Black Horse Pike Regional School District

Where inspiring excellence is our standard, and student achievement is the result.

Liberal Arts Math
Course Number: 034900

Updated: June 2024

PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Unit Title 1A: Problem Solving	
This unit equips students with essential tools for mathematical problem-solving through inductive and deductive reasoning, Polya's problem-solving method, and the application of tree diagrams and graphs. By mastering these techniques, students develop a robust foundation for approaching complex problems both within mathematics and beyond, preparing them for challenges across various liberal arts disciplines.	
Essential Questions	**Learning Targets/Objectives**
1. How can you understand and use inductive reasoning? 2. How can you understand and use deductive reasoning? 3. How can you solve problems using the organization of the four-step problem solving process?	Students will be able to: • Understand inductive reasoning • Use inductive reasoning to predict a number in a sequence • Use inductive reasoning to make a conjecture • Use inductive reasoning to solve an application • Find a counterexample • Use deductive reasoning to establish a conjecture • Determine types of reasoning • Solve a logic puzzle • Learn Polya's four-step problem solving strategy • Apply Polya's strategy using a diagram • Apply Polya's strategy using an organized list • Apply Polya's strategy using a table

	• Apply Polya's strategy by working backwards • Apply Polya's strategy by guess and check • Use graphs to solve problems • Read and interpret graphs
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Hypotheses, theorem, variable, plan, graphs	Inductive reasoning, conjectures, counterexample, deductive reasoning, Polya's four step problem solving, unit price, tree diagram

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. 5-OA.B.3	1. Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane.
2. 6-RP.A.3	2. Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
3. 7-SP.C.8.B	3. 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.
4. 8-G.A.4	4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

5. G-CO.A.5	5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
6. G-MG.A.1 	6. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). Climate Change Example: Students may use circles, their measures, and their properties to describe the cross section of a tree and compare changes in radial diameter or circumference variations of tree trunks when considering changes in seasonal weather patterns over time.
NJSLS	**Interdisciplinary Connections**
1. RI.MF.9–10.6	1. Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem.
2. RST.9-10.8	2. Determine if the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.3.12.BM.1	1. Utilize mathematical concepts, skills and problem solving to obtain necessary information for decision-making in business.
2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.1.2.DA.3	1. Identify and describe patterns in data visualizations.
2. 8.1.2.DA.4	2. Make predictions based on data using charts or graphs.

The 8 Mathematical Practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments, and projects:

Make sense of problems and persevere in solving them: Take time to analyze the given information and what the problem is asking to help you to plan a solution pathway. Throughout the unit students are given problems that require them to:

- Explain the Meaning
- Find Entry Points
- Analyze Givens
- Interpret a Solution
- Make a Plan
- Consider Similar Problems
- Check Progress
- Consider Simpler Forms
- Problem Solve

Reason abstractly and quantitatively: Investigate specific examples and represent them symbolically, and observe the relationships in numbers or symbols to derive conclusions about a concrete instance. Throughout the unit students are given problems that require them to:

- Make Sense of Quantities
- Use Equations
- Use Expressions
- Understand Quantities
- Use Operations
- Contextualize
- Relationships
- Reason Abstractly

Construct viable arguments and critique the reasoning of others: Make and justify conclusions and decide whether others' arguments are correct or flawed. Throughout the unit students are given problems that require them to:

- Use Assumptions
- Use Defi nitions
- Use Prior Results
- Make Conjectures
- Build Arguments
- Analyze Conjectures
- Use Counterexamples

- Justify Conclusions
- Compare Arguments
- Construct Arguments
- Listen and Ask Questions
- Critique Reasoning
- Use Logic
- Error Analysis

Model with mathematics: Apply the mathematics to a real-life problem, and you interpret mathematical results in the context of the situation. Throughout the unit students are given problems that require them to:

- Apply Mathematics
- Simplify a Solution
- Use a Diagram
- Use a Table
- Use a Graph
- Use a Formula
- Analyze Relationships
- Interpret Results
- Model Real Life

Use appropriate tools strategically: Know what tools are available and think about how each tool might help solve a mathematical problem. Use a tool for its advantages, while being aware of its limitations. Throughout the unit students are given problems that require them to:

- Choose Tools
- Recognize Usefulness of Tools
- Use Other Resources
- Use Technology to Explore

Attend to precision: Develop a habit of being careful how you talk about concepts, label your work, and write your answers. Throughout the unit students are given problems that require them to:

- Communicate Precisely
- Use Clear Definitions
- State the Meaning of Symbols
- Specify Units
- Label Axes
- Calculate Accurately
- Understand Mathematical Terms

Look for and make use of structure: Look closely to see structure within a mathematical statement, or step back for an overview to see how individual parts make one single object. Throughout the unit students are given problems that require them to:

- View as Components
- Look for Patterns
- Look for Structure

Look for and express regularity in repeated reasoning: Notice patterns and make generalizations. Keeping in mind the goal of a problem helps you evaluate reasonableness of answers along the way. Throughout the unit students are given problems that require them to:

- Repeat Calculations
- Find General Methods
- Maintain Oversight
- Evaluate Results

Resources

Textbook

Primary Textbook: Mathematical Excursions - 4e; Aufmann, Lockwood, Nation, and Clegg
Supplementary Textbook: Thinking Mathematically - Eighth Edition; Blitzer

Online Resources

- Desmos Activities
- WebAssign
- Pear Assessment
- IXL
- Quizizz
- EdPuzzle
- Canva
- Khan Academy
- Inside Mathematics
- NJDOE Digital Item Library
- New Jersey Center for Teaching and Learning
- New Jersey Climate Education Hub

Videos

- Inductive vs Deductive Reasoning
- Polya's Problem Solving Strategy

Integrated Technology

- Google Suite: Google Classroom, Docs, Drive, Mail, etc...
- Web Assign
- Devices:
  - Chromebooks
  - Texas Instrument TI-84 Plus Graphing Calculator

ML Resources

- Multi-Language Glossary

Gifted & Talented Resources

- Leveled Assessments
- Enrichment worksheets

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

Section 1.1 Inductive and Deductive Reasoning		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises, pg 11**
• Understand inductive reasoning • Use inductive reasoning to predict a number in a sequence • Use inductive reasoning to make a conjecture • Use inductive reasoning to solve an application • Find a counterexample • Use deductive reasoning to establish a conjecture • Determine types of reasoning • Solve a logic puzzle	**Cumulative Practice:** Thinking activity: Pair/share and have students solve a basic logic puzzle **Prerequisite Skills Practice:** Practice using TI-84 to add, subtract, multiply, and divide	Mathematical Excursions 1-15 odds, 17, 19, 21, 23, 25, 27, 31, 33, 41, 47

Section 1.3 Problem Solving Strategies		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises, pg 16**
• Learn Polya's four-step problem solving strategy • Apply Polya's strategy using a diagram • Apply Polya's strategy using an organized list • Apply Polya's strategy using a table • Apply Polya's strategy by working backwards • Apply Polya's strategy by guess and check • Use graphs to solve problems • Read and interpret graphs	**Cumulative Practice:** Thinking activity: Identify key components of a word problem **Prerequisite Skills Practice:** Recall place value skills. Recall how to apply the guess and check strategy when factoring quadratics.	Mathematical Excursions 1-15 odds, 23, 25, 27, 31, 35, 38

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

Assessments		
Summative	**Formative**	**Performance**
The following assessments will be used to evaluate student learning, skill acquisition and academic achievement of the Standards of Mathematical Practice and the New Jersey Learning Standards for Mathematics listed under each chapter in the Algebra 1 curriculum/syllabus at the conclusion of an instructional time period. ● Diagnostic Pre-Test ● Chapter Tests ● Standardized Tests	The effectiveness of the instructional program will be based on numerous activities and strategies including the following and are not limited to: ● Teacher observations ● Self-Assessments ● Student record-keeping ● Quizzes ● Warm-ups ● Exit Tickets ● Participation in class discussions ● Independent practice	The following assessments require students to utilize various strands of mathematics. ● Projects ● Performance Tasks ● Homework ● Classwork
List of Accommodations and Modifications ● Special Education ● 504 Students ● At Risk Students ● MLL ● Gifted and Talented		

State Mandates and Resources
● New Jersey Student Learning Standards ● Standards for Mathematical Practices

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PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Unit Title 1B: Set Theory

In this unit of liberal arts math, we delve into the foundational concepts of set theory, exploring set operations, subsets, Venn diagrams, and operations involving three sets. Set theory provides a structured framework for organizing and analyzing collections of objects based on common characteristics. Set operations such as union, intersection, and complement allow us to manipulate and combine sets, while subsets define relationships between sets in terms of inclusion. Venn diagrams visually represent these relationships, illustrating overlaps and distinctions between sets. Understanding these concepts equips students with analytical tools to categorize and reason about data and relationships in various contexts, laying a solid foundation for further studies in mathematics and other disciplines.

Essential Questions	Learning Targets/Objectives
1. What are three methods to represent sets? 2. How do you define and recognize the empty set? 3. How do you use set notation symbols? 4. How do you recognize equivalent sets? 5. How do you distinguish between finite and infinite sets? 6. How do you recognize subsets and use subset notation? 7. How do you make and use a Venn diagram for two and three sets? 8. How do you find the complement of a set? 9. How do you identify the intersection of sets?	Students will be able to: • Define a set • Name a set using a Word Description, Roster Method, and Set-Builder Notation • Find the cardinal number of a set and it's written form n[A]. • Define the empty set and know its symbol • Understand and use the "element of" or "not element of" symbol • Determine whether sets are equivalent and know its symbol. • Determine whether sets are equal and know its symbol. • Find the complement of a set

10. What is the union of a set? 11. How do you perform operations with sets? 12. What is And versus an OR? 13. How do you use Venn diagrams to visualize a survey's results? 14. How do you use Venn diagrams to determine counts for overlapping sets? 15. How do you use the Inclusion-Exclusion Principle to solve problems involving overlapping sets?	● Define a subset and use subset symbols ● Understand the universal set ● Define the complement of the universal and empty set ● Define a proper subset ● List all of the subsets of a set ● Calculate the number of subsets of a set and the number of proper subsets of a set ● Find the intersection of sets ● Find the union of sets ● Understand the symbol for ORs ● Understand the symbol for ANDs ● Describe the union and intersection of sets ● Draw and analyze Venn diagrams and identify unions and intersection areas ● Determine whether sets are equal given Venn diagrams ● Draw and analyze Venn diagrams for three sets ● Determine the equality of areas in Venn diagrams with three sets ● Understand the commutative, associative, and distributive properties of sets. ● Draw survey results using a Venn Diagram and solve problems using the Venn Diagram ● Understand the Inclusion-Exclusion (I-E) Principle ● Solve I-E problems for survey, percent, and tabular problems
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Members, natural numbers, whole numbers, integers, rational numbers, irrational numbers, real numbers, negative numbers, positive numbers, equal, equivalent	Sets, elements, roster method, empty set, null set, set-builder notation, cardinal number, universal set, complement, subset, Venn diagram, proper set, intersection, disjoint, union, Inclusion-Exclusion Principle

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. S-CP.A.1 2. S-CP.A.2	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"). 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
NJSLS	**Interdisciplinary Connections**
1. SL.PE.9-10.1.D 2. HS-LS3-3	1. Respond thoughtfully to various perspectives, summarize points of agreement and disagreement, and justify your own views. Make new connections in light of the evidence and reasoning presented. 2. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.3.12.BM.1 2. 9.3.12.FN.1	1. Utilize mathematical concepts, skills and problem solving to obtain necessary information for decision-making in business. 2. Utilize mathematical concepts, skills and problem solving to obtain necessary information for decision making in the finance industry.
2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.2.12.ETW.2 2. 8.1.2.DA.4	1. Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment. 2. Make predictions based on data using charts or graphs.

