# Unit 10: Probability

Content Area: **Mathematics**
Course(s): **Geometry Honors 8**
Time Period: **June**
Length: **3 weeks**
Status: **Published**

## Transfer

By the end of this unit: Students will be comfortable using set notation and calculating probability for an event to occur given a sample space. Honors students will go further by analyzing real world scenarios where probability has been used to see if it was used in a way that skewed the results.

Instructional Strategies:

- Use Venn diagrams and set notation to describe sample spaces to connect to the words "and" and "or" visually.
- Since this is the first time students have worked with probability is a while, start with simple probability as a review.
- (+) = denotes Honors only skill not on PARCC

## Essential Questions

What are the different ways we can represent a sample space?

What are the different conditions that will affect how probability is calculated?

## Enduring Understandings

Sample spaces can be represented using tree diagrams, lists, Venn diagrams, and set notation.

Sample spaces can be independent or dependent and events can be mutually exclusive or not mutually exclusive.

## Standards in Mathematics

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| 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 $A$ 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 | Use the rules of probability to compute probabilities of compound events in a uniform probability model |
| 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 | Use probability to evaluate outcomes of decisions |
| 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 | Investigate patterns of association in bivariate data. |
| 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. |

## Critical Knowledge and Skills

## Vocabulary

Describing Sample Spaces

Conditional Probability

Two-Way Frequency Tables

Everyday Probability

Permutations and Combinations (+)

Analyzing Probability in Real Life (+)

## Learning Objectives

Diagram and visualize sample spaces using set lists, tree diagrams, tables, and Venn diagrams.

Use mutually exclusive, complement, intersection and union to describe subsets of sample space and diagram them using a Venn diagram.

Explain what independence between two event means.

Determine if two events are independent of each other using $P(A) \bullet P(B) = P(A \text{ and } B)$.

Define and distinguish between mutually exclusive and independent.

Define independence using a conditional probability.

Determine if the probabilities probability is independent or not.

Test if events are independent or not by checking if $P(A|B) = P(A)$.

Construct a two-way frequency table.

Complete a two-way table given partial information.

Determine from a two-way frequency table basic probabilities, intersections, unions and conditional probabilities.

Determine independence of events using the data found in a two-way frequency table.

Determine convert a two-way frequency table to a two-way relative frequency table.

Recognize the concepts of conditional probability based on everday language and every day situations.

Recognize the concepts of independence based on everyday language and every day situations.

Calculate conditional probabilities for both independent and dependent events.

Explain conditional probability through Venn diagrams.

Calculate probabilities using the Addition Rule of probability.

Understand the Addition Rule of probability through Venn diagrams.

Calculate probabilities using the General Rule of Multiplication, $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$. (+)

Understand the General Rule of Multiplication through Venn diagrams. (+)

Determine whether the sample space is a Fundamental Counting Principle, Permutation or Combination format. (+)

Determine sample spaces using Permutation and Combinations. (+)

Determine probabilities using Permutations and Combinatioins. (+)

Derive and explain where the formulas for Permutations and Combinations come from. (+)

Use probability to make fair decisions. (+)

Analyze a given situation to determine if probability is used appropriately. (+)

## Resources

Pearson Resources:

Ch. 13

Online Resources:

- http://www.shmoop.com/common-core-standards/math-statistics-probability-conditional-probability-rules-probability.html

- http://www.shmoop.com/common-core-standards/math-statistics-probability-using-probability-make-decisions.html

- https://www.illustrativemathematics.org/HSS-CP (There are quite a few in this link)