Unit 13: Applications of Probability

Content Area: **Mathematics**
Course(s): **Geometry, Honors Geometry**
Time Period: **May**
Length: **4 weeks**
Status: **Published**

Unit Overview

- Combinations as opposed to permutations
- Compound events, mutually exclusive events, complements
- Finding the probability of independent and dependent events using real-world contexts.
- Finding theoretical probabilities including card games, dice games and geometric problems.
- Permutations with and without repetition.

Enduring Understandings

- Probability quantifies the likelihood that something will happen and enables us to make predictions and informed decisions.

Essential Questions

- How can experimental and theoretical probabilities be used to make predictions or draw conclusions?

Student Learning Objectives

- To apply the fundamental principal of counting
- To display data using frequency distributions, histograms, and stem-and-leaf plots, and to compute central measures of tendency
- To find the number of permutations of the elements of a set
- To find the probability that an event will occur
- To identify mutually exclusive and independent events and to find the probability of such events
- To recognize and analyze normal distribution
- To specify sample spaces and events for random events

Standards

MA.S-ID	Interpreting Categorical and Quantitative Data
MA.S-ID.A	Summarize, represent, and interpret data on a single count or measurement variable
	Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical

	package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts. Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7 × 8 equals the well remembered 7 × 5 + 7 × 3, in preparation for learning about the distributive property. In the expression $x^2 + 9x + 14$, older students can see the 14 as 2 × 7 and the 9 as 2 + 7. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.
MA.S-IC	Making Inferences and Justifying Conclusions
MA.S-CP	Conditional Probability and the Rules of Probability
MA.S-CP.A	Understand independence and conditional probability and use them to interpret data
MA.S-CP.B	Use the rules of probability to compute probabilities of compound events in a uniform probability model
MA.S-MD.A	Calculate expected values and use them to solve problems
MA.S-MD.B	Use probability to evaluate outcomes of decisions

Indicators

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.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.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-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.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.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).

Lesson Titles

- Frequency distributions, histograms, and stem-and-leaf plots, and central measures of tendency
- Fundamental principal of counting
- Mutually exclusive and independent events
- Normal distribution
- Permutations
- Probability of an event
- Sample spaces and random events

Career Readiness, Life Literacies & Key Skills

WRK.9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.

TECH.9.4.2.CI.2	Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a).
TECH.9.4.2.CT.3	Use a variety of types of thinking to solve problems (e.g., inductive, deductive).
TECH.9.4.2.DC.3	Explain how to be safe online and follow safe practices when using the internet (e.g., 8.1.2.NI.3, 8.1.2.NI.4).
TECH.9.4.2.TL.2	Create a document using a word processing application.
TECH.9.4.2.TL.3	Enter information into a spreadsheet and sort the information.

Inter-Disciplinary Connections

LA.RL.9-10.1	Cite strong and thorough textual evidence and make relevant connections to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
LA.RL.9-10.4	Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language evokes a sense of time and place; how it sets a formal or informal tone).
LA.RI.9-10.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.) and make relevant connections, to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.
LA.RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
LA.RI.9-10.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language of a court opinion differs from that of a newspaper).
LA.WHST.9-10.1.E	Provide a concluding paragraph or section that supports the argument presented.

Instructional Strategies. Learning Activities. and Levels of Blooms/DOK:

- Intro. analyzing statistical data
- Intro. central measures of tendency
- Intro. frequency distributions
- Intro. how to interpret and develop a histogram
- Intro. how to interpret and develop a stem-and-leaf plot
- Intro. independent events
- Intro. measures of dispersion
- Intro. mutually exclusive events
- Intro. permutations and combinations
- Intro. probability
- Intro. properties of the standard normal distribution
- Intro. quartiles
- Intro. sample spaces and events

- Intro. standard normal distribution
- Intro. students to presenting data
- Intro. the fundamental principle of counting
- Intro. the standardized value
- Intro. when to apply each central measure of tendency
- Review anticipatory Set
- Review Homework
- Review Quiz
- Review standardized-test practice questions for warmup
- Students will take a quiz on permutations and combinations
- students will take a quiz on presentation of data and central measures of tendency
- students will take a quiz on probability
- students will take a test on applications of probabililty

Modifications:

ELLs Modifications

- Offer alternate/or modify assessments
- 1:1 testing
- Focus on domain specific vocabulary and keywords
- Tutoring during Delsea One
- Utilize explicit learning strategies that are well planned in advance (intentional planning)

IEP & 504 Modifications

- direct teaching and/or assistance for organization, social skills/peer interactions
- modeling and showing lots of examples
- students could use calculator and/or other math tools (x grids, chips, etc)
- Tutoring during Delsea One

G&T Modifications

- Different test items.
- Employ differentiated curriculum to keep interest high.
- Math- provide additional rigorous challenge problems for advanced students
- Tutoring during Delsea One

At Risk Modifications

- Additional help during tutoring/Delsea One/Academic Enrichment
- Retesting
- Speaking to students privately when redirecting behaviors
- Study Guides
- Tutoring during Delsea One

Benchmark Assessment

Skills-based assessment- math practice

Formative Assessment

- closure using area and similarity in geometry to find probability of occurrence
- journal write
- pass out of class
- think-pair-share
- warm up relate probability to an event's occurrence

Summative Assessment

- Alternate Assessment
- Marking Period Assessment
- Test on probability of event as related to geometric figures

Resources & Technology

Resources and Materials

- Protractors
- Geometry Text Book- McDougal – Littell
- Manipulatives
- Ruler

- Study Guide and Practice Sheet – Glencoe/McGraw Hill
- Teacher Created worksheets
- Teacher Generated worksheets

Technology

- Geometer sketchpad
- Mathxl
- Smart Board
- Ti-84 calculator
- Videos

TECH.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.12.A.CS2	Select and use applications effectively and productively.
TECH.8.1.12.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.