

# Unit 5 (OPTIONAL): Probability

Content Area: **Mathematics**  
Course(s): **Generic Course, Geometry**  
Time Period: **4th Marking Period**  
Length: **2.5 Weeks**  
Status: **Published**

## Unit Overview

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This unit is designed to help students:

- Understand independence and conditional probability and use them to interpret data
- Use the rules of probability to compute probabilities of compound events in a uniform probability model
- Calculate expected values and use them to solve problems
- Use probability to evaluate outcomes of decisions

## Transfer

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Students will be able to independently use their learning to...

- Understand how probability is useful in interpreting data
- Use probability to make informed decisions
- Determine whether events are dependent upon or independent of one another

## Meaning

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## Understandings

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Students will understand that...

- Probability describes the likelihood that an event will occur, and can be used to make predictions in real-life situations.
- Probabilities are always between 0 and 1.
- Events are independent of one another if the occurrence of one does not effect the probability of the occurrence of the other. Otherwise, they are dependent upon one another.
- Specific formulas can be helpful in calculating various probabilities.

## **Essential Questions**

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Students will keep considering...

- How can I use probability to help me make decisions?
- How can I determine the probabilities of various events, both independent and dependent?

## **Application of Knowledge and Skill**

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### **Students will know...**

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- The difference between theoretical, experimental, and geometric probability
- How to distinguish between independent and dependent events
- How to calculate both theoretical and experimental probabilities

### **Students will be skilled at...**

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- Differentiating between dependent and independent events
- Calculating various probabilities
- Using probability to justify decisions

## **Academic Vocabulary**

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- combination
- complement
- compound event
- conditional probability
- conditional relative frequency
- dependent events
- equally likely outcomes
- event
- experiment
- experimental probability

- factorial
- favorable outcomes
- Fundamental Counting Principle
- geometric probability
- inclusive events
- independent events
- joint relative frequency
- marginal relative frequency
- mutually exclusive events
- outcome
- permutation
- probability
- sample space
- simple event
- theoretical probability
- trial

### **Learning Goal 6.1**

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Students will apply concepts of experimental and theoretical probabilities to solve real-world problems.

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### **Target 5.1.1 (Level of Difficulty: 2 - Skill)**

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SWBAT solve problems involving the Fundamental Counting Principle.

- SWBAT solve problems involving the Fundamental Counting Principle.

MA.K-12.1

Make sense of problems and persevere in solving them.

MA.K-12.7

Look for and make use of structure.

### **Target 6.1.2 (Level of Difficulty - 2: Skill) (+)**

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SWBAT solve problems involving permutations and combinations.

- SWBAT solve problems involving permutations and combinations.

MA.K-12.1

Make sense of problems and persevere in solving them.

MA.K-12.4

Model with mathematics.

MA.K-12.5

Use appropriate tools strategically.

MA.S-CP.B.9

Use permutations and combinations to compute probabilities of compound events and

solve problems.

### **Target 6.1.3 (Level of Difficulty - 3: Strategic Thinking) (+)**

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SWBAT find the experimental and theoretical probabilities of an event.

Note: See <http://illuminations.nctm.org/Lesson.aspx?id=1145>

- SWBAT find the experimental and theoretical probabilities of an event.

MA.K-12.1	Make sense of problems and persevere in solving them.
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.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).

### **Target 6.1.4 (Level of Difficulty - 3: Strategic Thinking)**

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SWBAT differentiate between dependent and independent events, and find the probabilities of each.

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MA.K-12.1	Make sense of problems and persevere in solving them.
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.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.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.

## Learning Goal 6.2

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SWBAT use tables and diagrams to find probabilities of compound events.

### Target 6.2.1 (Level of Difficulty: 2 - Skill)

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SWBAT construct and interpret two-way frequency tables of data when two categories are associated with each object being classified.

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MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.4	Model with mathematics.
MA.K-12.7	Look for and make use of structure.
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.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.

