NEW MILFORD PUBLIC SCHOOLS

New Milford, Connecticut

Practical Math - Applications of Probability

December 2021

BOE Approved March 2022

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BOE Approved March 2022

New Milford's Mission Statement

The mission of the New Milford Public Schools, a collaborative partnership of students, educators, family and community, is to prepare each and every student to compete and excel in an ever-changing world, embrace challenges with vigor, respect and appreciate the worth of every human being, and contribute to society by providing effective instruction and dynamic curriculum, offering a wide range of valuable experiences, and inspiring students to pursue their dreams and aspirations.

BOE Approved March 2022

Practical Math - Probability

High School grade 12

The goal of this ½ year (one semester) course is to provide a fundamental understanding of probability. Topics include: Basic probability, compound probabilities, combinations and permutations, geometric probabilities and probabilities associated with graphs/charts and 2- way frequency tables. Also included are applications associated with these topics, as well as the use of the graphing calculator and computer.

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Pacing Guide

Unit Title	# of weeks
1. Basic Probability – including charts and graphs	2
2. Applications of Odds	2
3. Applications of the Addition Rule	2
4. Applications of the Multiplication Rule	3
5. Applications of the Counting Principle	2
6. Applications of Combinations and Permutations	4
7. Applications of Geometric Probabilities	3
8. Review and Final assessment	2

ESTABLISHED GOALS

CCSS.MATH.CONTENT.HSS.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").
CCSS.MATH. 7.SP.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.
Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events.
CCSS.MATH. 7.SP.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.
CCSS.MATH.CONTENT.HSS.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.
CCSS.MATH.CONTENT.HSS.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.

Transfer

Students will be able to independently use their learning to…

Make sense of a problem by initiating a plan and designing a method to solve a problem
Make use of structure by organizing data into appropriate frequency tables
Model with mathematics by displaying probability with the appropriate method
Justify reasoning or understanding by making interpretations of the probability based on the data and tables

Meaning

UNDERSTANDINGS
Students will understand that…

- Probability describes the likelihood an event will occur.
- Data is collected for a purpose and has meaning in a context.
- A probability is a number between and including 0 and 1.
- The complement of event A consists of all outcomes in which event A does not occur.
- The probability of an event's occurrence can be predicted with varying degrees of confidence.

ESSENTIAL QUESTIONS
Students will keep considering…

- How is probability used in everyday life?
- How do you conduct a probability experiment?
- What is the difference between theoretical and experimental probabilities?
- How do the rules of probability play into the statistics field?
- What is conditional probability?

	Acquisition	
	Students will know… - The basic definition and rules of probability - The probability of an event must have a value between 0 and 1, inclusively - The Complement Rule to make calculating probabilities simpler - Probabilities have a direct relationship to the gaming and sports industries - Probabilities are used to influence actions in various other industries	*Students will be skilled at…* - Calculating simple probabilities, including complements of events - Applying probability calculations to real-world situations

Code	**Evaluative Criteria**	**Assessment Evidence**

	Further information:	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…*
T, M	Scoring Rubric used to evaluate successful understanding of the concepts of probability as they apply each appropriate strategy and organize their work	Goal: to successfully answer probability questions as they relate to several real situations Role: student Audience: teacher
M, A	Thorough understanding of vocabulary, probability notation and ability to successfully complete basic probability	Situation: complete a series of tasks related to probability through the use of games, manipulatives and real data. Product or Performance: completion of the activities at all stations
T, M, A	Accurate application of content in completing problems involving the addition, complement, and conditional rules and demonstrating an understanding of the vocabulary associated with these topics and recognizing the difference between them	Standards for Success: Accurate results for the majority of the activities
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* - Participation in class discussion, group work, and responses. - Projects/performance tasks - Activity cards: - Working with manipulatives - Working with games - Working with real data - Summative assessments Quizzes Unit Test (may include 10-20 multiple choice, 15-30 regular answer)

