ESL
SCIENCE
BUSINESS
BILINGUAL
PRESCHOOL
MATHEMATICS
LIBRARY MEDIA
SOCIAL STUDIES
WORLD LANGUAGES
GIFTED & TALENTED
TECHNOLOGY EDUCATION
ENGLISH LANGUAGE ARTS
FINE & PERFORMING ARTS
FAMILY & CONSUMER SCIENCE
HEALTH & PHYSICAL EDUCATION

RAHWAY PUBLIC SCHOOLS

CURRICULUM & INSTRUCTION

Course: Mathematics

Grade Level: 6

This curriculum is part of the Educational Program of Studies of the Rahway Public Schools.

ACKNOWLEDGMENTS

Anjanette Highsmith, Program Supervisor of K-6 Math, Science and Instructional Technology

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Dr. Tiffany A. Beer, Director of Curriculum and Instruction

Subject/Course Title:
Mathematics
Grade 6

Date of Board Adoption:
August 27, 2024

RAHWAY PUBLIC SCHOOLS CURRICULUM

Mathematics: Grade 6

PACING GUIDE

Unit	Title	Pacing
1	Area and Surface Area	5 Weeks
2	Introducing Ratios	5 Weeks
3	Unit Rates and Percentages	5 Weeks
4	Dividing Fractions	5 Weeks
5	Arithmetic in Base Ten	5 Weeks
6	Expressions and Equations	5 Weeks
7	Rational Numbers	5 Weeks
8	Data Sets and Distributions	5 Weeks
9	Putting It All Together **(Optional)**	3 Weeks

ACCOMMODATIONS

504 Accommodations:

- Provide scaffolded vocabulary and vocabulary lists.
- Provide extra visual and verbal cues and prompts.
- Provide adapted/alternate/excerpted versions of the text and/or modified supplementary materials.
- Provide links to audio files and utilize video clips.
- Provide graphic organizers and/or checklists.
- Provide modified rubrics.
- Provide a copy of teaching notes, especially any key terms, in advance.
- Allow additional time to complete assignments and/or assessments.
- Provide shorter writing assignments.
- Provide sentence starters.
- Utilize small group instruction.
- Utilize Think-Pair-Share structure.
- Check for understanding frequently.
- Have student restate information.
- Support auditory presentations with visuals.
- Weekly home-school communication tools (notebook, daily log, phone calls or email messages).
- Provide study sheets and teacher outlines prior to assessments.
- Quiet corner or room to calm down and relax when anxious.
- Reduction of distractions.
- Permit answers to be dictated.
- Hands-on activities.
- Use of manipulatives.
- Assign preferential seating.
- No penalty for spelling errors or sloppy handwriting.
- Follow a routine/schedule.
- Provide student with rest breaks.
- Use verbal and visual cues regarding directions and staying on task.
- Assist in maintaining agenda book.

IEP Accommodations:

- Provide scaffolded vocabulary and vocabulary lists.
- Differentiate reading levels of texts (e.g., Newsela).
- Provide adapted/alternate/excerpted versions of the text and/or modified supplementary materials.
- Provide extra visual and verbal cues and prompts.
- Provide links to audio files and utilize video clips.
- Provide graphic organizers and/or checklists.
- Provide modified rubrics.
- Provide a copy of teaching notes, especially any key terms, in advance.
- Provide students with additional information to supplement notes.
- Modify questioning techniques and provide a reduced number of questions or items on tests.
- Allow additional time to complete assignments and/or assessments.
- Provide shorter writing assignments.
- Provide sentence starters.
- Utilize small group instruction.
- Utilize Think-Pair-Share structure.
- Check for understanding frequently.
- Have student restate information.
- Support auditory presentations with visuals.
- Provide study sheets and teacher outlines prior to assessments.
- Use of manipulatives.
- Have students work with partners or in groups for reading, presentations, assignments, and analyses.
- Assign appropriate roles in collaborative work.
- Assign preferential seating.
- Follow a routine/schedule.

