify conclusions from statistical studies. **The student is expected to explain how a sample statistic provides evidence against a claim about a population parameter when using a hypothesis test.**	When paired with S(6)(G), students may be expected to construct a formal hypothesis for testing.
S(6)(G) **Inference.** The student applies the mathematical process standards to make inferences and justify conclusions from statistical studies. **The student is expected to construct null and alternative hypothesis statements about a population parameter.**	Students may be expected to determine if they need to use a one- or two-tailed test as situations warrant. When paired with S(6)(F), students may be expected to construct a formal hypothesis for testing.
S(6)(H) **Inference.** The student applies the mathematical process standards to make inferences and justify conclusions from statistical studies. **The student is expected to explain the meaning of the p-value in relation to the significance level in providing evidence to reject or fail to reject the null hypothesis in the context of the situation.**	When paired with S(1)(G), students may be expected to justify why they rejected or failed to reject the null hypothesis.
S(6)(I) **Inference.** The student applies the mathematical process standards to make inferences and justify conclusions from statistical studies. **The student is expected to interpret the results of a hypothesis test using technology-generated results such as large sample tests for proportion, mean, difference between two proportions, and difference between two independent means.**	This SE builds on S(6)(F), (G), and (H), as students may be expected to use the information developed in those skills to interpret the results of the listed techniques.
S(6)(J) **Inference.** The student applies the mathematical process standards to make inferences and justify conclusions from statistical studies. **The student is expected to describe the potential impact of Type I and Type II Errors.**	When paired with S(1)(A) and S(1)(G), students may be expected to explain the impact of making a type I or type II error in a given real-world situation.

TEKS: Bivariate data.	Supporting Information
S(7)(A) **Bivariate data.** The student applies the mathematical process standards to analyze relationships among bivariate quantitative data. **The student is expected to analyze scatterplots for patterns, linearity, outliers, and influential points.**	When paired with S(1)(G), students may be expected to explain what makes a point an outlier or influential.
S(7)(B) **Bivariate data.** The student applies the mathematical process standards to analyze relationships among bivariate quantitative data. **The student is expected to transform a linear parent function to determine a line of best fit.**	This SE builds on the concept of transformation of a linear function found in Algebra I [A(3)(E)].
S(7)(C) **Bivariate data.** The student applies the mathematical process standards to analyze relationships among bivariate quantitative data. **The student is expected to compare different linear models for the same set of data to determine best fit, including discussions about error.**	Students determine the line of best fit by visual approximation in grade 8 [8(5)(D)], by regression via technology in Algebra I [A(4)(C)] and Algebra II [2A(8)(B)], and by transformation in Statistics [S(7)(B)].
S(7)(D) **Bivariate data.** The student applies the mathematical process standards to analyze relationships among bivariate quantitative data. **The student is expected to compare different methods for determining best fit, including median-median and absolute value.**	Students determine the line of best fit by visual approximation in grade 8 [8(5)(D)], by regression via technology in Algebra I [A(4)(C)] and Algebra II [2A(8)(B)], and by transformation in Statistics [S(7)(B)]. Students determine the mean absolute deviation in grade 8 [8(11)(B)].
S(7)(E) **Bivariate data.** The student applies the mathematical process standards to analyze relationships among bivariate quantitative data. **The student is expected to describe the relationship between influential points and lines of best fit using dynamic graphing technology.**	This SE focuses on the relationship between influential points and their effect on the line of best fit.
S(7)(F) **Bivariate data.** The student applies the mathematical process standards to analyze relationships among bivariate quantitative data. **The student is expected to identify and interpret the reasonableness of attributes of lines of best fit within the context, including slope and *y*-intercept.**	When paired with S(1)(B), students may be expected to determine the best approach to finding the line of best fit and then to determine the reasonableness of that line, as determined by algorithm or technology, especially in cases where the data sets have an outlier(s).