Code	***Pre-Assessment*** - Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on solving equations,order of operations and substitution - Prerequisite knowledge is reinforced through algebra review assignments - Teacher will provide review and assessment on prerequisite probability vocabulary knowledge to ensure all students are capable of communicating effectively	
transfer master acquire	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
A	Teacher will introduce vocabulary and notation for basic, complement, and conditional probability	Warm up questions Monitoring class work through board work, group work, questioning, and walk-arounds
M, A	Teacher and students will collectively practice using the vocabulary and basic probability	Check for understanding via going over homework and medium such as reflections and exit tickets
T, M, A	Teacher differentiates through purposeful or flexible grouping, the use of diagrams and explanations to demonstrate understanding and active lessons involving scaffolding, games, and use of hands-on manipulatives	Class worksheets with direct teacher observation and/or student self assessment
T, M, A	Students will complete practice problems to demonstrate their level of understanding of vocabulary and notation	Practice on whiteboard with direct teacher observation Kahoot quiz with review questions and direct teacher supervision
T, M, A	Students will complete practice problems to demonstrate their level of understanding of basic probability and conditional rules. Practice will include work with 2-way frequency tables and problems similar to those seen on standardized tests	Homework assignments with direct teacher observation or self assessment
T, M	Students will explore probability using the unit's performance task and complete an activity based review in preparation for a unit assessment. (i.e. carnival games, sporting data and manipulatives)	

<table>
<tr><td rowspan="5">ESTABLISHED GOALS

<u>CCSS.Math.Content.7.SP.C.5</u>
Understand that the probability of a chance event is a number between 0 and 1, inclusively, that expresses the likelihood of the event occurring. Understand the odds of an event are not the same as the probability of an event.</td><td colspan="2">Transfer</td></tr>
<tr><td colspan="2">Students will be able to independently use their learning to…
Make sense of a problem by initiating a plan and designing a method to solve a problem
Makes use of structure by organizing data in to appropriate frequency tables
Model with mathematics by displaying odds with the appropriate method
Justify reasoning or understanding by making interpretations of the odds based on the data and tables</td></tr>
<tr><td colspan="2">Meaning</td></tr>
<tr><td>UNDERSTANDINGS
Students will understand that…

- The odds of an event are a comparison between the probability of the event and its complement.</td><td>ESSENTIAL QUESTIONS
Students will keep considering…

- What do the odds of an event tell us
- How can predictions be made using the odds of the event happening</td></tr>
<tr><td colspan="2">Acquisition</td></tr>
</table>

	Students will know…	*Students will be skilled at…*
	- The odds of an event occurring are not the same as the probability of the event - The odds of an event have a direct relationship to the gaming and sports industries - Probabilities/ odds are used to influence actions in various other industries	- Calculating the odds in favor and against an event - Calculating the odds of an event given the probability of the event - Calculating the probability of an event given the odds of the event - Applying probability/odds calculations to real-world situations

Code	**Evaluative Criteria**	**Assessment Evidence**
	Further information:	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…*
T, M	Scoring Rubric used to evaluate successful understanding of the concepts of odds as they apply each appropriate strategy and organize their work	Goal: to successfully answer probability questions as they relate to various sporting events
M, A	Thorough understanding of vocabulary, probability notation and ability to successfully complete basic probability	Role: student Audience: teacher Situation: complete a series of tasks related to probability through the use of real data.
T, M, A	Accurate application of content in completing problems involving the addition, complement, and conditional rules and demonstrating an understanding of the vocabulary associated with these topics and recognizing the difference between them	Product or Performance: completion of the activities Standards for Success: Accurate results for the majority of the activities

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* - Participation in class discussion, group work, and responses - Projects/performance tasks - Activity cards: Working with manipulatives Working with games Working with real data - Summative assessments Quizzes Unit Test (may include 10-20 multiple choice, 15-30 regular answer)

Code	***Pre-Assessment*** - Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on solving equations,order of operations and substitution - Prerequisite knowledge is reinforced through algebra review assignments - Teacher will provide review and assessment on prerequisite probability vocabulary knowledge to ensure all students are capable of communicating effectively	
transfer master acquire	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
A	Teacher will introduce vocabulary and notation for the usage of odds	Warm up questions
M, A	Teacher and students will collectively practice using the vocabulary	Monitoring class work through board work, group work, questioning, and walk-arounds
T, M, A	Teacher differentiates through purposeful or flexible grouping, the use of diagrams and explanations to demonstrate understanding and active lessons involving scaffolding, games, and use of hands-on manipulatives	Check for understanding via going over homework and medium such as reflections and exit tickets
T, M, A	Students will complete practice problems to demonstrate their level of understanding of vocabulary and notation	Class worksheets with direct teacher observation and/or student self assessment Practice on whiteboard with direct teacher observation

