Unit 10 Data Analysis and Statistics

Content Area: **Mathematics**
Course(s):
Time Period: **Marking Period 4**
Length: **2 weeks (if time permits)**
Status: **Published**

Brief Summary of Unit

This unit introduces students to probability distributions, different methods for organizing and displaying data, and measures of central tendency. Samples, surveys, experiments and simulations will be used as methods to collect data. Students will study measures of variation to describe how data in a data set are spread out. They will consider samples and the relationship between sample size and margin of error.

Revised Date: July 2025

Standards

Analyzing various sets of data will allow students to explore studies about people from different backgrounds. Statistical studies and analysis provides students an opportunity to read about historical statistics about people's cultures. Embracing the diversity within society incorporates the following:

Amistad Commission

This unit also reflects the goals of the Department of Education and the Amistad Commission including the infusion of the history of Africans and African-Americans into the curriculum in order to provide an accurate, complete, and inclusive history regarding the importance of of African-Americans to the growth and development of American society in a global context.

Asian American and Pacific Islander History Law

This unit includes instructional materials that highlight the history and contributions of Asian Americans and Pacific Islanders in accordance with the New Jersey Student Learning Standards in Social Studies.

New Jersey Diversity and Inclusion Law

In accordance with New Jersey’s Chapter 32 Diversity and Inclusion Law, this unit includes instructional materials that highlight and promote diversity, including:

economic diversity, equity, inclusion, tolerance, and belonging in connection with gender and sexual orientation, race and ethnicity, disabilities, and religious tolerance.

Commission on Holocaust Education

This unit further reflects the goals of the Holocaut Education mandate where students are able to identify and analyze applicable theories concerning human nature and behavior; understand that genocide is a consequence of prejudice and discrimination; understand that issues of moral dilemma and conscience have a profound impact on life; and understand the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

For Geometry topics:

Students will analyze geometric designs which connects to various cultures. Embracing the diversity within society incorporates the following:

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Generic: Diversity and Inclusion: Students will focus on equity, inclusion, and tolerance when analyzing the comparison of various quantities regarding characteristics of people. Equality will also be highlighted which can be associated with both numerical representations and the connection between people. This can be associated with treating people fairly and equally.

1	Developing Responsibility for Learning: Cultivating independence, self-reflection, and responsibility for one's own learning.
3	Valuing Evidence in Argumentation: Constructing viable claims and evaluating, defending, challenging, and qualifying the arguments of others.
4	Building Knowledge: Building strong content knowledge and connecting ideas across disciplines using a variety of text resources and media.
5	Leveraging Technology: Employing technology and digital media thoughtfully, strategically and capably to enhance reading, writing, speaking, listening, and language use.
S.ID.A.4	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
3.a	Identify complex, interdisciplinary, real-world problems that can be solved computationally.
3.b	Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures.
S.IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
S.IC.A.2	Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.
S.IC.B.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
S.IC.B.4	Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.
S.IC.B.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
S.IC.B.6	Evaluate reports based on data (e.g., interrogate study design, data sources, randomization, the way the data are analyzed and displayed, inferences drawn and methods used; identify and explain misleading uses of data; recognize when arguments based on data are flawed).
S.CP	Conditional Probability and the Rules of Probability
S.CP.A	Understand independence and conditional probability and use them to interpret data
S.CP.A.1	Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").
S.CP.A.2	Understand that two events □ and □ are independent if the probability of □ and □ occurring together is the product of their probabilities, and use this characterization to

	determine if they are independent.
S.CP.A.3	Understand the conditional probability of □ given □ as □(□ and □)/□(□), and interpret independence of □ and □ as saying that the conditional probability of □ given □ is the same as the probability of □, and the conditional probability of □ given □ is the same as the probability of □.
S.CP.A.4	Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.
8.1.12.AP.1	Design algorithms to solve computational problems using a combination of original and existing algorithms.
S.CP.A.5	Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.
S.CP.B	Use the rules of probability to compute probabilities of compound events in a uniform probability model
S.CP.B.6	Find the conditional probability of □ given □ as the fraction of □'s outcomes that also belong to □, and interpret the answer in terms of the model.
S.CP.B.7	Apply the Addition Rule, □(□ or □) = □(□) + □(□) – □(□ and □), and interpret the answer in terms of the model.
S.CP.B.8	Apply the general Multiplication Rule in a uniform probability model, □(□ and □) = □(□)□(□|□) = □(□)□(□|□), and interpret the answer in terms of the model.
S.CP.B.9	Use permutations and combinations to compute probabilities of compound events and solve problems.
S.MD	Using Probability to Make Decisions
S.MD.A	Calculate expected values and use them to solve problems
S.MD.A.1	Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.
S.MD.A.2	Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.
S.MD.A.3	Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.
S.MD.A.4	Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?
S.MD.B	Use probability to evaluate outcomes of decisions
S.MD.B.5	Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.

