Unit 6: Probability and Data Analysis

Content Area: **Mathematics**
Course(s): **Mathematics**
Time Period: **Week 23**
Length: **4 Weeks**
Status: **Published**

Unit Overview

In this unit, students use sample spaces to calculate probabilities and odds. They identify and use the number of permutations or combinations in a set of objects to calculate the probability of an event. They find probability of simple and compound events by determining if the events are mutually exclusive or overlapping, or whether the events are dependent or independent. They will be able to identify populations and different methods of sampling. Students compare measures of central tendency; the mean, median, mode; and compare measures of dispersion by using the range. They will analyze and display data in histograms, line graphs, frequency tables, stem-and-leaf plots, bar graphs, circle graphs, and box-and-whisker plots. Students will make scatter plots of data and use a line of fit to model and interpret the data using paper and pencil and technology.

Standards

MA.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots).
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.B.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.
MA.S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
MA.S-ID.B.6a	Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data.
MA.S-ID.B.6b	Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.
MA.S-ID.B.6c	Fit a linear function for a scatter plot that suggests a linear association.
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.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-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.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, $P(A \text{ and } B) = [P(A)] \times [P(B \mid A)] = [P(B)] \times [P(A \mid B)]$, 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.
MA.S-MD.B.6	Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
MA.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).
MA.8.SP.A.1	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
MA.8.SP.A.2	Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit (e.g. line of best fit) by judging the closeness of the data points to the line.
MA.8.SP.A.3	Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.
MA.8.SP.A.4	Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

Essential Questions

1. How can mathematical models be used to clarify mathematical relationships?
2. How can mathematical models be used to describe physical relationships?
3. How can you determine which type of display to use with a set of data?

Application of Knowledge and Skills...

Students will know that...

1. probabilities can be independent or dependent.

2. events can be mutually exclusive or overlapping.

3. the numbers representing odds in favor and odds against are reciprocals.

4. a permutation is an arrangement of objects in which order is important.

5. a combination is a selection of objects in which order is not important.

6. a biased sample has a population that is over- or under-represented.

6. measures of central tendency and dispersion are used to describe a set of data.

7. different data displays are used to represent different types of data.

Students will be able to:

a. find sample spaces and probabilities.

b. find the odds in favor and the odds against an event happening.

c. find probabilities using permutations and combinations.

d. find probabilities of compound events.

e. identify populations and sample methods.

f. compare measures of central tendency and dispersion.

g. make and interpret the following: stem-and-leaf plots, box-and-whisker plots, frequency tables, histograms, line graphs, bar graphs, and circle graphs.

h. make and interpret scatter plots and write equations to model the data.

i. make predictions using best-fitting lines.

Assessments

Daily Warm-Up Problems
Diagnostic: Other written assessments

Students will solve one or two problems from the previous lesson to assess readiness.

Communicator Practice
Diagnostic: Other written assessments

Students will solve practice problems on communicators to receive immediate feedback.

Ticket to Leave Problems
Formative: Other written assessments

Students will complete one or two problems to assess knowledge and skills learned from the lesson.

Probability and Sampling Quiz
Formative: Written Test

Students will take a quiz on calculating and interpreting probabilities, permutations, and combinations and sampling methods and populations.

Unit Test
Summative: Written Test

Students will take a test on all topics covered in the unit.

Activities

Finding Probabilities of Compound Events

Students will use Venn diagrams to find probabilities.

Investigating Algebra Activity: Combinations

Measures of Central Tendency Project

Students will use measures of central tendency and dispersion to analyze student collected data on a topic of their choice. They will calculate the measures using paper and pencil and the graphing calculator. They will also create data displays best suited to represent the data.

Voting Rights Activity

Students will analyze information about female voters.

Enrichment Project: Snack Time

Students will use data analysis and probability to determine whether or not to install vending machines at the school.

Activities to Differentiate Instruction

Mixed-ability grouping

Interactive Smart Board activities

Multi-Step Problem Solving

Math stations

Cooperative learning

Study guides (teacher and student completed)

Modify tests and homework as needed

Modified grading rubrics

Graphic organizers

Communicator response boards

Extended response questions

Challenge and enrichment homework, worksheets and enrichment project

Optional weekly challenge problems

Integrated/Cross-Disciplinary Instruction

Students will use skills learned in language arts when answering extended response questions

Resources

McDougal Littell Algebra 1 textbook and resource materials

Website: www.classzone.com (see link)

Kuta Software

Algebra with Pizzazz

Punchline Algebra

Smart Exchange Website (see link)

Grade 8 Ask Math

American Diploma Project Algebra 1 End-of-Course Exam

Discovering Math: Advanced: Statistics and Data Analysis: Part 01
A Segment of: Discovering Math: Advanced: Statistics and Data Analysis: Part 01

Video (see link)

Discovering Math: Advanced: Statistics and Data Analysis: Part 02

Video (see link)

Classzone Website
Smart Exchange Website
http://player.discoveryeducation.com/index.cfm?guidAssetId=7E84C036-8265-4618-8247-E1E5F89BA6BF&blnFromSearch=1&productcode=US
http://player.discoveryeducation.com/index.cfm?guidAssetId=ACD298DC-8CD7-4F6E-BD85-88958BF8F4EA&blnFromSearch=1&productcode=US

21st Century Skills

CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP11.1	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.
CRP.K-12.CRP12.1	Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.