M, A	Teacher will instruct students on the topic of odds and the difference between odds and probability	Kahoot quiz with review questions and direct teacher supervision Homework assignments with direct teacher observation or self assessment
M, A	Teacher and students will collectively transform odds in favor of an event to odds against an event	
M, A	Teacher and students will collectively practice odds and probability	
T, M, A	Students will complete activity cards designed to review basic concepts and odds using manipulatives and real data	
T, M	Students will explore probability using the unit's performance task and complete an activity based review in preparation for a unit assessment. (i.e. carnival games, sporting data and manipulatives)	

ESTABLISHED GOALS

CCSS.MATH.CONTENT.HSS.CP.B.7
Apply the Addition Rule, P(A or B) = P(A) + P(B) - P(A and B), and interpret the answer in terms of the model.
CCSS.MATH.CONTENT.HSS.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.

Transfer

Students will be able to independently use their learning to…

Make sense of a problem by initiating a plan and designing a method to solve a problem
Makes use of structure by organizing data in to appropriate frequency tables
Model with mathematics by displaying probability with the appropriate method
Justify reasoning or understanding by making interpretations of the probability based on the data and tables

Meaning

UNDERSTANDINGS
Students will understand that…

- Events A and B are mutually exclusive if they cannot occur simultaneously.
- The probability of two mutually exclusive events is the sum of the two events
- The probability of two overlapping events is the sum of the two events minus the probability both events happen simultaneously
- A two way frequency table can be used to interpret data when two categories are associated with each object being classified

ESSENTIAL QUESTIONS
Students will keep considering…

- What is meant by mutually exclusive?
- How does the probability of two mutually exclusive events differ from the probability of two non-mutually exclusive events?
- How can you interpret data when two categories are associated with each object being classified?

	Acquisition	
	Students will know… - How and when to apply the Addition Rule - How to determine if two events are mutually exclusive - Probabilities have a direct relationship to the gaming and sports industries - Probabilities are used to influence actions in various other industries	*Students will be skilled at…* - Determining if two events are mutually exclusive or not - Calculating the probability of two mutually exclusive events - Calculating the probability of two non-mutually exclusive events - Applying probability calculations to real-world situations

Code	**Evaluative Criteria**	**Assessment Evidence**
	Further information:	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…*
T, M	Scoring Rubric used to evaluate successful understanding of the concepts of probability as they apply each appropriate strategy and organize their work	Goal: to successfully answer probability questions as they relate to several real situations Role: student
M, A	Thorough understanding of vocabulary, probability notation and ability to successfully complete basic probability using the addition rule	Audience: teacher Situation: complete a series of tasks related to probability through the use of games, manipulatives and real data.
T, M, A	Accurate application of content in completing problems involving the addition, complement, and conditional rules and demonstrating an understanding of the vocabulary associated with these topics and recognizing the difference between them	Product or Performance: completion of the activities at all stations Standards for Success: Accurate results for the majority of the activities

		OTHER EVIDENCE:
		Students will show they have achieved Stage 1 goals by…
		
		- Participation in class discussion, group work, and responses
		- Projects/performance tasks
		- Activity cards:
		  Working with manipulatives
		  Working with games
		  Working with real data
		- Summative assessments
		  Quizzes
		  Unit Test (may include 10-20 multiple choice, 15-30 regular answer)

Code	***Pre-Assessment*** - Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on solving equations,order of operations and substitution - Prerequisite knowledge is reinforced through algebra review assignments - Teacher will provide review and assessment on prerequisite probability vocabulary knowledge to ensure all students are capable of communicating effectively