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Make sense of problems and persevere in solving them: Take time to analyze the given information and what the problem is asking to help you to plan a solution pathway. Throughout the unit students are given problems that require them to:

- Explain the Meaning
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Reason abstractly and quantitatively: Investigate specific examples and represent them symbolically, and observe the relationships in numbers or symbols to derive conclusions about a concrete instance. Throughout the unit students are given problems that require them to:

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- Understand Quantities
- Use Operations
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Construct viable arguments and critique the reasoning of others: Make and justify conclusions and decide whether others' arguments are correct or flawed. Throughout the unit students are given problems that require them to:

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Resources

Textbook

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- Quizizz
- EdPuzzle
- Canva
- Khan Academy
- Inside Mathematics
- NJDOE Digital Item Library
- New Jersey Center for Teaching and Learning
- New Jersey Climate Education Hub

Videos
• Intersection and Union of Sets • Representing Sets using Venn Diagrams
Integrated Technology

• Google Suite: Google Classroom, Docs, Drive, Mail, etc...
• Web Assign
• Devices:
  ○ Chromebooks
  ○ Texas Instrument TI-84 Plus Graphing Calculator

ML Resources
• Multi-Language Glossary
Gifted & Talented Resources
• Leveled Assessments • Enrichment worksheets

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

Section 2.1 Basic Properties of Sets		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises, pg 55**
• Define a set • Name a set using a Word Description, Roster Method, and Set-Builder Notation	**Warm-up:** Thinking activity: Have students list out the number of different colors they	Mathematical Excursions 1-13 odd, 15, 17, 19, 25-35 odd, 27, 39, 43, 53, 55, 59, 63, 67, 73

• Find the cardinal number of a set and it's written form n[A]. • Define the empty set and know its symbol • Understand and use the "element of" or "not element of" symbol • Determine whether sets are equivalent and know its symbol. • Determine whether sets are equal and know its symbol.	are wearing today. Show these colors in a list, each color separated by commas. **Prerequisite Skills Practice:** 1. Use set-builder notation. Ask students to find the domain of a graph and show it using set-builder notation. 2. List and understand inequality symbols.	

Section 2.2 Complements, Subsets, and Venn Diagrams		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises, pg 65**
• Find the complement of a set • Define a subset and use subset symbols • Understand the universal set • Define the complement of the universal and empty set • Define a proper subset • List all of the subsets of a set • Calculate the number of subsets of a set and the number of proper subsets of a set	**Thinking activity:** Pose question: How many outfits could I make if I have 3 tops and 3 bottoms? **Prerequisite Skills Practice:** Find the cardinal number of given sets.	Mathematical Excursions 1-7 odd, 9, 11, 13-21 odd, 23, 27, 31, 37, 43-46, 47, 51, 53, 57, 59

Section 2.3 Set Operations		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises, pg 77**
• Find the intersection of sets • Find the union of sets • Understand the symbol for ORs • Understand the symbol for ANDs • Describe the union and intersection of sets	**Thinking Task:** List out your favorite book character's qualities along with your least favorite character's qualities. What's in common?	Mathematical Excursions 1-19 odd, 21-27, 29-33 odd, 37, 47-49, 53-61 odd

• Draw and analyze Venn diagrams and identify unions and intersection areas • Determine whether sets are equal given Venn diagrams • Draw and analyze Venn diagrams for three sets • Determine the equality of areas in Venn diagrams with three sets • Understand the commutative, associative, and distributive properties of sets.	**Prerequisite Skills Practice:** Practice naming a set using a Word Description, Roster Method, and Set-Builder Notation	

Section 2.4 Applications of Sets		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises, pg 87**
• Draw survey results using a Venn Diagram and solve problems using the Venn Diagram • Understand the Inclusion-Exclusion (I-E) Principle • Solve I-E problems for survey, percent, and tabular problems	**Warm-up:** Ask students to identify an overlapping region in survey results as displayed in a table. **Prerequisite Skills Practice:** Find the union and intersection of two sets.	Mathematical Excursions 1-15 odd, 18, 19, 23, 25, 27

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

Assessments		
Summative	**Formative**	**Performance**
The following assessments will be used to evaluate student learning, skill acquisition and	The effectiveness of the instructional program will be based on numerous activities and	The following assessments require students to utilize various strands of mathematics.

academic achievement of the Standards of Mathematical Practice and the New Jersey Learning Standards for Mathematics listed under each chapter in the Algebra 1 curriculum/syllabus at the conclusion of an instructional time period. • Diagnostic Pre-Test • Chapter Tests • Standardized Tests	strategies including the following and are not limited to: • Teacher observations • Self-Assessments • Student record-keeping • Quizzes • Warm-ups • Exit Tickets • Participation in class discussions • Independent practice	• Projects • Performance Tasks • Homework • Classwork
List of Accommodations and Modifications • Special Education • 504 Students • At Risk Students • MLL • Gifted and Talented		

State Mandates and Resources

- New Jersey Student Learning Standards
- Standards for Mathematical Practices

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PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Unit Title 1C: Number Theory and Real Number System

In this unit, students will delve into number theory, exploring the distinctions and properties of prime and composite numbers, and learning techniques for prime factorization. They will examine the real number system, understanding the classification of real numbers into rational and irrational, and applying the fundamental properties of real numbers such as commutativity, associativity, and distributivity. The unit will also cover exponent rules, including the laws governing positive, negative, and zero exponents, and their applications in simplifying expressions. Additionally, students will learn to express and manipulate very large or small numbers using scientific notation, and apply this knowledge to real-world problems. Through a combination of theoretical understanding and practical application, this unit will provide a solid mathematical foundation essential for further studies and everyday life.

Essential Questions	Learning Targets/Objectives
1. What are divisibility rules? 2. How do you perform prime factorization of a composite number? 3. How do you find the greatest common factor divisor of two numbers? 4. How do you solve problems using the greatest common factor? 5. How do you find the least common multiple of two numbers? 6. How do you solve problems using the least common multiple? 7. How do you recognize subsets of the real numbers? 8. How do you use properties of real numbers? 9. How do you use properties of exponents?	Students will be able to: • Learn the set of natural numbers • Learn and use divisibility rules • Learn definition of prime versus composite numbers • Be able to perform prime factorization using a factor tree • Be able to find the greatest common divisor • Be able to solve a problem using the greatest common divisor • Be able to find the least common multiple • Be able to solve a problem using the least common multiple • Learn the subsets of real numbers

10. How do you convert from scientific notation to decimal notation? 11. How do you convert from decimal notation to scientific notation? 12. How do you perform computations using scientific notation? 13. How do you solve applied problems using scientific notation?	● Classify real numbers ● Learn the properties of real numbers ● Identify properties of real numbers ● Verify closure ● Learn and use product rule, power rule, quotient rule ● Learn and use the zero exponent rule ● Learn and use the negative exponent rule ● Use exponent rules in conjunction ● Learn the power of ten rules ● Know how to convert numbers from decimal notation to scientific notation ● Know how to convert numbers from scientific notation to decimal notation ● Multiply and divide numbers in scientific notation ● Understand when it is appropriate to use scientific notation
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
number theory, natural numbers, whole numbers, integers, divisible, divisor, positive exponents, negative exponents	factor tree, relatively prime, greatest common divisor, least common multiple, prime number, composite number, rational numbers, irrational numbers, commutative, associative, distributive, identity, inverse, closure, scientific notation, standard notation

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. 3-OA.B5	1. Apply properties of operations as strategies to multiply and divide.
2. 4-OA.B4	2. Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite.
3. 6-NS.B4	3. Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor.
4. 8-NS.A1	4. Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually and convert a decimal expansion which repeats eventually into a rational number.
5. 8-EE.A1	5. Know and apply the properties of integer exponents to generate equivalent numerical expressions.
6. 8-EE.A4	6. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology
NJSLS	**Interdisciplinary Connections**
1. HS-LS2-2	1. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
2. W.WR.9–10.5 	2. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	

1. 9.3.HL-BRD.2	1. Apply the fundamentals of biochemistry, cell biology, genetics, mathematical concepts, microbiology, molecular biology, organic chemistry and statistics to conduct effective biotechnology research and development of products.
2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.1.12.DA.5	1. Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

The 8 Mathematical Practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments, and projects:

Make sense of problems and persevere in solving them: Take time to analyze the given information and what the problem is asking to help you to plan a solution pathway. Throughout the unit students are given problems that require them to:

- Explain the Meaning
- Find Entry Points
- Analyze Givens
- Interpret a Solution
- Make a Plan
- Consider Similar Problems
- Check Progress
- Consider Simpler Forms
- Problem Solve

Reason abstractly and quantitatively: Investigate specific examples and represent them symbolically, and observe the relationships in numbers or symbols to derive conclusions about a concrete instance. Throughout the unit students are given problems that require them to:

- Make Sense of Quantities
- Use Equations
- Use Expressions
- Understand Quantities
- Use Operations
- Contextualize
- Relationships

- Reason Abstractly

Construct viable arguments and critique the reasoning of others: Make and justify conclusions and decide whether others' arguments are correct or flawed. Throughout the unit students are given problems that require them to:

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- Analyze Conjectures
- Use Counterexamples
- Justify Conclusions
- Compare Arguments
- Construct Arguments
- Listen and Ask Questions
- Critique Reasoning
- Use Logic
- Error Analysis

Model with mathematics: Apply the mathematics to a real-life problem, and you interpret mathematical results in the context of the situation. Throughout the unit students are given problems that require them to:

- Apply Mathematics
- Simplify a Solution
- Use a Diagram
- Use a Table
- Use a Graph
- Use a Formula
- Analyze Relationships
- Interpret Results
- Model Real Life

Use appropriate tools strategically: Know what tools are available and think about how each tool might help solve a mathematical problem. Use a tool for its advantages, while being aware of its limitations. Throughout the unit students are given problems that require them to:

- Choose Tools
- Recognize Usefulness of Tools
- Use Other Resources

- Use Technology to Explore

Attend to precision: Develop a habit of being careful how you talk about concepts, label your work, and write your answers. Throughout the unit students are given problems that require them to:

- Communicate Precisely
- Use Clear Definitions
- State the Meaning of Symbols
- Specify Units
- Label Axes
- Calculate Accurately
- Understand Mathematical Terms

Look for and make use of structure: Look closely to see structure within a mathematical statement, or step back for an overview to see how individual parts make one single object. Throughout the unit students are given problems that require them to:

- View as Components
- Look for Patterns
- Look for Structure

Look for and express regularity in repeated reasoning: Notice patterns and make generalizations. Keeping in mind the goal of a problem helps you evaluate reasonableness of answers along the way. Throughout the unit students are given problems that require them to:

- Repeat Calculations
- Find General Methods
- Maintain Oversight
- Evaluate Results

Resources

Textbook

Primary Textbook: Mathematical Excursions - 4e; Aufmann, Lockwood, Nation, and Clegg
Supplementary Textbook: Thinking Mathematically - Eighth Edition; Blitzer

Online Resources

- Desmos Activities
- WebAssign
- Pear Assessment
- IXL
- Quizizz
- EdPuzzle
- Canva
- Khan Academy
- Inside Mathematics
- NJDOE Digital Item Library
- New Jersey Center for Teaching and Learning
- New Jersey Climate Education Hub