Gifted and Talented Accommodations:

- Differentiate reading levels of texts (e.g., Newsela).
- Offer students additional texts with higher lexile levels.
- Provide more challenging and/or more supplemental readings and/or activities to deepen understanding.
- Allow for independent reading, research, and projects.
- Accelerate or compact the curriculum.
- Offer higher-level thinking questions for deeper analysis.
- Offer more rigorous materials/tasks/prompts.
- Increase number and complexity of sources.
- Assign group research and presentations to teach the class.
- Assign/allow for leadership roles during collaborative work and in other learning activities.

ELL Accommodations:

- Provide extended time.
- Assign preferential seating.
- Assign peer buddy who the student can work with.
- Check for understanding frequently.
- Provide language feedback often (such as grammar errors, tenses, subject-verb agreements, etc…).
- Have student repeat directions.
- Make vocabulary words available during classwork and exams.
- Use study guides/checklists to organize information.
- Repeat directions.
- Increase one-on-one conferencing.
- Allow student to listen to an audio version of the text.
- Give directions in small, distinct steps.
- Allow copying from paper/book.
- Give student a copy of the class notes.

	● Provide written and oral instructions. ● Differentiate reading levels of texts (e.g., Newsela). ● Shorten assignments. ● Read directions aloud to student. ● Give oral clues or prompts. ● Record or type assignments. ● Adapt worksheets/packets. ● Create alternate assignments. ● Have student enter written assignments in criterion, where they can use the planning maps to help get them started and receive feedback after it is submitted. ● Allow student to resubmit assignments. ● Use small group instruction. ● Simplify language. ● Provide scaffolded vocabulary and vocabulary lists. ● Demonstrate concepts possibly through the use of visuals. ● Use manipulatives. ● Emphasize critical information by highlighting it for the student. ● Use graphic organizers. ● Pre-teach or pre-view vocabulary. ● Provide student with a list of prompts or sentence starters that they can use when completing a written assignment. ● Provide audio versions of the textbooks. ● Highlight textbooks/study guides. ● Use supplementary materials. ● Give assistance in note taking ● Use adapted/modified textbooks. ● Allow use of computer/word processor. ● Allow student to answer orally, give extended time (time-and-a-half). ● Allow tests to be given in a separate location (with the ESL teacher). ● Allow additional time to complete assignments and/or assessments. ● Read question to student to clarify. ● Provide a definition or synonym for words on a test that do not impact the validity of the exam. ● Modify the format of assessments. ● Shorten test length or require only selected test items. ● Create alternative assessments. ● On an exam other than a spelling test, don’t take points off for spelling errors.

UNIT OVERVIEW

Content Area: Mathematics

Unit Title: Area and Surface Area

Target Course/Grade Level: 6

Unit Summary: In this unit, students extend their reasoning about area to include shapes that are not composed of rectangles. Through activities designed and sequenced to allow students to make sense of problems and persevere in solving them Math Practices 1 (MP1), students build on these abilities and their knowledge of areas of rectangles to find the areas of polygons by decomposing and rearranging them to make figures whose areas they can determine (MP7). They learn strategies for finding areas of parallelograms and triangles, and use regularity in repeated reasoning (MP8) to develop formulas for these areas, using geometric properties to justify the correctness of these formulas. Students use these formulas to solve problems. They understand that any polygon can be decomposed into triangles, and use this knowledge to find areas of polygons. Students find the surface areas of polyhedra with triangular and rectangular surfaces. They study, assemble, and draw nets for polyhedra and use nets to determine surface areas. Throughout the unit, they discuss their mathematical ideas and respond to the ideas of others (MP3, MP6).

Approximate Length of Unit: 5 Weeks

LEARNING TARGETS

NJ Student Learning Standards:
Mathematics:

6.G.A.1 Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.

6.G.A.2 Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas and to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.

6.G.A.3 Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.

6.G.A.4 Represent three-dimensional figures (e.g., pyramid, triangular prism, rectangular prism) using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

6.EE.A.1 Write and evaluate numerical expressions involving whole-number exponents.