transfer master acquire	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
A	Teacher will introduce vocabulary and notation for overlapping and nonoverlapping sets	Warm up questions Monitoring class work through board work, group work, questioning, and walk-arounds
M, A	Teacher and students will collectively practice using the vocabulary and basic probability using the addition rules	Check for understanding via going over homework and medium such as reflections and exit tickets
T, M, A	Teacher differentiates through purposeful or flexible grouping, the use of diagrams and explanations to demonstrate understanding and active lessons involving scaffolding, games, and use of hands-on manipulatives	Class worksheets with direct teacher observation and/or student self assessment
T, M, A	Students will complete practice problems to demonstrate their level of understanding of vocabulary and notation	Practice on whiteboard with direct teacher observation
M, A	Teacher will instruct students on the use of the addition rules of probability and vocabulary associated with these topics	Kahoot quiz with review questions and direct teacher supervision
M, A	Teacher and students will collectively practice problems comparing the addition rules	Homework assignments with direct teacher observation or self assessment
T, M, A	Students will complete practice problems to demonstrate their level of understanding of the addition rule. Practice will include work with 2-way frequency tables and problems similar to those seen on standardized tests	
T, M	Students will analyze information in a series of problems to determine whether the addition rule is appropriate in finding the solution	

ESTABLISHED GOALS

CCSS.MATH.CONTENT.HSS.CP.B.8
Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model
CCSS.MATH.CONTENT.HSS.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.
CCSS.MATH.CONTENT.HSS.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..
CCSS.MATH.CONTENT.7.SP.8
Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.

a. 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.
b. 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 events.
c. Design and use a simulation to generate frequencies for compound events.

Transfer

Students will be able to independently use their learning to…

Make sense of a problem by initiating a plan and designing a method to solve a problem
Makes use of structure by organizing data in to appropriate frequency tables
Model with mathematics by displaying probability with the appropriate method
Justify reasoning or understanding by making interpretations of the probability based on the data and tables

Meaning

UNDERSTANDINGS
Students will understand that…

- Two events, A and B, are independent if the occurrence of one does not affect the probability of the occurrence of the other.
- If A and B are not independent, then they are said to be dependent
- The probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.
- The probability of two independent events is the product of their individual probabilities
- The probability of two dependent events is the probability of the first event multiplied by the probability of the second event happening given the first event happened.

ESSENTIAL QUESTIONS
Students will keep considering…

- What is meant by independent/dependent outcomes?
- How are events defined and what are examples of each?
- How do the probabilities of independent and dependent differ?

	Acquisition	
	Students will know… - How and when to apply the Multiplication Rule - How to determine if two events are dependent or independent - Probabilities have a direct relationship to the gaming and sports industries - Probabilities are used to influence actions in various other industries	*Students will be skilled at…* - Determining if two events are dependent or independent - Calculating the probability of two dependent events - Calculating the probability of two independent events - Applying probability calculations to real-world situations

Code	**Evaluative Criteria**	**Assessment Evidence**
	Further information:	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…*
T, M	Scoring Rubric used to evaluate successful understanding of the concepts of probability as they apply each appropriate strategy and organize their work	Goal: to successfully answer probability questions as they relate to several real situations Role: student Audience: teacher
M, A	Thorough understanding of vocabulary, probability notation and ability to successfully complete basic probability	Situation: complete a series of tasks related to probability through the use of games, manipulatives and real data. Product or Performance: completion of the activities at all stations
T, M, A	Accurate application of content in completing problems involving the addition, complement, and conditional rules and demonstrating an understanding of the vocabulary associated with these topics and recognizing the difference between them	Standards for Success: Accurate results for the majority of the activities

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* - Participation in class discussion, group work, and responses - Projects/performance tasks - Activity cards: Working with manipulatives Working with games Working with real data - Summative assessments Quizzes Unit Test (may include 10-20 multiple choice, 15-30 regular answer)

Code	***Pre-Assessment*** - Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on solving equations,order of operations and substitution - Prerequisite knowledge is reinforced through algebra review assignments - Teacher will provide review and assessment on prerequisite probability vocabulary knowledge to ensure all students are capable of communicating effectively	
transfer master acquire	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
A	Teacher will introduce vocabulary and notation for dependent and independent events	Warm up questions Monitoring class work through board work, group work, questioning, and walk-arounds
A	Teacher will introduce the multiplication rule for dependent and independent events	Check for understanding via going over homework and medium such as reflections and exit tickets
M, A	Teacher and students will collectively practice using the vocabulary and multiplication rule	Class worksheets with direct teacher observation and/or student self assessment
T, M, A	Teacher differentiates through purposeful or flexible grouping, the use of diagrams and explanations to demonstrate understanding and active	Practice on whiteboard with direct teacher observation

