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

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

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

Understandings

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

Students will keep considering...

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

Application of Knowledge and Skill

Students will know...

- 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...

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

Academic Vocabulary

- 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

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

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Target 5.1.1 (Level of Difficulty: 2 - Skill)

SWBAT solve problems involving the Fundamental Counting Principle.

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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) (+)

SWBAT solve problems involving permutations and combinations.

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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.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) (+)

SWBAT find the expiremental and theoretical probabilities of an event.

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

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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.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)

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

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

Target 6.2.1 (Level of Difficulty: 2 - Skill)

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)

SWBAT differentiate between, and find the probabilites 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) (+)

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, $P(A \text{ and } B) = [P(A)] \times [P(B \mid A)] = [P(B)] \times [P(A \mid B)]$, and interpret the answer in terms of the model.

21st Century Life and Careers

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

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

Formative Assessment and Performance Opportunities

- "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

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

Unit Resources

- 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/spreadsheet/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/