Unit 7: Probability

Content Area: **Mathematics**
Course(s): **Algebra 3CP**
Time Period: **Semester 2**
Length: **6 weeks**
Status: **Published**

Unit Description

This unit develops students' understanding of counting techniques and probability concepts used to analyze real-world situations involving uncertainty and decision-making. Students will learn to apply the Fundamental Counting Principle with and without repetition, distinguish between permutations and combinations, and calculate probabilities of simple and compound events. The unit also introduces factorial notation, permutations of subsets, permutations with repetition, unions and intersections of sets, Venn diagrams, conditional probability, and the relationships among independent, conditional, and mutually exclusive events. Instruction is designed to support learners who may struggle with abstract mathematical concepts by emphasizing visual models, real-life applications, guided practice, and multiple representations of mathematical thinking.

Essential Questions

How can counting principles be used to determine the number of possible outcomes in a situation?

When should permutations be used instead of combinations?

How does repetition affect counting and arrangement problems?

What does probability tell us about the likelihood of an event?

How can compound probabilities be calculated and interpreted?

What is the difference between independent, conditional, and mutually exclusive events?

How do Venn diagrams help represent relationships among events?

How can probability be applied to real-world decision-making?

Standards

MA.K-12.2	Reason abstractly and quantitatively.
MA.S-CP.A	Understand independence and conditional probability and use them to interpret 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 □ 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.
MA.S-CP.A.3	Understand the conditional probability of □ given □ as □(□ □□□ □)/□(□), 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 □.
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 □ given □ as the fraction of □'s outcomes that also belong to □, and interpret the answer in terms of the model.
MA.S-CP.B.7	Apply the Addition Rule, □(□ □□ □) = □(□) + □(□) – □(□ □□□ □), and interpret the answer in terms of the model.
MA.S-CP.B.8	Apply the general Multiplication Rule in a uniform probability model, □(□ □□□ □) = [□(□)] × [□(□|□)] = [□(□)] × [□(□|□)], 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.

Enduring Understandings

- Probability is a measure of likelyhood.
- A random experiment is an experiment in which there are multiple outcomes, and the outcome of the experiment is completely random.
- A sample space is the set of possible outcomes for a particular random experiment.
- Permutations and Combinations are used to count the number or possible outcomes for a random experiment
- Two events are said to be independent if the outcome of one event has no impact on the outcome of the other.
- Conditional probability allows you to compute the probability of one event given another event has occured.

Knowledge and Skills

- Apply the Fundamental Counting Principle with and without repetition.
- Determine the total number of outcomes in multi-stage experiments.
- Define and evaluate factorial expressions.
- Calculate permutations of entire sets and subsets.
- Solve permutation problems involving repeated elements.
- Distinguish between situations requiring permutations and combinations.
- Calculate combinations using appropriate formulas.
- Determine probabilities of simple events.
- Calculate probabilities of compound events using addition and multiplication rules.
- Identify and calculate unions and intersections of sets.
- Interpret and construct Venn diagrams to represent event relationships.
- Determine conditional probabilities from tables, diagrams, and contextual situations.
- Differentiate between independent, dependent, and mutually exclusive events.

- Use mathematical reasoning to justify probability calculations.
- Apply probability concepts to real-world contexts involving data and uncertainty.

Transfer Goals

Students will independently use counting methods and probability concepts to analyze situations involving uncertainty, make predictions, evaluate risks, and support decision-making in academic, professional, and personal contexts. They will transfer their understanding of permutations, combinations, and probability relationships to solve unfamiliar problems, interpret statistical information, and communicate mathematical reasoning effectively. Students will recognize how probability models are used in fields such as business, healthcare, technology, social sciences, and everyday decision-making.

Resources

Intermediate Algebra with Applications 5/6th ed by Aufmann/Barker/Lockwood

Online resources which include, but are not limited to: Desmos Graphing Calculator, Class Kick, Delta Math, Khan Academy, and CK-12 Foundation's Algebra 2 with Trigonometry Concepts by CK-12/Gloag/ Rawley, last modified April 12, 2024