06 - Probability & Expected Value

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

General Overview, Course Description or Course Philosophy

Pre-Algebra 7A units were created and organized in line with the areas of focus as identified by the New Jersey Student Learning Standards. Each unit consists of standards that are considered major content along with standards that are supporting and/or additional content. The expectation is that students will have many opportunities to develop fluency with rational number arithmetic and solving multi-step problems (including those involving positive and negative rational numbers and word problems leading to one variable equations) throughout the school year. This course prepares students to take Algebra 1 in Grade 8 by addressing a combination of Grade 7 and Grade 8 standards in one school year.

This unit develops students' abilities to understand and reason about the probability of simple and compound events. They will use this understanding to develop fluency in finding likelihoods, relative frequencies, and determining the sample space for compound events. Students will gain an understanding of experimental and theoretical probabilities and the relationship between them. They will also compare probabilities, design simulations, and apply their understanding of probability to solve real-world problems. This unit also makes important connections between probability and rational numbers, geometry, statistics, science, and business.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

Objectives:

Experimental and Theoretical Probabilities:

- Understand experimental and theoretical probabilities
- Recognize that probabilities are useful for predicting what will happen over the long run
- For an event described in everyday language, identify the outcomes in a sample space that compose the event
- Interpret experimental and theoretical probabilities and the relationship between them and recognize that experimental probabilities are better estimates of theoretical probabilities when they are based on larger numbers
- Distinguish between outcomes that are equally likely or not equally likely by collecting data and analyzing experimental probabilities
- Realize that the probability of simple events is a ratio of favorable outcomes to all outcomes in the sample space

- Recognize that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring
- Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability
- Determine the fairness of a game

Reasoning With Probability:

- Explore and develop probability models by identifying possible outcomes and analyze probabilities to solve problems
- Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events
- Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process
- Represent sample spaces for simple and compound events and find probabilities using organized lists, tables, tree diagrams, area models, and simulation
- Realize that, just as with simple events, the probability of a compound event is a ratio of favorable outcomes to all outcomes in the sample space
- Design and use a simulation to generate frequencies for simple and compound events
- Analyze situations that involve two or more stages (or actions) called compound events
- Use area models to analyze the theoretical probabilities for two-stage outcomes
- Analyze situations that involve binomial outcomes
- Use probability to calculate the long-term average of a game of chance
- Determine the expected value of a probability situation
- Use probability and expected value to make a decision

Essential Questions:

- How can probability be used to predict future events?
- What real-life applications would involve finding the probability of an event?
- How does one use modeling to form a prediction? Why would one need to use a probability model?
- What is a simulation? How can it be useful?

Enduring Understanding:

- Probabilities are ratios. Probability can be used to predict outcomes in real world events or analyze games for fairness.
- Theoretical probability is determined by reasoning about the likelihood of a specific outcome based on all possible outcomes of an event.
- Lists, tree diagrams, or area models can show all of the possible outcomes and determine the theoretical probability of a compound event.
- The experimental probability of an event can be found by gathering data from experiments or observations, counting the number of times the specified outcome

occurred, and comparing that to the number of trials.

CONTENT AREA STANDARDS

7.SP

A. Use random sampling to draw inferences about a population

B. Draw informal comparative inferences about two populations

C. Investigate chance processes and develop, use, & evaluate probability models

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.
MA.7.SP.C.5	Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
MA.7.SP.C.6	Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability.
MA.7.SP.C.7	Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.
MA.7.SP.C.7a	Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events.
MA.7.SP.C.7b	Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.
MA.7.SP.C.8	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
MA.7.SP.C.8a	Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
MA.7.SP.C.8b	Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., "rolling double sixes"), identify the outcomes in the sample space which compose the event.

MA.7.SP.C.8c	Design and use a simulation to generate frequencies for compound events.

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

9.1.8.PB.5: Identify factors that affect one's goals, including peers, culture, location, and past experiences. •
9.1.8.PB.6: Construct a budget to save for short-term, long term, and charitable goals.

WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.

STUDENT LEARNING TARGETS

Declarative Knowledge

Students will:

- Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring.
- Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
- Understand independence and conditional probability.

Procedural Knowledge

Students will be able to:

- Find the probability of simple and compound events.
- Find the relative frequency of simple events
- Predict the approximate relative frequency given the probability of a chance event.
- Compare relative frequency to experimental probability.
- Solve problems involving theoretical probability of simple events and their complements.
- Solve problems involving the probability of compound events
- Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency.
- Design and use a simulation to generate frequencies for compound events.
- Solve problems by simulating compound probability events.

- Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.
- Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events.
- Represent sample spaces for compound events using methods such as organized lists, tables, and tree diagrams.

EVIDENCE OF LEARNING

Benchmark Assessments
- BOY Diagnostic Snapshot Assessment
- MP1 Quarterly Assessment
- MP2 Quarterly Assessment
- MP3 Quarterly Assessment
- MP4 Quarterly Assessment
- EOY Diagnostic Snapshot Assessment

Formative Assessments
- Delta Math Assignments
- Do Now Check ins
- Formative Assessments - exit tickets, student-friendly proficiency scales, skill checklists ([Google Drive Folder](#))

Summative Assessments
- Summative Assessment [Google Drive Folder](#)
- OnCourse Assessments
- Teacher created assessments (both test generator and teacher generated questions)
- Delta Math - Teacher generated assessments

Alternate Assessments

- Portfolios

- Verbal Assessment (instead of written)

- Multiple choice

- Modified Rubrics

- Performance Based Assessments

RESOURCES (Instructional, Supplemental, Intervention Materials)

Instructional Materials:

- Reveal Math Accelerated - Probability (Module 9) ([Online link](#) - teacher and student resources)
- Resources for Unit 6 [Google Drive Folder](#)

Supplemental/Intervention Materials:

- Desmos - [Intro to Probablilty](#), [Last Taco](#)
- [Delta Math](#)
- [Khan Academy](#)
- [NCTM Illuminations](#)
- [Illustrative Math](#)
- [Illustrative Math Tasks](#)

INTERDISCIPLINARY CONNECTIONS

- Data collection/analysis
- Computations
- Statistics

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.