Videos

- Scientific Notation Example
- Properties of Exponents

Integrated Technology

- Google Suite: Google Classroom, Docs, Drive, Mail, etc...
- Web Assign
- Devices:
    - Chromebooks
    - Texas Instrument TI-84 Plus Graphing Calculator

ML Resources
• Multi-Language Glossary
Gifted & Talented Resources
• Leveled Assessments • Enrichment worksheets

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

Section 5.1 (Blitzer) Number Theory: Prime and Composite Numbers		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises, pg 55**
• Learn the set of natural numbers • Learn and use divisibility rules • Learn definition of prime versus composite numbers • Be able to perform prime factorization using a factor tree • Be able to find the greatest common divisor • Be able to solve a problem using the greatest common divisor • Be able to find the least common multiple • Be able to solve a problem using the least common multiple	**Warm-up:** Ask student to group a set of numbers into whole numbers versus integer numbers **Prerequisite Skills Practice:** Ask students to write all factors of a composite number	Thinking Mathematically 1-9 odd, 25, 29, 33, 37, 41, 45, 49, 53, 57, 61, 65, 89, 91, 96

Section 5.5 (Blitzer) Real Numbers and Their Properties		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises, pg 65**
• Learn the subsets of real numbers • Classify real numbers • Learn the properties of real numbers • Identify properties of real numbers • Verify closure	**Thinking activity:** Have students populate a Venn Diagram classifying numbers by their divisibility rule **Prerequisite Skills Practice:** Create a three way Venn Diagram	Thinking Mathematically 1-11 odd, 13, 15, 17, 19, 21, 25, 29, 31, 33, 35, 39, 40, 53, 55, 84-87

Section 5.6 (Blitzer) Exponents and Scientific Notation		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises, pg 77**
• Learn and use product rule, power rule, quotient rule • Learn and use the zero exponent rule • Learn and use the negative exponent rule • Use exponent rules in conjunction • Learn the power of ten rules • Know how to convert numbers from decimal notation to scientific notation • Know how to convert numbers from scientific notation to decimal notation • Multiply and divide numbers in scientific notation • Understand when it is appropriate to use scientific notation	**Thinking Task:** Tell students to divide 1 by 1,000 on the TI-84 calculator. Ask what does the “1E-4” mean? **Prerequisite Skills Practice:** Practice dividing whole numbers. Compare this result to dividing variables.	Thinking Mathematically 1-11 odd, 13-23 odd, 25, 27, 29, 31-42, 43, 47, 51, 55, 59, 63, 67, 71, 79-91 odd, 111-113

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

Assessments		
Summative	**Formative**	**Performance**
The following assessments will be used to evaluate student learning, skill acquisition and academic achievement of the Standards of Mathematical Practice and the New Jersey Learning Standards for Mathematics listed under each chapter in the Algebra 1 curriculum/syllabus at the conclusion of an instructional time period. ● Diagnostic Pre-Test ● Chapter Tests ● Standardized Tests	The effectiveness of the instructional program will be based on numerous activities and strategies including the following and are not limited to: ● Teacher observations ● Self-Assessments ● Student record-keeping ● Quizzes ● Warm-ups ● Exit Tickets ● Participation in class discussions ● Independent practice	The following assessments require students to utilize various strands of mathematics. ● Projects ● Performance Tasks ● Homework ● Classwork
List of Accommodations and Modifications ● Special Education ● 504 Students ● At Risk Students ● MLL ● Gifted and Talented		

State Mandates and Resources
● New Jersey Student Learning Standards ● Standards for Mathematical Practices

Black Horse Pike Regional School District

Where inspiring excellence is our standard, and student achievement is the result.

Liberal Arts Math
Course Number: 034900

Updated: June 2024

PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Unit Title 2A: Equations and Inequalities

This unit introduces fundamental concepts essential for navigating mathematical applications in liberal arts contexts. We begin by mastering the skill of evaluating algebraic expressions, enabling us to substitute values and simplify complex mathematical statements. Next, we explore mathematical models as powerful tools for representing real-world scenarios. This involves understanding how variables interact within equations, aiding in the analysis and prediction of various phenomena. Linear inequalities and equations are then examined, providing techniques to solve and interpret relationships between variables. This skill proves invaluable in decision-making processes across disciplines. Proportions are studied for their utility in comparing quantities and scaling relationships, enhancing our ability to interpret ratios and solve practical problems. Lastly, graphing subsets of real numbers is explored, offering visual representations of mathematical concepts such as inequalities and intervals. This visual approach aids in understanding and communicating mathematical ideas effectively. Throughout the unit, emphasis is placed on applying these skills in diverse contexts within the liberal arts, fostering critical thinking and problem-solving abilities essential for informed decision-making and lifelong learning.

Essential Questions	Learning Targets/Objectives
1. How can you evaluate algebraic expressions? 2. How can you use mathematical models? 3. How can you understand the vocabulary of algebraic expressions? 4. How can you simplify algebraic expressions?	Students will be able to: • Evaluate algebraic expressions • Simplify algebraic expressions • Use mathematical models • Use properties of equality to solve an equation

5. How can you solve linear equations? 6. How can you solve linear equations containing fractions? 7. How can you solve proportions? 8. How can you solve problems using proportions? 9. How can you identify equations with no solution or infinitely many solutions? 10. How can you use linear equations to solve problems? 11. How can you solve a formula for a variable? 12. How can you graph subsets of real numbers on a number line? 13. How can you solve linear inequalities? 14. How can you solve applied problems using linear inequalities?	• Solve linear equations • Solve linear equations involving fractions • Solve proportions • Apply proportions to real world scenarios • Attempt to solve equations with no solution • Solve equations in which every real number is a solution • Problem solve with linear equations • Write expressions for unknown quantities • Write equations that model verbal conditions problems • Solve equations • Graph subsets of real numbers • Solve linear inequalities • Solve three-part inequalities
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Variable, Expression, Equation, formula, Terms, Coefficient , Numerical term, Constant , Factors, Like terms, Simplify, Solutions, Roots, Equivalent, Ratio, proportion, inequality	Mathematical models, Solution sets, Isolate

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. 6-EE.A.2c	1. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations).

2. 7-RP.2c	2. Represent proportional relationships by equations.
3. 7-EE.B.3	3. Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.
4. 7-EE.4a	4. Solve word problems leading to equations of the form px q r + = and px q r ( ) + = , where p , q , and r are specific rational numbers. Solve equations of these forms with accuracy and efficiency. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach.
5. 7-EE.4b	5. Solve word problems leading to inequalities of the form px q r + > or px q r + < , where p , q , and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem.
6. 8-EE.C.7b	6. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.
7. A-CED.A.3	7. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
8. A-REI.B.3	8. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
9. A-CED.A.1 	9. Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. Climate Change Example: Students may create equations and/or inequalities to represent the economic impact of climate change.

NJSLS	Interdisciplinary Connections
1. RI.MF.9–10.6	1. Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem.
2. HS-PS2-3	2. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a

	macroscopic object during a collision.
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.3.ST-ET.1 2. 9.3.12.BM.1	1. Use STEM concepts and processes to solve problems involving design and/or production. 2. Utilize mathematical concepts, skills and problem solving to obtain necessary information for decision-making in business.
2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.1.12.AP.1	1. Design algorithms to solve computational problems using a combination of original and existing algorithms.

The 8 Mathematical Practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments, and projects:

Make sense of problems and persevere in solving them: Take time to analyze the given information and what the problem is asking to help you to plan a solution pathway. Throughout the unit students are given problems that require them to:

- Explain the Meaning
- Find Entry Points
- Analyze Givens
- Interpret a Solution
- Make a Plan
- Consider Similar Problems
- Check Progress
- Consider Simpler Forms
- Problem Solve

Reason abstractly and quantitatively: Investigate specific examples and represent them symbolically, and observe the relationships in numbers or symbols to derive conclusions about a concrete instance. Throughout the unit students are given problems that require them to:

- Make Sense of Quantities
- Use Equations
- Use Expressions
- Understand Quantities
- Use Operations
- Contextualize
- Relationships
- Reason Abstractly

Construct viable arguments and critique the reasoning of others: Make and justify conclusions and decide whether others' arguments are correct or flawed. Throughout the unit students are given problems that require them to:

- Use Assumptions
- Use Defi nitions
- Use Prior Results
- Make Conjectures
- Build Arguments
- Analyze Conjectures
- Use Counterexamples
- Justify Conclusions
- Compare Arguments
- Construct Arguments
- Listen and Ask Questions
- Critique Reasoning
- Use Logic
- Error Analysis

Model with mathematics: Apply the mathematics to a real-life problem, and you interpret mathematical results in the context of the situation. Throughout the unit students are given problems that require them to:

- Apply Mathematics
- Simplify a Solution
- Use a Diagram
- Use a Table
- Use a Graph
- Use a Formula
- Analyze Relationships
- Interpret Results

- Model Real Life

Use appropriate tools strategically: Know what tools are available and think about how each tool might help solve a mathematical problem. Use a tool for its advantages, while being aware of its limitations. Throughout the unit students are given problems that require them to:

- Choose Tools
- Recognize Usefulness of Tools
- Use Other Resources
- Use Technology to Explore

Attend to precision: Develop a habit of being careful how you talk about concepts, label your work, and write your answers. Throughout the unit students are given problems that require them to:

- Communicate Precisely
- Use Clear Definitions
- State the Meaning of Symbols
- Specify Units
- Label Axes
- Calculate Accurately
- Understand Mathematical Terms

Look for and make use of structure: Look closely to see structure within a mathematical statement, or step back for an overview to see how individual parts make one single object. Throughout the unit students are given problems that require them to:

- View as Components
- Look for Patterns
- Look for Structure

Look for and express regularity in repeated reasoning: Notice patterns and make generalizations. Keeping in mind the goal of a problem helps you evaluate reasonableness of answers along the way. Throughout the unit students are given problems that require them to:

- Repeat Calculations
- Find General Methods
- Maintain Oversight
- Evaluate Results

Resources

Textbook

Primary Textbook: Mathematical Excursions - 4e; Aufmann, Lockwood, Nation, and Clegg
Supplementary Textbook: Thinking Mathematically - Eighth Edition; Blitzer

Online Resources

- Desmos Activities
- Pear Assessment
- IXL
- Quizizz
- EdPuzzle
- Canva
- Khan Academy
- Inside Mathematics
- NJDOE Digital Item Library
- New Jersey Center for Teaching and Learning
- New Jersey Climate Education Hub

Videos

- Evaluating algebraic expressions with one variable
- Solving and graphing linear inequalities

Integrated Technology

- Google Suite: Google Classroom, Docs, Drive, Mail, etc...
- **Textbook Platform???**
- Devices:

○ Chromebooks ○ Texas Instrument TI-84 Plus Graphing Calculator
ML Resources
● Multi-Language Glossary
Gifted & Talented Resources
● Leveled Assessments ● Enrichment worksheets

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

Section 6.1 Algebraic Expressions and Formulas		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Evaluate algebraic expressions • Simplify algebraic expressions • Use mathematical models	**Cumulative Practice:** Thinking activity: Determine what is happening to each algebraic expression	Thinking Mathematically 1-20 odds, 29, 31, 33, 37, 39, 41-50 odds, 68, 69, 71

	Prerequisite Skills Practice: Recall what to do when given a value of x. Recall the order of operations (PEMDAS)	

Section 6.2 Linear Equations in One Variable and Proportions		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Use properties of equality to solve an equation • Solve linear equations • Solve linear equations involving fractions • Solve proportions • Apply proportions to real world scenarios • Attempt to solve equations with no solution • Solve equations in which every real number is a solution	**Cumulative Practice:** Thinking activity: Recall what method to use when solving a proportion **Prerequisite Skills Practice:** Practice using the distributive property when given algebraic expressions	Thinking Mathematically 1-20 odds, 41, 43, 45, 55, 58, 59, 64, 65, 68, 71, 73-80 odds, 105, 107,