	For example, find the forecasted value of an investment.
S.MD.B.5.a	Find the expected payoff for a game of chance.
	For example, find the expected winnings from a game at a fast food restaurant.
S.MD.B.5.b	Evaluate and compare strategies on the basis of expected values.
	For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.
S.MD.B.6	Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
S.MD.B.7	Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).
	Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

Essential Questions

- How do you decide which method to use when collecting data?
- How does bias affect the validity of data analysis?
- How is probability used to make informed decisions about uncertain events?
- What does it mean to make an inference? How can statistics help?

Enduring Understandings

- Random phenomena are unpredictable in the short term, but show long run regularity.
- Statistical inference is a tool for validating a claim about a population parameter and judging the reliability of statistical relationships, typically on the basis of random sampling.
- The probability of an event is the proportion of times the event will occur over many trials.

Students Will Know

- Students will know basic combinatorial principles.
- Students will know how to design and conduct an experiment.
- Students will know how to develop a margin of error through the use of simulation models for random sampling.
- Students will know how to estimate population parameters.
- Students will know how to find a sample space of an experiment.
- Students will know how to find the probability of either of two events: P(AorB) = P(A)+P(B)– P(A and B).
- Students will know how to randomly assign groups.
- Students will know how to use data from a randomized experiement to compare two treatments and evaluate reports based on data.
- Students will know how to use Venn Diagrams to display the sample space for an event.

- Students will know sampling methods (simple random, stratified, cluster).
- Students will know that distributions can be summarized in frequency tables and characterized by their shape, center, spread, and outliers.
- Students will know that probability = #successful outcomes / # total outcomes.
- Students will know that probability is the study of chance and random processes.
- Students will know that the probability of events occurring together P(B|A)= P(A and B)/ P(A).
- Students will know the effects of taking large samples.
- Students will know the set notation of union and intersection.

Students Will Be Skilled At

- Knowing the difference between a permutation and a combination
- Students will be skilled at calculating and interpreting probabilities and conditional probabilities.
- Students will be skilled at calculating probabilities of compoud events using the multiplication rule (and).
- Students will be skilled at calculating probabilities of compound events using the addition rule (or).
- Students will be skilled at constructing and interpreting two way frequency tables.
- Students will be skilled at designing experiments that are well planned, well designed, and well conducted.
- Students will be skilled at determing margins of error.
- Students will be skilled at determining methods of data collection.
- Students will be skilled at Identifing and calculating Sample Space.
- Students will be skilled at Identifing and calculating the probability of a simple event.
- Students will be skilled at identifing independent or mutually exclusive events.
- Students will be skilled at identifying differences in sampling methods.
- Students will be skilled at Interpreting and calculating conditional probabilites using formulas and tree diagrams.
- Students will be skilled at using permutations and combinations to compute the probability of compound events and solve real-world problems.

Evidence/Performance Tasks

Assessments

- Formative: Daily assessments using examples from class notes, NJSLA test bank problems, and/or Albert/AP Classroom assessments
- Summative: Teacher-created assessments, NJSLA test bank problems, Albert/AP Classroom and/or Big Ideas Math unit assessments
- Benchmark: teacher created diagnostic assessments in addition to unit assessments, quick quizzes
- Alternative Assessments: Student-centered activities such as scavenger hunts, various projects

involving real world applications, and differentiated learning tasks in Khan Academy, and DeltaMath

- Answer essential questions
- Class discussion of daily topic
- Classwork and homework that assess the essential questions
- Provide alternative means of assessments for certain students
- Teacher Observation
- Tests and quizzes that assess the essential questions
- Written assignments that assess the essential questions that involves providing explanations

Learning Plan

Unit 10 Probability and Statistics (3 weeks)

** As time permits**

- Basic theoretical/experimental probability (1 day)
- Independent/dependent rules (1 day)
- Mutually exclusive and overlapping rules (1 day)
- Deciding if a specified model is consistent with the results from a given data-generating process (½ day)
- Recognizing the purposes of and differences among sample surveys, experiments, and observational studies (½ day)
- Using the mean and standard deviation of a data set to fit to a normal distribution (1 day)
- Estimating population percentages (½ day)
- Recognizing when data sets are not appropriate for the use of a normal distribution (½ day)
- Using calculators spreadsheets (1 day)
- Tables to estimate areas under the normal curve (1 day)
- Evaluate factorial values
- Find the number of permutations for a problem
- Find the number of combinations for a problem
- Explore Pascal's Triangle
- Explore the Binomial Theorem and find a specific value on an expansion (find the 32nd term of $(5x + 1)^{18}$

Materials

Core instructional materials:Core Book List including Algebra & Trigonometry 4E by Stewart

Supplemental materials: Khan Academy, Edia, and DeltaMath

- District approved textbook and ancillary materials
- Graphing Calculator
- Online materials such as Desmos, Delta Math, Edia, Ed Puzzle, Khan Academy
- Teacher created activiites
- Teacher created notes

Integrated Accommodation & Modifications

Integrated Accommodation & Modifications for Algebra 2/Intro to Trig Honors