6.EE.A.2 Write, read, and evaluate expressions in which letters stand for numbers.

6.EE.A.2a Write expressions that record operations with numbers and with letters standing for numbers. For example, express the calculation “Subtract from 5” as 5-y.

6.EE.A.2c 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). For example, use the formulas and to find the volume and surface area of a cube with sides of length.

Interdisciplinary Connections and Standards:
English Language Arts:
SL.PE.6.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.
SL.II.6.2: Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.

Career Readiness, Life Literacies, and Key Skills:
9.4.5.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).
9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.
9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).
9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).
9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Technology:
8.1.2.DA.3: Identify and describe patterns in data visualizations.

Science & Engineering Practices:
Asking Questions and Defining Problems
Developing and Using Models
Constructing Explanations and Designing Solutions
Engaging in Argument from Evidence
Using Mathematics and Computational Thinking
Obtaining, Evaluating, and Communicating Information

Unit Understandings:

- Students learn to find areas of polygons by decomposing, rearranging, and composing shapes.
- They learn to understand and use the terms "base" and "height," and find areas of parallelograms and triangles.
- Students approximate areas of non-polygonal regions by polygonal regions.
- They represent polyhedra with nets and find their surface areas.

Unit Essential Questions:

- How can we extend our understanding of area beyond rectangles to include other shapes?
- How does composing and decomposing shapes help us find the area of polygons?
- What strategies can we use to find the areas of parallelograms and triangles?
- How can we use regularity in repeated reasoning to develop formulas for finding the areas of polygons?
- How do geometric properties justify the correctness of area formulas?

- How can we apply these formulas to solve real-world problems involving area?
- Why can any polygon be decomposed into triangles, and how does this knowledge help us find areas?
- What is the process for finding the surface areas of polyhedra with triangular and rectangular surfaces?
- How can we use nets to determine the surface areas of polyhedra, and what role do they play in understanding spatial relationships?
- How does discussing mathematical ideas and responding to the ideas of others enhance our understanding of geometry and area concepts?

Knowledge and Skills:

Students will know...

- How to solve real-world and mathematical problems involving area, surface area, and volume.
- How to apply and extend previous understandings of arithmetic to algebraic expressions.
- How to reason about and solve one-variable equations and inequalities.
- How to represent and analyze quantitative relationships between dependent and independent variables.
- How to find the area of a figure by decomposing it and rearranging its parts.

Students will be able to...

- Understand Geometric Patterns and Two-Dimensional Shapes:
    - Compare areas of shapes within geometric patterns and recognize the term "area" as the amount of plane a shape covers.
    - Calculate the area of regions by decomposing and rearranging shapes, explaining the solution method orally and in writing.
    - Demonstrate the additive property of area by composing polygons with a given area.
    - Recognize that if two figures can be placed one on top of another to match up exactly, they must have the same area.
- Understand Parallelograms, Triangles, and Polygons:
    - Compare and contrast different strategies for determining the area of parallelograms, triangles, and polygons.
    - Describe characteristics of parallelograms, triangles, and polygons orally and in writing.
    - Explain methods for finding the area of parallelograms, triangles, and polygons orally and in writing, including rearrangement and enclosure in a rectangle.
    - Generalize processes for finding the area of parallelograms, triangles, and polygons, understanding the relationship between base and height.
    - Apply formulas for the area of parallelograms, triangles, and polygons, making informed choices about measurements.
- Understand Three-Dimensional Objects:
    - Calculate surface area of rectangular prisms, understanding the concept of surface area and volume.
    - Compare features of prisms and pyramids orally and in writing.
    - Describe polyhedra using appropriate terminology and create nets for polyhedra.
    - Generalize processes for finding the surface area of prisms and pyramids, understanding their differences.
    - Explore the relationship between surface area and volume in three-dimensional objects.

EVIDENCE OF LEARNING

Assessment:
What evidence will be collected and deemed acceptable to show that students truly "understand"?