Section 6.3 Applications of Linear Equations		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Problem solve with linear equations • Write expressions for unknown quantities • Write equations that model verbal conditions problems • Solve equations	**Cumulative Practice:** Thinking activity: Identify components in a word problem and let x represent one of the unknown quantities	Thinking Mathematically 1-18 odds, 19, 21, 23, 25, 27, 35, 39

	Prerequisite Skills Practice: Practice writing expressions for unknown quantities in a word problem	

Section 6.4 Linear Inequalities in One Variable		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Graph subsets of real numbers • Solve linear inequalities • Solve three-part inequalities	**Cumulative Practice:** Thinking activity: Recall the greater than, less than, and equal to symbol **Prerequisite Skills Practice:** Practice solving linear equations	Thinking Mathematically 1-30 odds, 51, 54, 56, 66, 77, 83, 87, 93

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

Assessments		
Summative	**Formative**	**Performance**
The following assessments will be used to evaluate student learning, skill acquisition and academic achievement of the Standards of Mathematical Practice and the New Jersey Learning Standards for Mathematics listed under each chapter in the Algebra 1 curriculum/syllabus at the conclusion of an instructional time period.	The effectiveness of the instructional program will be based on numerous activities and strategies including the following and are not limited to: ● Teacher observations ● Self-Assessments ● Student record-keeping	The following assessments require students to utilize various strands of mathematics. ● Projects ● Performance Tasks ● Homework ● Classwork

• Diagnostic Pre-Test • Chapter Tests • Periodic Benchmarks • Standardized Tests	• Quizzes • Warm-ups • Exit Tickets • Participation in class discussions • Independent practice	
List of Accommodations and Modifications • Special Education • 504 Students • At Risk Students • MLL • Gifted and Talented		

State Mandates and Resources

- New Jersey Student Learning Standards
- Standards for Mathematical Practices

Black Horse Pike Regional School District

Where inspiring excellence is our standard, and student achievement is the result.

Liberal Arts Math
Course Number: 034900

Updated: June 2024

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Unit Title 2B: Graphs, Functions, and Linear Systems

This unit equips students with essential skills in graphing, analyzing, and solving linear equations and systems. Understanding these foundational concepts prepares them for further studies in mathematics and its applications across diverse disciplines. By mastering these concepts, students not only enhance their mathematical proficiency but also develop critical thinking skills essential for analyzing relationships and making informed decisions in the liberal arts and beyond.

Essential Questions	Learning Targets/Objectives
1. How can you plot points in the rectangular coordinate system? 2. How can you graph equations in the rectangular coordinate system? 3. How can you use function notation? 4. How can you graph functions? 5. How can you use the vertical line test? 6. How can you obtain information about a function from its graph? 7. How can you use intercepts to graph a linear equation? 8. How can you calculate slope? 9. How can you use the slope and y-intercept to graph a line?	Students will be able to: • Plot points in the rectangular coordinate system • Graph equations using the point-plotting method • Apply using graphs and equations to real world scenarios • Use function notation • Apply function notation to real world scenarios • Graph functions • Use the vertical line test • Analyze graphs of functions • Use intercepts to graph linear equations

10. How can you graph horizontal or vertical lines? 11. How can you interpret slope as a rate of change? 12. How can you use slope and y-intercept to model data? 13. How can you determine whether an ordered pair is a solution of a linear system? 14. How can you solve linear systems by graphing? 15. How can you solve linear systems by substitution? 16. How can you solve linear systems by addition? 17. How can you identify systems that do not have exactly one ordered-pair solution? 18. How can you solve problems using systems of linear equations?	• Use the definition of slope graph by using slopes and y-intercepts • Graph horizontal lines • Graph vertical lines • Interpret slope as a rate of change • Use slope and y-intercept to model data • Determine whether an ordered pair is a solution of a system • Solve linear systems by graphing • Solve systems by substitution • Solve systems by the addition method • Solve systems with no solution • Solve systems with infinitely many solutions • Find break-even point
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
X-axis, Y-axis, Origin, Quadrants, solution, Ordered pair, Function, slope, horizontal, vertical, Parallel, Profit, intersection point	Vertical line test, Rate of change, coincide, revenue, break even point

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. A-REI.D.10	1. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
2. F-IF.A1	2. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the

	domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).
3. F-IF.A2	3. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
4. F-IF.B4	4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
5. F-IF.B6	5. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
6. A-REI.C6	6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
7. A-REI.C5	7. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
8. A-CED.A.3 	8. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. Climate Change Example: Students may represent constraints describing the economic impact of climate change by equations, inequalities, and/or by systems of inequalities, and interpret solutions as viable or nonviable options.
NJSLS	**Interdisciplinary Connections**
1. RI.MF.9–10.6	1. Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem.
2. HSA-CED.A.2	2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.3.ST-SM.2	1. Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.

2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.1.12.AP.5	1. Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.

The 8 Mathematical Practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments, and projects:

Make sense of problems and persevere in solving them: Take time to analyze the given information and what the problem is asking to help you to plan a solution pathway. Throughout the unit students are given problems that require them to:

- Explain the Meaning
- Find Entry Points
- Analyze Givens
- Interpret a Solution
- Make a Plan
- Consider Similar Problems
- Check Progress
- Consider Simpler Forms
- Problem Solve

Reason abstractly and quantitatively: Investigate specific examples and represent them symbolically, and observe the relationships in numbers or symbols to derive conclusions about a concrete instance. Throughout the unit students are given problems that require them to:

- Make Sense of Quantities
- Use Equations
- Use Expressions
- Understand Quantities
- Use Operations
- Contextualize
- Relationships
- Reason Abstractly

Construct viable arguments and critique the reasoning of others: Make and justify conclusions and decide whether others' arguments are correct or flawed. Throughout the unit students are given problems that require them to:

- Use Assumptions
- Use Defi nitions
- Use Prior Results
- Make Conjectures
- Build Arguments
- Analyze Conjectures
- Use Counterexamples
- Justify Conclusions
- Compare Arguments
- Construct Arguments
- Listen and Ask Questions
- Critique Reasoning
- Use Logic
- Error Analysis

Model with mathematics: Apply the mathematics to a real-life problem, and you interpret mathematical results in the context of the situation. Throughout the unit students are given problems that require them to:

- Apply Mathematics
- Simplify a Solution
- Use a Diagram
- Use a Table
- Use a Graph
- Use a Formula
- Analyze Relationships
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- Model Real Life

Use appropriate tools strategically: Know what tools are available and think about how each tool might help solve a mathematical problem. Use a tool for its advantages, while being aware of its limitations. Throughout the unit students are given problems that require them to:

- Choose Tools
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- Understand Mathematical Terms

Look for and make use of structure: Look closely to see structure within a mathematical statement, or step back for an overview to see how individual parts make one single object. Throughout the unit students are given problems that require them to:

- View as Components
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Look for and express regularity in repeated reasoning: Notice patterns and make generalizations. Keeping in mind the goal of a problem helps you evaluate reasonableness of answers along the way. Throughout the unit students are given problems that require them to:

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- Find General Methods
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- Pear Assessment
- IXL
- Quizizz
- EdPuzzle
- Canva
- Khan Academy
- Inside Mathematics
- NJDOE Digital Item Library
- New Jersey Center for Teaching and Learning
- New Jersey Climate Education Hub

Videos

- Solving Systems of Equations by Substitution
- Function Notation

Integrated Technology

- Google Suite: Google Classroom, Docs, Drive, Mail, etc...
- Web Assign
- Devices:
  - Chromebooks
  - Texas Instrument TI-84 Plus Graphing Calculator

ML Resources
• Multi-Language Glossary
Gifted & Talented Resources
• Leveled Assessments • Enrichment worksheets

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

Section 7.1 Graphing and Functions		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Plot points in the rectangular coordinate system • Graph equations using the point-plotting method • Apply using graphs and equations to real world scenarios • Use function notation • Apply function notation to real world scenarios • Graph functions • Use the vertical line test • Analyze graphs of functions	**Cumulative Practice:** Thinking activity: Determine how we move from the origin when given points plotted on a coordinate plane **Prerequisite Skills Practice:** Recall how to find f(x) when given a value of x	Thinking Mathematically 1, 9, 7, 19, 20, 21-30 odds, 33-45 odds, 47, 51, 53, 55, 57, 58, 64, 73, 77

Section 7.2 Linear Functions and Their Graphs		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Use intercepts to graph linear equations • Use the definition of slope graph by using slopes and y-intercepts • Graph horizontal lines • Graph vertical lines • Interpret slope as a rate of change • Use slope and y-intercept to model data	**Cumulative Practice:** Thinking activity: Determine the slope of an equation **Prerequisite Skills Practice:** Recall slope intercept form	Thinking Mathematically 1-8 odds, 9-20 odds, 21, 27, 28, 32, 36, 37, 43, 47, 48, 57, 63

Section 7.3 Systems of Linear Equations in Two Variables		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Determine whether an ordered pair is a solution of a system • Solve linear systems by graphing • Solve systems by substitution • Solve systems by the addition method • Solve systems with no solution • Solve systems with infinitely many solutions • Find break-even point	**Cumulative Practice:** Thinking activity: Draw a pair of parallel and intersecting lines. When are there infinitely many solutions? **Prerequisite Skills Practice:** Recall how to find x and y intercepts	Thinking Mathematically 1-24 odds, 30, 35, 39, 41, 51, 56, 61, 62

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

Assessments		
Summative	**Formative**	**Performance**
The following assessments will be used to evaluate student learning, skill acquisition and academic achievement of the Standards of Mathematical Practice and the New Jersey Learning Standards for Mathematics listed under each chapter in the Algebra 1 curriculum/syllabus at the conclusion of an instructional time period. ● Diagnostic Pre-Test ● Chapter Tests ● Periodic Benchmarks ● Standardized Tests	The effectiveness of the instructional program will be based on numerous activities and strategies including the following and are not limited to: ● Teacher observations ● Self-Assessments ● Student record-keeping ● Quizzes ● Warm-ups ● Exit Tickets ● Participation in class discussions ● Independent practice	The following assessments require students to utilize various strands of mathematics. ● Projects ● Performance Tasks ● Homework ● Classwork
List of Accommodations and Modifications ● Special Education ● 504 Students ● At Risk Students ● MLL ● Gifted and Talented		

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● New Jersey Student Learning Standards ● Standards for Mathematical Practices

Black Horse Pike Regional School District

Where inspiring excellence is our standard, and student achievement is the result.

Liberal Arts Math
Course Number: 034900

Updated: June 2024

PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Unit Title 2C: Personal Finance

In this unit of liberal arts math, students explore fundamental concepts essential for navigating everyday financial decisions. The focus is on understanding percentages, sales tax, and discounts within the context of personal finance. Beginning with the basics of percentages, students learn to convert between fractions, decimals, and percentages, applying these skills to calculate tips, interest rates, and commission payments. They then delve into the implications of sales tax on purchases, mastering techniques to compute total costs accurately. The unit culminates in a detailed exploration of discounts, encompassing markdowns, percent-offs, and promotional offers, equipping students with the tools to determine final prices after discounts are applied. Through practical examples and exercises, students develop critical skills in budgeting, comparison shopping, and financial planning, enhancing their ability to make informed financial choices in their daily lives.