### Target 6.2.2 (Level of Difficulty: 3 - Strategic Thinking)

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SWBAT differentiate between, and find the probabilities of, both mutually exclusive events and inclusive events.

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MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.4	Model with mathematics.
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.

### Target 6.2.3 (Level of Difficulty: 3 - Strategic Thinking) (+)

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STWBAT apply the general Multiplication Rule in a uniform probability model, and interpret the answer in terms of the model.

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answer in terms of the model.

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.7	Look for and make use of structure.
MA.S-CP.B.8	Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = [P(A)] \times [P(B   A)] = [P(B)] \times [P(A   B)]$ , and interpret the answer in terms of the model.

## 21st Century Life and Careers

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WORK.9-12.9.1.12.1	The ability to recognize a problem and apply critical thinking and problem-solving skills to solve the problem is a lifelong skill that develops over time.
WORK.9-12.9.1.12.1	Collaboration and teamwork enable individuals or groups to achieve common goals with greater efficiency.
WORK.9-12.9.1.12.2	Critical thinking and problem solving in the 21st century are enhanced by the ability to work in cross-cultural teams in face-to-face and virtual environments.
WORK.9-12.9.1.12.2	Leadership abilities develop over time through participation in groups and/or teams that are engaged in challenging or competitive activities.
WORK.9-12.9.1.12.A.1	Apply critical thinking and problem-solving strategies during structured learning experiences.
WORK.9-12.9.1.12.F.2	Demonstrate a positive work ethic in various settings, including the classroom and during structured learning experiences.
WORK.9-12.9.3.12.C.6	Develop job readiness skills by participating in structured learning experiences and employment seeking opportunities.

## Summative Assessment

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- Projects
- Quizzes
- Student Portfolios
- Tests
- Unit 1 Assessment (Common Assessment)

## Formative Assessment and Performance Opportunities

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- "I have...Who has..." Review Activities
- Academic Games
- Carousel Activities
- Class Discussions
- Classwork
- Closure Activities

- Concept Sorting Activities
- Do Nows
- Exit Tickets
- Four Corners Activities
- Graphic Organizers
- Homework
- Placemat Activities
- Question-All-Writes
- Quiz-Quiz-Trade Activities
- Station Activities
- Student Interviews
- Student Response Systems
- Student Self-Ratings
- Teacher Observation
- Teacher Questioning
- Think, Pair, Share Discussions
- Thumbs Up/Down
- Whip Around
- Whiteboard Use

## **Differentiation/Enrichment**

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- 504 Accommodations
- Challenge Problems
- IEP Modifications
- Learning Centers/Stations
- Leveled Practice Opportunities
- Scaffolding Questions
- Small Group Instruction
- Student Companion Website Resources
- Technology
- Use of Manipulatives (Paper Strips, Exploragons, etc.)

## **Unit Resources**

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- Textbook: Geometry, Common Core Ed. (Holt McDougal, 2012)
- Textbook Resource Kit & Companion Website: <https://my.hrw.com/>
- Geometer's Sketchpad
- Kuta Software

Additional Websites:

- Dan Meyer's 3-Act Math Tasks:  
<https://docs.google.com/spreadsheets/pub?key=0AjIqyKM9d7ZYdEhtR3BJMmdBWnM2YWxWYVM1UWowTEE&output=htmlG>
- Engage NY: Geometry Lesson Notes & Handouts: <https://www.engageny.org/resource/high-school-geometry>
- Geometry Teacher Mike Patterson's Common Core Teaching Notes:  
<http://www.geometrycommoncore.com/>
- Khan Academy: <https://www.khanacademy.org/>
- NCTM Illuminations Website: Resources for Teaching Math:  
<http://illuminations.nctm.org/Default.aspx>
- PARCC Educator Resources: <http://www.parcconline.org/for-educators>
- The Geometer's Sketchpad Resource Center: <http://www.dynamicgeometry.com/>