	lessons involving scaffolding, games, and use of hands-on manipulatives	
T, M, A	Students will complete practice problems to demonstrate their level of understanding of vocabulary and notation	Kahoot quiz with review questions and direct teacher supervision
M, A	Teacher will instruct students on the use of the multiplication rules of probability and vocabulary associated with these topics	Homework assignments with direct teacher observation or self assessment
M, A	Teacher and students will collectively practice problems comparing the addition and multiplication rules	
T, M, A	Students will complete practice problems to demonstrate their level of understanding of the multiplication rule. Practice will include work with 2-way frequency tables and problems similar to those seen on standardized tests	
T, M	Students will analyze information in a series of problems to determine whether the addition or multiplication rule is appropriate in finding the solution	
T, M	Students will explore probability using the unit's performance task and complete an activity based review in preparation for a unit assessment. (i.e. carnival games, sporting data and manipulatives)	

ESTABLISHED GOALS

CCSS.MATH.CONTENT.HSS.CP.B.9
Use permutations and combinations to compute probabilities of compound events and solve problems.

Transfer

Students will be able to independently use their learning to…

Make sense of a problem by initiating a plan and designing a method to solve a problem
Makes use of structure by organizing data in to appropriate frequency tables
Model with mathematics by displaying probability with the appropriate method
Justify reasoning or understanding by making interpretations of the probability based on the data and tables

Meaning

UNDERSTANDINGS *Students will understand that…*	ESSENTIAL QUESTIONS *Students will keep considering…*
- Counting techniques can be used to find all of the possible ways to complete different tasks or choose items from a list. - The counting principle can be an alternative for some combination and permutation questions	- Can the fundamental counting principle and rules for combinations and permutations help us calculate statistical probabilities? - How does the counting principle compare to combination and permutation calculations?

Acquisition

Students will know…	*Students will be skilled at…*
- How and when to apply the counting principle - How the counting principle compares to combination and permutation calculations - How the counting principle can be used in probability calculations - Probabilities have a direct relationship to the gaming and sports industries - Probabilities are used to influence actions in various other industries	- Calculating the possible ways to complete different tasks or choosing items from a list using the counting principle - Applying the results of a counting principle question to a probability situation - Applying probability calculations to real-world situations

Code	Evaluative Criteria	Assessment Evidence
	Further information:	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…*
T, M	Scoring Rubric used to evaluate successful understanding of the concepts of probability as they apply each appropriate strategy and organize their work	Goal: to successfully answer probability questions as they relate to several real situations Role: student Audience: teacher
M, A	Thorough understanding of vocabulary, probability notation and ability to successfully complete basic probability	Situation: complete a series of tasks related to probability through the use of games, manipulatives and real data. Product or Performance: completion of the activities at all stations
T, M, A	Accurate application of content in completing problems involving the addition, complement, and conditional rules and demonstrating an understanding of the vocabulary associated with these topics and recognizing the difference between them	Standards for Success: Accurate results for the majority of the activities
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* - Participation in class discussion, group work, and responses - Projects/performance tasks - Activity cards: Working with manipulatives Working with games Working with real data - Summative assessments Quizzes Unit Test (may include 10-20 multiple choice, 15-30 regular answer)

Code	***Pre-Assessment*** - Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on solving equations,order of operations and substitution - Prerequisite knowledge is reinforced through algebra review assignments - Teacher will provide review and assessment on prerequisite probability vocabulary knowledge to ensure all students are capable of communicating effectively	
transfer master acquire	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
A	Teacher will introduce the counting principle	Warm up questions
A	Teacher will introduce vocabulary and notation for permutations and combinations	Monitoring class work through board work, group work, questioning, and walk-arounds
M, A	Teacher and students will collectively practice using the vocabulary	Check for understanding via going over homework and medium such as reflections and exit tickets
T, M, A	Teacher differentiates through purposeful or flexible grouping, the use of diagrams and explanations to demonstrate understanding and active lessons involving scaffolding, games, and use of hands-on manipulatives	Class worksheets with direct teacher observation and/or student self assessment
T, M, A	Students will complete practice problems to demonstrate their level of understanding of vocabulary and notation	Practice on whiteboard with direct teacher observation Kahoot quiz with review questions and direct teacher supervision
M, A	Teacher will instruct students on the counting principle, combinations and permutations and their use in the calculation of probabilities	Homework assignments with direct teacher observation or self assessment
M, A	Teacher and students will collectively practice problems using formulas and rework problems using technology	
T, M	Students will explore probability using the unit's performance task and complete an activity based review in preparation for a unit assessment. (i.e. carnival games, sporting data and manipulatives)	