Essential Questions	Learning Targets/Objectives
1. How can you express a fraction as a percent? 2. How can you express a decimal as a percent? 3. How can you express a percent as a decimal? 4. How can you solve applied problems involving sales tax and discounts? 5. How can you determine percent increase or decrease? 6. How can you investigate some of the ways percent can be abused? 7. How can you write fractions as percents? 8. How can you write percents of fractions?	Students will be able to: • Express fractions as percents • Express decimals as percents • Express percents as decimals • Solve applied problems involving involving sales tax and discounts • Find percent increase and decrease • Find percents of percents • Write a percent as a fraction • Write a fraction as a percent • Use the proportion method to solve percent problems

9. How can you use the proportion method to solve percents? 10. How can you apply the percent equations?	• Use the basic percent equation
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Percents, Sales tax, Percent increase, Percent decrease,	tax rate

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. 7-RP.3	1. Use proportional relationships to solve multistep ratio and percent problems
2. 7-EE.B.3 	2. Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. Climate Change Example: Students may solve multi-step real-life problems posed with positive and negative rational numbers in any form related to the relationship between altitude and the temperature above sea level.

NJSLS	Interdisciplinary Connections
1. RI.MF.9–10.6 2. HS-PS1-7	1. Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem. 2. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.1.12.PB.5	1. Analyze how changes in taxes, inflation, and personal circumstances can affect a personal budget.
2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.1.12.DA.3	1. Translate between decimal numbers and binary numbers.

The 8 Mathematical Practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments, and projects:

Make sense of problems and persevere in solving them: Take time to analyze the given information and what the problem is asking to help you to plan a solution pathway. Throughout the unit students are given problems that require them to:

- Explain the Meaning
- Find Entry Points
- Analyze Givens
- Interpret a Solution
- Make a Plan
- Consider Similar Problems
- Check Progress
- Consider Simpler Forms
- Problem Solve

Reason abstractly and quantitatively: Investigate specific examples and represent them symbolically, and observe the relationships in numbers or symbols to derive conclusions about a concrete instance. Throughout the unit students are given problems that require them to:

- Make Sense of Quantities
- Use Equations
- Use Expressions
- Understand Quantities
- Use Operations
- Contextualize
- Relationships
- Reason Abstractly

Construct viable arguments and critique the reasoning of others: Make and justify conclusions and decide whether others' arguments are correct or flawed. Throughout the unit students are given problems that require them to:

- Use Assumptions
- Use Defi nitions
- Use Prior Results
- Make Conjectures
- Build Arguments
- Analyze Conjectures
- Use Counterexamples
- Justify Conclusions
- Compare Arguments
- Construct Arguments
- Listen and Ask Questions
- Critique Reasoning
- Use Logic
- Error Analysis

Model with mathematics: Apply the mathematics to a real-life problem, and you interpret mathematical results in the context of the situation. Throughout the unit students are given problems that require them to:

- Apply Mathematics
- Simplify a Solution
- Use a Diagram
- Use a Table
- Use a Graph

- Use a Formula
- Analyze Relationships
- Interpret Results
- Model Real Life

Use appropriate tools strategically: Know what tools are available and think about how each tool might help solve a mathematical problem. Use a tool for its advantages, while being aware of its limitations. Throughout the unit students are given problems that require them to:

- Choose Tools
- Recognize Usefulness of Tools
- Use Other Resources
- Use Technology to Explore

Attend to precision: Develop a habit of being careful how you talk about concepts, label your work, and write your answers. Throughout the unit students are given problems that require them to:

- Communicate Precisely
- Use Clear Definitions
- State the Meaning of Symbols
- Specify Units
- Label Axes
- Calculate Accurately
- Understand Mathematical Terms

Look for and make use of structure: Look closely to see structure within a mathematical statement, or step back for an overview to see how individual parts make one single object. Throughout the unit students are given problems that require them to:

- View as Components
- Look for Patterns
- Look for Structure

Look for and express regularity in repeated reasoning: Notice patterns and make generalizations. Keeping in mind the goal of a problem helps you evaluate reasonableness of answers along the way. Throughout the unit students are given problems that require them to:

- Repeat Calculations
- Find General Methods
- Maintain Oversight
- Evaluate Results

Resources

Textbook

Primary Textbook: Mathematical Excursions - 4e; Aufmann, Lockwood, Nation, and Clegg
Supplementary Textbook: Thinking Mathematically - Eighth Edition; Blitzer

Online Resources

- Desmos Activities
- Pear Assessment
- IXL
- Quizizz
- EdPuzzle
- Canva
- Khan Academy
- Inside Mathematics
- NJDOE Digital Item Library
- New Jersey Center for Teaching and Learning
- New Jersey Climate Education Hub

Videos

- Converting percents to decimals and fractions
- Percent word problems: Tax and Discount

Integrated Technology

- Google Suite: Google Classroom, Docs, Drive, Mail, etc...
- Web Assign
- Devices:
    - Chromebooks
    - Texas Instrument TI-84 Plus Graphing Calculator

ML Resources
• Multi-Language Glossary
Gifted & Talented Resources
• Leveled Assessments • Enrichment worksheets

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

Section 8.1 Percent, Sales Tax, and Discounts		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Express fractions as percents • Express decimals as percents • Express percents as decimals • Solve applied problems involving involving sales tax and discounts • Find percent increase and decrease • Find percents of percents	**Cumulative Practice:** Thinking activity: Have students think of something they would like to buy. If there is a 10% discount, what would the new cost be? **Prerequisite Skills Practice:** Recall what operation is involved with fractions	Thinking Mathematically 1-34 odds, 39, 42, 46, 50, 53, 58

Section 9.3 Percents		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Write a percent as a fraction • Write a fraction as a percent • Use the proportion method to solve percent problems • Use the basic percent equation	**Cumulative Practice:** Thinking activity: What method is used to solve when given a proportion? **Prerequisite Skills Practice:** Recall the definition of a proportion	Thinking Mathematically 1-12, 15, 18, 23, 25, 29,

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

Assessments		
Summative	**Formative**	**Performance**
The following assessments will be used to evaluate student learning, skill acquisition and academic achievement of the Standards of Mathematical Practice and the New Jersey Learning Standards for Mathematics listed under each chapter in the Algebra 1 curriculum/syllabus at the conclusion of an instructional time period. • Diagnostic Pre-Test • Chapter Tests • Periodic Benchmarks • Standardized Tests	The effectiveness of the instructional program will be based on numerous activities and strategies including the following and are not limited to: • Teacher observations • Self-Assessments • Student record-keeping • Quizzes • Warm-ups • Exit Tickets • Participation in class discussions • Independent practice	The following assessments require students to utilize various strands of mathematics. • Projects • Performance Tasks • Homework • Classwork

List of Accommodations and Modifications

- Special Education
- 504 Students
- At Risk Students
- MLL
- Gifted and Talented

State Mandates and Resources

- New Jersey Student Learning Standards
- Standards for Mathematical Practices

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PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Unit Title 3A: Measurement	
By mastering dimensional analysis and unit conversion within the metric system, students develop critical mathematical skills applicable across disciplines. These skills empower them to navigate and solve problems involving measurements effectively, fostering quantitative literacy and a deeper understanding of mathematical concepts in everyday life. This unit equips students with the tools necessary to approach measurement challenges methodically and confidently, reinforcing the importance of precision and accuracy in mathematical reasoning and application.	
Essential Questions	**Learning Targets/Objectives**
1. How can you use dimensional analysis to change units of measurement? 2. How can you understand and use metric prefixes? 3. How can you convert units within the metric system? 4. How can you use dimensional analysis to change to and from the metric system?	Students will be able to: • Use dimensional analysis to change units of measurement • Change units within the metric system • Use dimensional analysis to change to and from the metric system • Use dimensional analysis
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Measure, length, linear	linear measurement, linear units, dimensional analysis, unit fraction

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. 5-M.A.1	1. Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.
2. M-MD.A.1	2. Convert units of measurement in both customary and metric systems through the use of proportions and dimensional analysis.
3. N-Q.A.3 	3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. Climate Change Example: Students may, when reporting quantities related to how variations in the flow of energy into and out of the Earth's systems result in climate change, choose a level of accuracy appropriate to limitations on how quantities were measured.
NJSLS	**Interdisciplinary Connections**
1. HSN-Q.A.1	1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays
2. W.WR.9–10.5	2. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.3.12.BM.1	1. Utilize mathematical concepts, skills and problem solving to obtain necessary information for decision-making in business.

2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.1.12.AP.1	1. Design algorithms to solve computational problems using a combination of original and existing algorithms

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- EdPuzzle
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- Khan Academy
- Inside Mathematics
- NJDOE Digital Item Library
- New Jersey Center for Teaching and Learning
- New Jersey Climate Education Hub

Videos

- Dimensional Analysis

Integrated Technology

- Google Suite: Google Classroom, Docs, Drive, Mail, etc...
- **Textbook Platform???**
- Devices:
  - Chromebooks
  - Texas Instrument TI-84 Plus Graphing Calculator

ML Resources

- Multi-Language Glossary

Gifted & Talented Resources

- Leveled Assessments
- Enrichment worksheets

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

Section 9.1 Measuring Length; The Metric System		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Use dimensional analysis to change units of measurement • Change units within the metric system • Use dimensional analysis to change to and from the metric system • Use dimensional analysis	**Cumulative Practice:** Thinking activity: How can you convert inches to feet? **Prerequisite Skills Practice:** Recall how many inches are in a foot	Thinking Mathematically 1-26 odd, 27, 28, 34, 39, 44, 46, 48, 63, 70, 74, 78

PART IV: EVIDENCE OF LEARNING

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Assessments		
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• Periodic Benchmarks • Standardized Tests	• Participation in class discussions • Independent practice	

List of Accommodations and Modifications

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PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Unit Title 3B: Geometry	
This unit provides a foundational understanding of geometric concepts essential for liberal arts students. By mastering points, lines, planes, angles, and triangles, students gain the ability to analyze and solve problems involving spatial relationships, laying the groundwork for deeper exploration in mathematics and related disciplines.	
Essential Questions	**Learning Targets/Objectives**
1. How can you understand points, lines, and planes as the basis of geometry? 2. How can you solve problems involving angle measures? 3. How can you solve problems involving angles formed by parallel lines and transversals? 4. How can you solve problems involving angle relationships in triangles? 5. How can you solve problems involving similar triangles? 6. How can you solve problems using the Pythagorean Theorem?	Students will be able to: • Use degree measures • Find angle measures and complements • Find angle measures and supplements • Use vertical angles • Find angle measures when parallel lines are intersected by a transversal • Use angle relationships in triangles • Use similar triangles • Problem solve using similar triangles • Use the Pythagorean Theorem

Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Point, line, ray, line segment, angle, vertex, degree, acute angle, right angle, straight angle, obtuse angle, complementary angles, complement, supplementary angles, supplement, vertical angles, parallel lines, intersecting lines, perpendicular lines, Triangle, scale drawings, corresponding sides, hypotenuse, legs, pythagorean theorem, Perimeter, polygon, quadrilateral, regular polygon, rectangle,	Plane, initial side, terminal side, transversal, alternate interior angles, alternate exterior angles, corresponding angles, tessellation

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. G-CO.1	1. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.
2. G-CO.11	2. Prove theorems about parallelograms. Theorems include the opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.
3. 8-G.5	3. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.
4. G-CO.9	4. Prove theorems about lines and angles. Theorems include alternate interior angles are congruent, alternate exterior angles are congruent, same-side interior angles are supplementary, same-side exterior angles are supplementary,

	corresponding angles are congruent, and vertical angles are congruent.
5. G-CO.10	5. Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180 degrees; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.
6. G-SRT.6	6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
7. G-SRT.8	7. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
8. G-MG.A.1 	8. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder). Climate Change Example: Students may use circles, their measures, and their properties to describe the cross section of a tree and compare changes in radial diameter or circumference variations of tree trunks when considering changes in seasonal weather patterns over time.
NJSLS	**Interdisciplinary Connections**
1. RI.MF.9–10.6.	1. Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem.
2. RST.9-10.7	2. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.3.ST-SM.2	1. Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.

