10 Data Analysis and Probability

Content Area: **TEMPLATE**
Course(s):
Time Period: **Full Year**
Length: **2 - 3 weeks**
Status: **Published**

General Overview, Course Description or Course Philosophy

This course is an extension of Algebra 1. Emphasis is upon the development of insights into the structure of algebra as a deductive process. The content includes function foundations, equations and inequalities, polynomial functions and equations, rational functions and equations, radical expressions and equations, exponential and logarithmic functions and equations, trigonometric functions and equations, introductory data analysis, and probability.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Objectives:

- Model and interpret real-world situations using the language of mathematics and appropriate technology
- Collect, organize, analyze, and present data using technology as needed
- Apply the basic concepts of statistics and probability to predict possible outcomes of real- world situations, using technology as needed
- Data analysis is part of a decision making process (decisions or predictions are often based on data—numbers in context)
- Data is gathered, displayed, summarized, examined, and interpreted to discover patterns and deviations from patterns.
- Probability assigns a numerical value for the likelihood of an event or events.

Essential Questions:

- How can the results of a statistical investigation be used to support an argument?

Enduring Understanding:

- Statistics and probability are used to make inferences and predictions

CONTENT AREA STANDARDS

S.IC

A. Understand and evaluate random processes underlying statistical experiments

B. Make inferences and justify conclusions from sample surveys, experiments, and observational studies

S.CP

A. Understand independence and conditional probability and use them to interpret data

B. Use the rules of probability to compute probabilities of compound events in a uniform probability model

S.MD

A. Calculate expected values and use them to solve problems

B. Use probability to evaluate outcomes of decisions

MA.S-ID.A.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.
MA.S-ID.A.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
MA.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.
MA.S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
MA.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
MA.S-IC.A.2	Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation.
MA.S-IC.B.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
MA.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.
MA.S-IC.B.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
MA.S-IC.B.6	Evaluate reports based on data.
MA.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").
MA.S-CP.A.2	Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.

MA.S-CP.A.3	Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.
MA.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.
MA.S-CP.A.5	Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.
MA.S-CP.B.6	Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.
MA.S-CP.B.7	Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.
MA.S-CP.B.8	Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = [P(A)] \times [P(B|A)] = [P(B)] \times [P(A|B)]$, and interpret the answer in terms of the model.
MA.S-CP.B.9	Use permutations and combinations to compute probabilities of compound events and solve problems.

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

9.1.8.PB.1: Predict future expenses or opportunities that should be included in the budget planning process. • 9.1.8.PB.2: Explain how different circumstances can affect one's personal budget. • 9.1.8.PB.3: Explain how to create budget that aligns with financial goals. • 9.1.8.PB.4: Construct a simple personal savings and spending plan based on various sources of income and different stages of life (e.g. teenager, young adult, family).

PFL.9.1.K12.P.4	Demonstrate creativity and innovation.
PFL.9.1.K12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
PFL.9.1.K12.P.6	Model integrity, ethical leadership and effective management.
PFL.9.1.K12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
PFL.9.1.K12.P.9	Work productively in teams while using cultural/global competence.
LA.K-12.NJSLSA.R7	Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
CS.K-12.4.a	Extract common features from a set of interrelated processes or complex phenomena.
CS.K-12.4.c	Create modules and develop points of interaction that can apply to multiple situations and reduce complexity.
CS.K-12.4.d	Model phenomena and processes and simulate systems to understand and evaluate potential outcomes.

STUDENT LEARNING TARGETS

Refer to the 'Declarative Knowledge' and 'Procedural Knowledge sections.

Declarative Knowledge

Students will understand that:

- Understand statistics as a process for making inferences about population parameters based on a random sample from that population
- Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent
- Understand the conditional probability of *A* given *B* as *P(A and B)/P(B)*

Procedural Knowledge

Students will be able to:

- Compare the center and spread of two or more different data sets using statistics appropriate to the shape of the data distribution
- Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified
- Decide if a specified model is consistent with results from a given data-generating process
- Evaluate reports based on data
- Fit a linear function for a scatter plot that suggests a linear association
- Informally assess the fit of a function by plotting and analyzing residual
- Use data from a randomized experiment to compare two treatments
- Use data from a sample survey to estimate a population mean or proportion
- Apply the general Multiplication Rule in a uniform probability model, *P(A and B) = P(A)P(B|A) = P(B)P(A|B)*, and interpret the answer in terms of the model
- Use permutations and combinations to compute probabilities of compound events and solve problems
- Apply the Addition Rule, *P(A or B) = P(A) + P(B) - P(A and B)*, and interpret the answer in terms of the model
- Describe events as subsets of a sample space using characteristics of the outcomes, or as unions, intersections, or complements of other events
- Explain how randomization relates to sample surveys, experiments, and observational studies
- Find the conditional probability of *A* given *B* as the fraction of *B's* outcomes that also belong to *A* and interpret the answer in terms of the model
- Interpret differences in shape, center, and spread in the context of the data sets
- Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations
- Use functions fitted to data to solve problems in the context of the data

- Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages

EVIDENCE OF LEARNING

Refer to the 'Formative Assessments' and 'Summative Assessments' sections.

Benchmark Assessments

Benchmark Assessments conducted three times per year, using Pear Assessment (Standards Based Assessments)

Alternate Assessments

- Portfolios

- Verbal Assessment (instead of written)

- Multiple choice

- Modified Rubrics

- Performance Based Assessments

Formative Assessments

- Class Discussion
- Teacher observation
- Exit/Entrance Tickets
- Classwork
- Homework

Summative Assessments

- Quizzes
- Test
- Projects

RESOURCES (Instructional, Supplemental, Intervention Materials)

Core Instructional Materials

- Sullivan Algebra and Trigonometry Textbook (Chapter 14)

Supplemental Materials

- Khan Academy
- Deltamath
- Illustrative Mathematics Tasks by standard
- Illustrative Mathematics Curriculum
- Desmos

INTERDISCIPLINARY CONNECTIONS

Interdisciplinary connections are frequently addressed through modeling and application problems whereby students solve and analyze situations such as carnival games, probability of graduation, likelihood an event will happen, and distribution of test score Examples can be found in topic specific textbook problems and digital resources.

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.