ESTABLISHED GOALS

CCSS.MATH.CONTENT.HSS.CP.B.9
Use permutations and combinations to compute probabilities of compound events and solve problem

Transfer

Students will be able to independently use their learning to…

Make sense of a problem by initiating a plan and designing a method to solve a problem
Makes use of structure by organizing data in to appropriate frequency tables
Model with mathematics by displaying probability with the appropriate method
Justify reasoning or understanding by making interpretations of the probability based on the data and tables

Meaning

UNDERSTANDINGS
Students will understand that…

- Counting techniques can be used to find all of the possible ways to complete different tasks or choose items from a list.
- The rules for combinations apply to situations in which the order of the events does not matter
- The rules for permutations apply to situations where the order of the events does matter

ESSENTIAL QUESTIONS
Students will keep considering…

- Can the fundamental counting principle and rules for combinations and permutations help us calculate statistical probabilities?
- How do the rules for combinations and permutations differ?

	Acquisition	
	Students will know… - How and when to apply combination and permutation formulas - How the counting principle compares to combination and permutation calculations - How the results of combination/permutation problems can be used in probability calculations - Probabilities have a direct relationship to the gaming and sports industries - Probabilities are used to influence actions in various other industries	*Students will be skilled at…* - Calculate the total number of possibilities for situations involving multiple tasks or arrangements - Determine when the counting principle is a more efficient method for finding the total number of possibilities as compared to the combination/permutation formulas in the graphing calculator - Apply probability calculations to real-world situations

Code	**Evaluative Criteria**	**Assessment Evidence**
	Further information:	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…*
T, M	Scoring Rubric used to evaluate successful understanding of the concepts of probability as they apply each appropriate strategy and organize their work	Goal: to successfully answer probability questions as they relate to several real situations Role: student Audience: teacher
M, A	Thorough understanding of vocabulary, probability notation and ability to successfully complete basic probability	Situation: complete a series of tasks related to probability through the use of games, manipulatives and real data. Product or Performance: completion of the activities at all stations
T, M, A	Accurate application of content in completing problems involving the addition, complement, and conditional rules and demonstrating an understanding of the vocabulary associated with these topics and recognizing the difference between them	Standards for Success: Accurate results for the majority of the activities

		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* - Participation in class discussion, group work, and responses - Projects/performance tasks - Activity cards: Working with manipulatives Working with games Working with real data - Summative assessments Quizzes Unit Test (may include 10-20 multiple choice, 15-30 regular answer)

Code	***Pre-Assessment*** - Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on solving equations,order of operations and substitution - Prerequisite knowledge is reinforced through algebra review assignments - Teacher will provide review and assessment on prerequisite probability vocabulary knowledge to ensure all students are capable of communicating effectively	
transfer master acquire	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
A	Teacher will introduce vocabulary and notation for combinations and permutations	Warm up questions Monitoring class work through board work, group work, questioning, and walk-arounds
M, A	Teacher and students will collectively practice using the vocabulary and formulas	Check for understanding via going over homework and medium such as reflections and exit tickets
T, M, A	Teacher differentiates through purposeful or flexible grouping, the use of diagrams and explanations to demonstrate understanding and active lessons involving scaffolding, games, and use of hands-on manipulatives	Class worksheets with direct teacher observation and/or student self assessment

T, M, A	Students will complete practice problems to demonstrate their level of understanding of vocabulary and notation	Practice on whiteboard with direct teacher observation Kahoot quiz with review questions and direct teacher supervision Homework assignments with direct teacher observation or self assessment
M, A	Teacher will instruct students on the counting principle, combinations and permutations and their use in the calculation of probabilities.	
M, A	Teacher and students will collectively practice/compare the difference between combinations and permutations	
T, M, A	Students will analyze problems in order to distinguish when combinations or permutations are appropriate in solving applications and then use them to calculate probabilities	
T, M	Students will explore probability using the unit's performance task and complete an activity based review in preparation for a unit assessment. (i.e. carnival games, sporting data and manipulatives)	