2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.1.12.AP.1	1. Design algorithms to solve computational problems using a combination of original and existing algorithms.

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- Interpret a Solution
- Make a Plan
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- Problem Solve

Reason abstractly and quantitatively: Investigate specific examples and represent them symbolically, and observe the relationships in numbers or symbols to derive conclusions about a concrete instance. Throughout the unit students are given problems that require them to:

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- Understand Quantities
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- Apply Mathematics
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- Use a Graph
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Videos

- Pythagorean Theorem
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- Google Suite: Google Classroom, Docs, Drive, Mail, etc...
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PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

Section 10.1 Points, Lines, Planes, and Angles		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Use degree measures • Find angle measures and complements • Find angle measures and supplements • Use vertical angles • Find angle measures when parallel lines are intersected by a transversal	**Cumulative Practice:** Thinking activity: Match the vocabulary word to their corresponding image (parallel, perpendicular, vertical, complementary, supplementary) **Prerequisite Skills Practice:** Recall the difference between a line, a line segment, and a ray	Thinking Mathematically 1-32 odds, 35-38, 39-42, 57, 58, 59, 60, 62

Section 10.2 Triangles		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises**
• Use angle relationships in triangles • Use similar triangles • Problem solve using similar triangles • Use the Pythagorean Theorem	**Cumulative Practice:** Thinking activity: When given two angles in a triangle, how do you find the third angle? **Prerequisite Skills Practice:** Recall the sum of the angles in a triangle	Thinking Mathematically 1-20 odds, 22, 25, 26, 29-35, 38, 41, 45

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Summative	**Formative**	**Performance**
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WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Unit Title 4A: Counting Methods and Probability Theory

By the end of the unit, students are equipped with a foundational understanding of the Fundamental Counting Principle, the basics of probability theory, and the nuances of events and conditional probability. They are prepared to apply these concepts not only within mathematical contexts but also as analytical tools that enrich their perspectives and approaches to problem-solving in the liberal arts and beyond. The unit encourages ongoing exploration and application of probabilistic reasoning as a valuable asset in navigating uncertainties in an increasingly complex world.

Essential Questions	Learning Targets/Objectives
1. How do you use the fundamental counting principle to determine the number of possible outcomes given a situation? 2. How do you compute theoretical probability? 3. How do you compute empirical probability? 4. How do you find the probability that an event will not occur? 5. How do you find the probability of one event or a second event occurring? 6. How do you understand and use odds? 7. How do you find the probability of one event and a second event occurring? 8. How do you compute conditional probabilities?	Students will be able to: • Count by forming a list • List the elements of an event using a table and tree diagram • Learn the fundamental counting principle • Apply the fundamental counting principle • Apply the fundamental counting principle with more than two groups of items • Apply the fundamental counting principle with or without replacement • Find a sample space • Learn how to find and use the theoretical probability of an event with a sample space of equally likely outcomes

	• Learn how to find and use the empirical probability of an event • Learn how to find the probability given a Punnett Square • Learn how to calculate odds • Learn about mutually exclusive (disjoint) events • Find the probability of mutually exclusive events • Draw Venn diagrams for disjoint and non-disjoint events • Use the addition rule for disjoint and non-disjoint events • Use the addition rule for probabilities • Find the complement of an event using the complement rule • Find a probability using the complement rule • Learn and apply the conditional probability formula • Determine conditional probability given tables • Use the product rule for probabilities • Find the product rule for successive events • Prove that events are independent • Learn and use the product rule for independent events
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Experiment, event, theoretical, empirical, odds	Sample space, single-stage experiment, multi-stage experiments, tree diagram, counting principle, replacement, decision tree, probability, complement, mutually exclusive, disjoint, independence, dependence, conditional

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. 7-SP.C8b	1. 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.
2. 7-SP.C5	2. 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.
3. 7-SP.C6	3. 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.
4. S-CP.A.1	4. 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").
5. S-CP.B.7	5. 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.
6. S-CP.A.2	6. 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.
7. S-CP.A.3	7. Understand the conditional probability of A given 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.
8. S-CP.A.4	8. 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.
9. S-CP.A.5 	9. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations Climate Change Example: Students may analyze the genetic composition in a Punnett Square of plants over time to determine whether there are statistically significant changes due to climate change.

10. S-CP.B.6	10. 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.
11. S-CP.B.8	11. 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.
NJSLS	**Interdisciplinary Connections**
1. RI.AA.9–10.7	1. Describe and evaluate the argument and specific claims in an informational text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and reasoning.
2. SL.PE.9-10.1.D	2. Respond thoughtfully to various perspectives, summarize points of agreement and disagreement, and justify own views. Make new connections in light of the evidence and reasoning presented.
3. HS-LS3-3	3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.3.12.BM.1	1. Utilize mathematical concepts, skills and problem solving to obtain necessary information for decision-making in business.
2. 9.3.HL-BRD.2	2. Apply the fundamentals of biochemistry, cell biology, genetics, mathematical concepts, microbiology, molecular biology, organic chemistry and statistics to conduct effective biotechnology research and development of products
2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.2.12.ETW.2	1. Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment.
2. 8.1.2.DA.4	2. Make predictions based on data using charts or graphs.

The 8 Mathematical Practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments, and projects:

Make sense of problems and persevere in solving them: Take time to analyze the given information and what the problem is asking to help you to plan a solution pathway. Throughout the unit students are given problems that require them to:

- Explain the Meaning
- Find Entry Points
- Analyze Givens
- Interpret a Solution
- Make a Plan
- Consider Similar Problems
- Check Progress
- Consider Simpler Forms
- Problem Solve

Reason abstractly and quantitatively: Investigate specific examples and represent them symbolically, and observe the relationships in numbers or symbols to derive conclusions about a concrete instance. Throughout the unit students are given problems that require them to:

- Make Sense of Quantities
- Use Equations
- Use Expressions
- Understand Quantities
- Use Operations
- Contextualize
- Relationships
- Reason Abstractly

Construct viable arguments and critique the reasoning of others: Make and justify conclusions and decide whether others' arguments are correct or flawed. Throughout the unit students are given problems that require them to:

- Use Assumptions
- Use Defi nitions
- Use Prior Results
- Make Conjectures
- Build Arguments
- Analyze Conjectures
- Use Counterexamples

- Justify Conclusions
- Compare Arguments
- Construct Arguments
- Listen and Ask Questions
- Critique Reasoning
- Use Logic
- Error Analysis

Model with mathematics: Apply the mathematics to a real-life problem, and you interpret mathematical results in the context of the situation. Throughout the unit students are given problems that require them to:

- Apply Mathematics
- Simplify a Solution
- Use a Diagram
- Use a Table
- Use a Graph
- Use a Formula
- Analyze Relationships
- Interpret Results
- Model Real Life

Use appropriate tools strategically: Know what tools are available and think about how each tool might help solve a mathematical problem. Use a tool for its advantages, while being aware of its limitations. Throughout the unit students are given problems that require them to:

- Choose Tools
- Recognize Usefulness of Tools
- Use Other Resources
- Use Technology to Explore

Attend to precision: Develop a habit of being careful how you talk about concepts, label your work, and write your answers. Throughout the unit students are given problems that require them to:

- Communicate Precisely
- Use Clear Definitions
- State the Meaning of Symbols
- Specify Units
- Label Axes
- Calculate Accurately
- Understand Mathematical Terms

Look for and make use of structure: Look closely to see structure within a mathematical statement, or step back for an overview to see how individual parts make one single object. Throughout the unit students are given problems that require them to:

- View as Components
- Look for Patterns
- Look for Structure

Look for and express regularity in repeated reasoning: Notice patterns and make generalizations. Keeping in mind the goal of a problem helps you evaluate reasonableness of answers along the way. Throughout the unit students are given problems that require them to:

- Repeat Calculations
- Find General Methods
- Maintain Oversight
- Evaluate Results

Resources

Textbook

Primary Textbook: Mathematical Excursions - 4e; Aufmann, Lockwood, Nation, and Clegg
Supplementary Textbook: Thinking Mathematically - Eighth Edition; Blitzer

Online Resources

- Desmos Activities
- WebAssign
- Pear Assessment
- IXL
- Quizizz
- EdPuzzle
- Canva
- Khan Academy
- Inside Mathematics
- NJDOE Digital Item Library
- New Jersey Center for Teaching and Learning
- New Jersey Climate Education Hub

Videos
• Comparing Theoretical to Experimental Probabilities • Compound Sample Spaces
Integrated Technology

• Google Suite: Google Classroom, Docs, Drive, Mail, etc...
• Web Assign
• Devices:
  ○ Chromebooks
  ○ Texas Instrument TI-84 Plus Graphing Calculator

ML Resources
• Multi-Language Glossary
Gifted & Talented Resources
• Leveled Assessments • Enrichment worksheets

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

Section 12.1 The Fundamental Counting Principle		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises, pg 695**
• Count by forming a list • List the elements of an event using a table and tree diagram • Learn the fundamental counting principle • Apply the fundamental counting principle • Apply the fundamental counting principle with more than two groups of items • Apply the fundamental counting principle with or without replacement	**Warm-up:** Thinking activity: Pair/share and have students guess at the probability of winning a lottery. Have students use calculator to determine the percent of winning tickets out of millions. Discuss meaning of odds. **Prerequisite Skills Practice:** Practice using TI-84 to calculate percentages. Change percentages to decimal and percentage format and vice versa.	Mathematical Excursions 1-9 odds, 11-33 odds

Section 12.3 Probability and Odds		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises, pg 715**
• Find a sample space • Learn how to find and use the theoretical probability of an event with a sample space of equally likely outcomes • Learn how to find and use the empirical probability of an event • Learn how to find the probability given a Punnett Square • Learn how to calculate odds	**Warm-up:** Thinking activity: Pair/share. Have students think about the comparison - the probability of winning the lottery versus being struck by lightning. **Prerequisite Skills Practice:** Listing out a sample space, determining the number of items in a sample space	Mathematical Excursions 1-5 odds, 7-21 odds, 35, 37, 44-48, 49, 51, 53, 72

Section 12.4 Addition and Complement Rules		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises, pg 725**
• Learn about mutually exclusive (disjoint) events • Find the probability of mutually exclusive events • Draw Venn diagrams for disjoint and non-disjoint events • Use the addition rule for disjoint and non-disjoint events • Use the addition rule for probabilities • Find the complement of an event using the complement rule • Find a probability using the complement rule	**Warm-up:** Compare two situations (two events with overlapping elements and two events with no overlapping elements). Ask students what they notice. **Prerequisite Skills Practice:** Listing out a sample space, determining the probability of a specific event	Mathematical Excursions 1, 2, 3-9 odds, 11-14, 15-25 odd, 27, 29, 35, 37, 39

Section 12.5 Conditional Probability		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises, pg 734**
• Learn and apply the conditional probability formula • Determine conditional probability given tables • Use the product rule for probabilities • Find the product rule for successive events • Prove that events are independent • Learn and use the product rule for independent events	**Warm-up:** Ask the student to calculate the empirical probability given a table, and then change the question to include a “given” event. Discuss how the problem changes. **Prerequisite Skills Practice:** Find the probability of an event given a table.	Mathematical Excursions 3-6, 7-10, 11-21 odd, 23-33 odd, 35, 37, 39, 43, 49, 51, 57, 59

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

Assessments		
Summative	**Formative**	**Performance**
The following assessments will be used to evaluate student learning, skill acquisition and academic achievement of the Standards of Mathematical Practice and the New Jersey Learning Standards for Mathematics listed under each chapter in the Algebra 1 curriculum/syllabus at the conclusion of an instructional time period. ● Diagnostic Pre-Test ● Chapter Tests ● Standardized Tests	The effectiveness of the instructional program will be based on numerous activities and strategies including the following and are not limited to: ● Teacher observations ● Self-Assessments ● Student record-keeping ● Quizzes ● Warm-ups ● Exit Tickets ● Participation in class discussions ● Independent practice	The following assessments require students to utilize various strands of mathematics. ● Projects ● Performance Tasks ● Homework ● Classwork
List of Accommodations and Modifications ● Special Education ● 504 Students ● At Risk Students ● MLL ● Gifted and Talented		

State Mandates and Resources
● New Jersey Student Learning Standards ● Standards for Mathematical Practices

Black Horse Pike Regional School District

Where inspiring excellence is our standard, and student achievement is the result.

Liberal Arts Math
Course Number: 034900

Updated: June 2024

PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Unit Title 4B: Statistics	
By the conclusion of the unit, students have acquired a comprehensive toolkit for exploring, analyzing, and interpreting data through the lens of statistical principles. They are equipped with skills to navigate between populations and samples, apply diverse sampling techniques, summarize data effectively through frequency distributions and graphs, and derive meaningful insights using measures of central tendency and dispersion. The unit underscores the integral role of data analysis in the liberal arts, empowering students to engage critically with quantitative information and contribute thoughtfully to academic inquiry and societal discourse.	
Essential Questions	**Learning Targets/Objectives**
1. How do you describe a population? 2. How do you choose an appropriate sampling technique? 3. How do you organize and present data? 4. How do you identify deceptions in visual displays of data? 5. How do you determine the mean, median, and mode of a dataset? 6. How do you interpret the mean, median, and mode of a dataset? 7. How do you determine the range and standard deviation for a dataset? 8. How do you interpret the range and standard deviation for a dataset?	Students will be able to: • Describe population versus sample • Design random samples • Select appropriate sampling techniques • Define a representative sample • Construct a frequency distribution • Construct a grouped frequency distribution • Construct a histogram of grouped data • Construct a stemplot • Identify misleading displays of data • Find and interpret the mean of a dataset • Find and interpret the median of a dataset

	• Find mean and median using TI-84 • Find the mode of a dataset • Determine which measure of center is best • Find a weighted mean • Find the mean of data displayed in a frequency distribution • Find the range of a dataset • Find and interpret the standard deviation of a dataset • Find the variance of a dataset • Find measures of dispersion using TI-84
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Data, random, statistics	Descriptive, inferential, population, sample, frequency distribution, grouped, lower class limits, upper class limits, histogram, line graph, stemplot, mean, median, mode, weighted mean, range, standard deviation

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. S-IC.A.1	1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
2. S-IC.B.3	2. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
3. S-ID.A.1	3. Represent data with plots on the real number line (dot plots, histograms, and box plots). Climate Change Example: Students may represent geoscience data, with plots on the real number line, as they analyze results from global climate models.

4. S-ID.B.5	4. Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.
5. S-ID.A.2	5. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.
6. S-ID.A.3	6. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).
NJSLS	**Interdisciplinary Connections**
1. RI.AA.9–10.7	1. Describe and evaluate the argument and specific claims in an informational text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and reasoning.
2. HS-LS3-3	2. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
3. HS-LS2-1	3. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.3.12.BM.1	1. Utilize mathematical concepts, skills and problem solving to obtain necessary information for decision-making in business.
2. 9.3.HL-BRD.2	2. Apply the fundamentals of biochemistry, cell biology, genetics, mathematical concepts, microbiology, molecular biology, organic chemistry and statistics to conduct effective biotechnology research and development of products.
2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.2.12.ETW.2	1. Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment.
2. 8.1.2.DA.3	2. Identify and describe patterns in data visualizations.
3. 8.1.2.DA.4	3. Make predictions based on data using charts or graphs.

The 8 Mathematical Practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments, and projects:

Make sense of problems and persevere in solving them: Take time to analyze the given information and what the problem is asking to help you to plan a solution pathway. Throughout the unit students are given problems that require them to:

- Explain the Meaning
- Find Entry Points
- Analyze Givens
- Interpret a Solution
- Make a Plan
- Consider Similar Problems
- Check Progress
- Consider Simpler Forms
- Problem Solve

Reason abstractly and quantitatively: Investigate specific examples and represent them symbolically, and observe the relationships in numbers or symbols to derive conclusions about a concrete instance. Throughout the unit students are given problems that require them to:

- Make Sense of Quantities
- Use Equations
- Use Expressions
- Understand Quantities
- Use Operations
- Contextualize
- Relationships
- Reason Abstractly

Construct viable arguments and critique the reasoning of others: Make and justify conclusions and decide whether others' arguments are correct or flawed. Throughout the unit students are given problems that require them to:

- Use Assumptions
- Use Defi nitions
- Use Prior Results
- Make Conjectures
- Build Arguments

- Analyze Conjectures
- Use Counterexamples
- Justify Conclusions
- Compare Arguments
- Construct Arguments
- Listen and Ask Questions
- Critique Reasoning
- Use Logic
- Error Analysis

Model with mathematics: Apply the mathematics to a real-life problem, and you interpret mathematical results in the context of the situation. Throughout the unit students are given problems that require them to:

- Apply Mathematics
- Simplify a Solution
- Use a Diagram
- Use a Table
- Use a Graph
- Use a Formula
- Analyze Relationships
- Interpret Results
- Model Real Life

Use appropriate tools strategically: Know what tools are available and think about how each tool might help solve a mathematical problem. Use a tool for its advantages, while being aware of its limitations. Throughout the unit students are given problems that require them to:

- Choose Tools
- Recognize Usefulness of Tools
- Use Other Resources
- Use Technology to Explore

Attend to precision: Develop a habit of being careful how you talk about concepts, label your work, and write your answers. Throughout the unit students are given problems that require them to:

- Communicate Precisely
- Use Clear Definitions
- State the Meaning of Symbols
- Specify Units
- Label Axes

- Calculate Accurately
- Understand Mathematical Terms

Look for and make use of structure: Look closely to see structure within a mathematical statement, or step back for an overview to see how individual parts make one single object. Throughout the unit students are given problems that require them to:

- View as Components
- Look for Patterns
- Look for Structure

Look for and express regularity in repeated reasoning: Notice patterns and make generalizations. Keeping in mind the goal of a problem helps you evaluate reasonableness of answers along the way. Throughout the unit students are given problems that require them to:

- Repeat Calculations
- Find General Methods
- Maintain Oversight
- Evaluate Results

Resources

Textbook

Primary Textbook: Mathematical Excursions - 4e; Aufmann, Lockwood, Nation, and Clegg
Supplementary Textbook: Thinking Mathematically - Eighth Edition; Blitzer

Online Resources

- Desmos Activities
- WebAssign
- Pear Assessment
- IXL
- Quizizz
- EdPuzzle
- Canva
- Khan Academy
- Inside Mathematics
- NJDOE Digital Item Library
- New Jersey Center for Teaching and Learning

- New Jersey Climate Education Hub

Videos

- Finding mean, median, mode
- Finding range, variance, standard deviation

Integrated Technology

- Google Suite: Google Classroom, Docs, Drive, Mail, etc...
- Web Assign
- Devices:
  - Chromebooks
  - Texas Instrument TI-84 Plus Graphing Calculator

ML Resources

- Multi-Language Glossary

Gifted & Talented Resources

- Leveled Assessments
- Enrichment worksheets

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

Section 12.1 (Blitzer) Sampling, Frequency, Distributions, and Graphs		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises, pg 798 (Blitzer)**
• Describe population versus sample • Design random samples • Select appropriate sampling techniques • Define a representative sample • Construct a frequency distribution • Construct a grouped frequency distribution • Construct a histogram of grouped data • Construct a stemplot • Identify misleading displays of data	**Warm-up:** Pose question for pair/share: which graphs shown are misleading? Discuss as class. **Prerequisite Skills Practice:** Compare mean versus median for a dataset. Which better represents the center?	Thinking Mathematically 1, 3-6, 7, 9-16, 22-25, 32, 33-37

Section 13.1 Measures of Central Tendency		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises, pg 759**
• Find and interpret the mean of a dataset • Find and interpret the median of a dataset • Find mean and median using TI-84 • Find the mode of a dataset • Determine which measure of center is best • Find a weighted mean • Find the mean of data displayed in a frequency distribution	**Warm-up:** Have students practice adding up test scores and dividing by total on TI-84. What happens if one score is replaced with a zero? Pair/share **Prerequisite Skills Practice:** Have students practice ordering a dataset and finding the middle data point.	Mathematical Excursions 1-9 odd, 11-17 odd, 22, 35, 38

Section 13.2 Measures of Dispersion		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises, pg 769**
• Find the range of a dataset • Find and interpret the standard deviation of a dataset • Find the variance of a dataset • Find measures of dispersion using TI-84	**Warm-up:** Ask the student to identify the minimum and maximum number in a dataset. **Prerequisite Skills Practice:** Find the mean of a dataset using a calculator	Mathematical Excursions 1, 3-9 odd, 13,15, 18, 22

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

Assessments		
Summative	**Formative**	**Performance**
The following assessments will be used to evaluate student learning, skill acquisition and academic achievement of the Standards of Mathematical Practice and the New Jersey Learning Standards for Mathematics listed under each chapter in the Algebra 1 curriculum/syllabus at the conclusion of an instructional time period. • Diagnostic Pre-Test • Chapter Tests • Standardized Tests	The effectiveness of the instructional program will be based on numerous activities and strategies including the following and are not limited to: • Teacher observations • Self-Assessments • Student record-keeping • Quizzes • Warm-ups • Exit Tickets • Participation in class discussions • Independent practice	The following assessments require students to utilize various strands of mathematics. • Projects • Performance Tasks • Homework • Classwork

List of Accommodations and Modifications

- Special Education
- 504 Students
- At Risk Students
- MLL
- Gifted and Talented

State Mandates and Resources

- New Jersey Student Learning Standards
- Standards for Mathematical Practices

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Course Number: 034900

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PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Unit Title 4C: Positional Measures and Normal Distribution

This unit in liberal arts math introduces measures of position, the empirical rule, and the normal distribution, pivotal concepts for comprehending data distribution and variability. Measures of position, such as percentiles and quartiles, provide insights into where individual data points lie within a dataset. The empirical rule, based on the properties of the normal distribution, outlines how data is typically spread around the mean, guiding expectations for data values within specific ranges. Understanding the normal distribution, characterized by its symmetrical bell curve, further enables students to analyze and predict outcomes in diverse fields from economics to natural sciences. Mastering these concepts equips learners with essential tools to interpret data patterns critically and apply statistical reasoning in various academic and practical contexts.