ESTABLISHED GOALS

CC.9-12.S.CP.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").
CCSS.MATH. 7.SP.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
CCSS.MATH. 7.G.6.
Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

Transfer

Students will be able to independently use their learning to…

Make sense of a problem by initiating a plan and designing a method to solve a problem
Makes use of structure by organizing data in to appropriate frequency tables
Model with mathematics by displaying probability with the appropriate method
Justify reasoning or understanding by making interpretations of the probability based on the data and tables

Meaning

UNDERSTANDINGS
Students will understand that…

- Certain problems in probability can be solved by modeling the situation with geometric measures
- Probability can be used to make fair decisions based on prior experience.

ESSENTIAL QUESTIONS
Students will keep considering…

- How can you model a geometric problem as a probability?
- How can geometric probabilities be used to influence fair decisions?

Acquisition

Students will know…

- How to apply geometric calculations to probability applications
- Probabilities have a direct relationship to the gaming and sports industries
- Probabilities are used to influence actions in various other industries

Students will be skilled at…

- Calculating areas and volumes of 2 and 3 dimensional figures
- Applying the area and volume calculations to probability applications
- Applying probability calculations to real-world situations

Code	Evaluative Criteria	Assessment Evidence
	Further information:	PERFORMANCE TASK(S): *Students will show that they really understand evidence of…*
T, M	Scoring Rubric used to evaluate successful understanding of the concepts of probability as they apply each appropriate strategy and organize their work	Goal: to successfully answer probability questions as they relate to several real situations Role: student Audience: teacher
M, A	Thorough understanding of vocabulary, probability notation and ability to successfully complete basic probability	Situation: complete a series of tasks related to probability through the use of games, manipulatives and real data. Product or Performance: completion of the activities at all stations
T, M, A	Accurate application of content in completing problems involving the addition, complement, and conditional rules and demonstrating an understanding of the vocabulary associated with these topics and recognizing the difference between them	Standards for Success: Accurate results for the majority of the activities
		OTHER EVIDENCE: *Students will show they have achieved Stage 1 goals by…* - Participation in class discussion, group work, and responses - Projects/performance tasks - Activity cards: Working with manipulatives Working with games Working with real data - Summative assessments Quizzes Unit Test (may include 10-20 multiple choice, 15-30 regular answer)

Code	***Pre-Assessment*** - Teacher checks for prerequisite and prior knowledge via warm-up and questioning activities, such as basic problems on solving equations,order of operations and substitution - Prerequisite knowledge is reinforced through algebra review assignments - Teacher will provide review and assessment on prerequisite probability vocabulary knowledge to ensure all students are capable of communicating effectively

transfer master acquire	Summary of Key Learning Events and Instruction *Student success at transfer meaning and acquisition depends on…*	Progress Monitoring
A	Teacher will review area and volume calculations	Warm up questions Monitoring class work through board work, group work, questioning, and walk-arounds Check for understanding via going over homework and medium such as reflections and exit tickets Class worksheets with direct teacher observation and/or student self assessment Practice on whiteboard with direct teacher observation Kahoot quiz with review questions and direct teacher supervision Homework assignments with direct teacher observation or self assessment
M, A	Teacher and students will collectively practice using the area and volume formulas to calculate probability	
T, M, A	Teacher differentiates through purposeful or flexible grouping, the use of diagrams and explanations to demonstrate understanding and active lessons involving scaffolding, games, and use of hands-on manipulatives	
T, M, A	Students will complete practice problems to demonstrate their level of understanding of vocabulary and formulas	
T, M, A	Students will complete practice problems to demonstrate their level of understanding of the use of area and volume formulas of 2 and 3 dimensional figures	
T, M, A	Students will complete practice problems to demonstrate their level of understanding of the use of area and volume formulas of 2 and 3 dimensional figures to calculate probabilities	
T, M, A	Students will analyze problems in order to distinguish when combinations or permutations are appropriate in solving applications and then use them to calculate probabilities	
T, M	Students will explore probability using the unit's performance task and complete an activity based review in preparation for a unit assessment. (i.e. carnival games, sporting data and manipulatives)	