Essential Questions	Learning Targets/Objectives
1. How do you measure and interpret relative position? 2. What are z scores and how are they interpreted? 3. What are percentiles and quartiles and how do you find them? 4. How do you graph key measures of a dataset to show relative position? 5. How do you recognize characteristics of normal distributions? 6. What is the empirical rule (68-95-99.7 rule) and how is it used? 7. How do you find probabilities for approximately normally distributed data sets? 8. How do you find values given standard normal probabilities and z scores?	Students will be able to: • Find and interpret z scores • Compare z scores • Use z scores to find data values • Find a percentile • Use percentiles in conjunction with z scores • Find and use quartiles • Make and interpret boxplots • Understand the properties of the Normal Distribution • Understand and use the Empirical Rule to solve an application • Understand the properties of the Standard Normal Distribution

9. How do you recognize whether distributions are normal or not?	• Find probabilities for a Standard Normal Distribution using the Standard Normal Curve Table and z scores (left, right, and in between cases) • Use the TI-84 to find standard normal probabilities • Given a probability, determine the threshold value of the variable (standard normal process backwards). • For non-normal distributions, identify skewness.
Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Symmetric, distribution, mean, median, standard deviation, probability	Normal, z score, percentile, quartile, skewness

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. S-ID.A.1	1. Represent data with plots on the real number line (dot plots, histograms, and box plots).Climate Change Example: Students may represent geoscience data, with plots on the real number line, as they analyze results from global climate models.
2. S-ID.A.4	2. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
3. S-IC.A.1	3. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
NJSLS	**Interdisciplinary Connections**
1. HS-LS3-3	1. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
2. HS-LS2-1	2. Use mathematical and/or computational representations to support explanations of factors that affect carrying

	capacity of ecosystems at different scales.
3. RI.MF.9–10.6.	3. Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem.
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.3.12.BM.1	1. Utilize mathematical concepts, skills and problem solving to obtain necessary information for decision-making in business.
2. 9.3.HL-BRD.2	2. Apply the fundamentals of biochemistry, cell biology, genetics, mathematical concepts, microbiology, molecular biology, organic chemistry and statistics to conduct effective biotechnology research and development of products.
2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.2.12.ETW.2.	1. Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment.
2. 8.1.2.DA.3	2. Identify and describe patterns in data visualizations.
3. 8.1.2.DA.4	3. Make predictions based on data using charts or graphs.

The 8 Mathematical Practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments, and projects:

Make sense of problems and persevere in solving them: Take time to analyze the given information and what the problem is asking to help you to plan a solution pathway. Throughout the unit students are given problems that require them to:

- Explain the Meaning
- Find Entry Points
- Analyze Givens
- Interpret a Solution
- Make a Plan
- Consider Similar Problems
- Check Progress

- Consider Simpler Forms
- Problem Solve

Reason abstractly and quantitatively: Investigate specific examples and represent them symbolically, and observe the relationships in numbers or symbols to derive conclusions about a concrete instance. Throughout the unit students are given problems that require them to:

- Make Sense of Quantities
- Use Equations
- Use Expressions
- Understand Quantities
- Use Operations
- Contextualize
- Relationships
- Reason Abstractly

Construct viable arguments and critique the reasoning of others: Make and justify conclusions and decide whether others' arguments are correct or flawed. Throughout the unit students are given problems that require them to:

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- Use Defi nitions
- Use Prior Results
- Make Conjectures
- Build Arguments
- Analyze Conjectures
- Use Counterexamples
- Justify Conclusions
- Compare Arguments
- Construct Arguments
- Listen and Ask Questions
- Critique Reasoning
- Use Logic
- Error Analysis

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Resources

Textbook

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Online Resources

- Desmos Activities
- WebAssign
- Pear Assessment
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- Quizizz
- EdPuzzle
- Canva
- Khan Academy
- Inside Mathematics
- NJDOE Digital Item Library
- New Jersey Center for Teaching and Learning
- New Jersey Climate Education Hub

Videos

- Normal Distribution
- Empirical Rule Example

Integrated Technology

- Google Suite: Google Classroom, Docs, Drive, Mail, etc...
- Web Assign
- Devices:
  - Chromebooks
  - Texas Instrument TI-84 Plus Graphing Calculator

ML Resources
• Multi-Language Glossary
Gifted & Talented Resources
• Leveled Assessments • Enrichment worksheets

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills?

Section 13.3 Measures of Relative Position		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises, pg 779**
• Find and interpret z scores • Compare z scores • Use z scores to find data values • Find a percentile • Use percentiles in conjunction with z scores • Find and use quartiles • Make and interpret boxplots	**Warm-up:** Provide two different student test scores and the class test average. Ask the students: which student performed better and why. Now ask students to compare a student's grade from two different classes (History vs English). Ask which grade is better. Discuss. **Prerequisite Skills Practice:** Evaluate a formula given different input values. Practice PEMDAS.	Mathematical Excursions 1,3,5,9,15,17,20,21

Section 13.4 The Normal Distribution		
Specific Learning Objective	**Warm-Up/Starting Options**	**Practice & Apply Exercises, pg 791**
• Understand the properties of the Normal	**Warm-up:**	Mathematical Excursions

Distribution ● Understand and use the Empirical Rule to solve an application ● Understand the properties of the Standard Normal Distribution ● Find probabilities for a Standard Normal Distribution using the Standard Normal Curve Table and z scores (left, right, and in between cases) ● Use the TI-84 to find standard normal probabilities ● Given a probability, determine the threshold value of the variable (standard normal process backwards). ● For non-normal distributions, identify skewness.	Recall: Find the z score for two runners 40 yard dash time. Interpret the z scores. **Prerequisite Skills Practice:** Solve an equation for a variable (Algebra 1 review)	3-7 odd, 9-14, 17-23 odd, 25, 27, 31-37 odd

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

Assessments		
Summative	**Formative**	**Performance**
The following assessments will be used to evaluate student learning, skill acquisition and academic achievement of the Standards of Mathematical Practice and the New Jersey Learning Standards for Mathematics listed under each chapter in the Algebra 1 curriculum/syllabus at the conclusion of an instructional time period. ● Diagnostic Pre-Test ● Chapter Tests ● Standardized Tests	The effectiveness of the instructional program will be based on numerous activities and strategies including the following and are not limited to: ● Teacher observations ● Self-Assessments ● Student record-keeping ● Quizzes ● Warm-ups ● Exit Tickets ● Participation in class discussions	The following assessments require students to utilize various strands of mathematics. ● Projects ● Performance Tasks ● Homework ● Classwork

	• Independent practice	

List of Accommodations and Modifications

- Special Education
- 504 Students
- At Risk Students
- MLL
- Gifted and Talented

State Mandates and Resources

- New Jersey Student Learning Standards
- Standards for Mathematical Practices

Black Horse Pike Regional School District

Where inspiring excellence is our standard, and student achievement is the result.

Liberal Arts Math
Course Number: 034900

Updated: June 2024

PART I: UNIT RATIONALE

<u>WHY</u> ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Unit Title 4D: Linear Regression and Correlation

In this unit of liberal arts math, we explore essential tools for analyzing relationships between variables: scatterplots, correlation, and regression analysis. Scatterplots visually depict the relationship between two variables, illustrating patterns that can suggest connections or trends. Correlation measures the strength and direction of these relationships, providing a numerical assessment of how closely related variables are. Regression analysis extends this by fitting a mathematical model to the data, enabling predictions and understanding of how changes in one variable affect another. These tools are foundational for interpreting and making informed decisions based on data, essential skills applicable across disciplines such as sociology, economics, and environmental studies.

Essential Questions	Learning Targets/Objectives
1. How do you create and interpret a scatterplot for a table of data items? 2. How do you compute and interpret the correlation coefficient? 3. How do you write the equation of the regression line? 4. How do you use technology to find the correlation coefficient and the equation of the regression line? 5. How do you make predictions using a line of best fit on a graph or using an equation? 6. How do you use the sample correlation coefficient to determine whether there is a correlation in the population?	Students will be able to: ● Draw a scatterplot by plotting points ● Describe the scatter plot ● Understand the rough “line of best fit” process ● Understand correlation and its properties ● Make a prediction about the correlation of a scatter plot (strength and direction) ● Find the least squares regression line (LSRL) using technology ● Make a prediction using the LSRL ● Find the correlation coefficient, r, using technology

Tier 2 Vocabulary *High-frequency words used throughout the unit*	**Tier 3 Vocabulary** *Discipline-specific words used throughout the unit*
Coordinate plane, coordinate pair, scatterplot, line of best fit	Correlation, causation, regression line, correlation coefficient, negative, positive, predictions, significance level

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

New Jersey Student Learning Standards That Support Learning Targets	
2023 New Jersey Student Learning Standards for Mathematics	
1. S-ID.B.6	1. Represent data on two quantitative variables on a scatter plot and describe how the variables are related. Climate Change Example: Students may represent geoscience data on two quantitative variables on a scatter plot and describe how the variables are related in order to analyze the data and the results from global climate models.
2. S-ID.B.6a	2. Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models. Climate Change Example: Students may use linear or exponential functions fitted to geoscience data to solve problems and analyze the results from global climate models to make an evidence-based forecast of the current rate of global climate change.
3. S-ID.B.6c	3. Fit a linear function for a scatter plot that suggests a linear association.
4. S-ID.C.7	4. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
5. S-ID.C.8	5. Compute (using technology) and interpret the correlation coefficient of a linear fit.
NJSLS	**Interdisciplinary Connections**
1. RI.MF.9–10.6	1. Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem.
2. HS-LS4-3	2. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable

	trait tend to increase in proportion to organisms lacking this trait.
2020 New Jersey Student Learning Standards for Career Readiness, Life Literacies, and Key Skills	
1. 9.3.12.BM.1	1. Utilize mathematical concepts, skills and problem solving to obtain necessary information for decision-making in business.
2. 9.3.12.AC-DES.2	2. Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.
2020 New Jersey Student Learning Standards for Computer Science and Design Thinking	
1. 8.2.12.ETW.2	1. Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment.
2. 8.1.2.DA.3	2. Identify and describe patterns in data visualizations.
3. 8.1.2.DA.4	3. Make predictions based on data using charts or graphs.

The 8 Mathematical Practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments, and projects:

Make sense of problems and persevere in solving them: Take time to analyze the given information and what the problem is asking to help you to plan a solution pathway. Throughout the unit students are given problems that require them to:

- Explain the Meaning
- Find Entry Points
- Analyze Givens
- Interpret a Solution
- Make a Plan
- Consider Similar Problems
- Check Progress
- Consider Simpler Forms
- Problem Solve

Reason abstractly and quantitatively: Investigate specific examples and represent them symbolically, and observe the relationships in numbers or symbols to derive conclusions about a concrete instance. Throughout the unit students are given problems that require them to:

- Make Sense of Quantities
- Use Equations
- Use Expressions
- Understand Quantities
- Use Operations
- Contextualize
- Relationships
- Reason Abstractly

Construct viable arguments and critique the reasoning of others: Make and justify conclusions and decide whether others' arguments are correct or flawed. Throughout the unit students are given problems that require them to:

- Use Assumptions
- Use Defi nitions
- Use Prior Results
- Make Conjectures
- Build Arguments
- Analyze Conjectures
- Use Counterexamples
- Justify Conclusions
- Compare Arguments
- Construct Arguments
- Listen and Ask Questions
- Critique Reasoning
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Section 13.5 Linear Regression and Correlation		
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• Draw a scatterplot by plotting points • Describe the scatter plot • Understand the rough "line of best fit" process • Understand correlation and its properties • Make a prediction about the correlation of a scatter plot (strength and direction) • Find the least squares regression line (LSRL) using technology • Make a prediction using the LSRL • Find the correlation coefficient, r, using technology	**Warm-up:** Recall: Ask students to recall the line of best fit process. **Prerequisite Skills Practice:** Plot points on a coordinate plane.	Mathematical Excursions 1-4, 5-9 odds, 11,15,17 *use technology when finding r and LSRL.

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