- Warm-ups
- Cool-downs
- Section Checkpoints
- Common Assessment: Illustrative Math End-of-Unit 1
- Daily Exit Slips
- Standards Mastery Assessment (iReady)

Learning Activities:
What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Online math games/activities
- Math Dialogue
- Thinking Classrooms
- Illustrative Mathematics (IM) 6.1 Lessons 1-19

6.G.A.1

- **Polygon Decomposition Activity**: Provide students with various polygons, such as irregular pentagons or hexagons, and ask them to decompose them into triangles and rectangles. Students can cut out paper shapes or use digital tools to manipulate the polygons. After decomposition, they should find the total area by summing the areas of the individual triangles and rectangles. This activity helps students understand how to find the area of irregular shapes by breaking them down into familiar shapes.
- **Real-world Problem Solving**: Present students with real-world scenarios that require finding the area of irregular shapes. For example, give them a blueprint of a garden with irregular boundaries and ask them to calculate the area for laying down turf. Students can use the decomposition method learned in class to find the total area. This activity reinforces the application of area calculation techniques in practical situations.

6.G.A.2

- **Prism Packing Exploration**: Provide students with various right rectangular prisms with fractional edge lengths. Have them physically pack the prisms with unit cubes, each representing a fraction of the length, width, and height. Then, guide them to recognize that the volume of the prism is equal to the total number of unit cubes packed inside. This hands-on activity helps students visualize and understand the concept of volume.
- **Real-world Volume Problems**: Present students with real-world scenarios that involve finding the volume of right rectangular prisms with fractional edge lengths. For example, give them a scenario where they need to calculate the volume of a juice box with dimensions given in fractions. Students can use both the packing method and the volume formula to solve the problem. This activity reinforces the application of volume calculation techniques in practical contexts.

6.G.A.3

- **Coordinate Plane Polygon Drawing**: Provide students with sets of coordinates and ask them to plot the points on the coordinate plane to form polygons. Start with simple shapes like triangles and quadrilaterals before progressing to more complex polygons. After drawing the polygons, students should find the lengths of the sides by counting the units between the points. This activity helps students understand how to draw polygons on the coordinate plane and calculate side lengths using coordinates.
- **Real-world Coordinate Problems**: Present students with real-world scenarios that require using coordinates to find the lengths of sides of polygons. For example, give them a map with coordinates representing the vertices of a building or a park boundary, and ask them to find the lengths of certain sides. Students can use their understanding of coordinate geometry to solve the problem and interpret the results in a real-world context. This activity reinforces the application of coordinate geometry techniques in practical situations.

6.G.A.4

- **Net Construction Challenge**: Provide students with various three-dimensional figures, such as cubes, rectangular prisms, and pyramids, and ask them to create nets for each figure using rectangles and triangles. Encourage students to think critically about how to arrange the shapes to form a net that can be folded to recreate the original figure. After constructing the nets, students should calculate the surface area of each figure using the net. This activity helps students understand how to represent three-dimensional figures using nets and calculate surface area.
- **Real-world Surface Area Problems**: Present students with real-world scenarios that require finding the surface area of three-dimensional figures. For example, give them a problem where they need to determine the amount of wrapping paper needed to wrap a gift box. Students can use their understanding of nets and surface area calculation to solve the problem. This activity reinforces the application of surface area calculation techniques in practical contexts.

6.EE.A.1

- **Exponent Exploration Game**: Create a game where students roll dice or draw cards to generate numerical expressions involving exponents. Provide each student with a set of dice or cards labeled with numbers and exponent symbols. For example, a roll might yield "2^3 + 4^2 - 5^2." Students then evaluate the expression and earn points based on their correct answers. This activity encourages students to practice evaluating expressions with whole-number exponents in a fun and engaging way.
- **Exponent Puzzle Challenge**: Create a set of puzzle pieces, each containing a numerical expression involving exponents. Cut the pieces apart and mix them up. Then, challenge students to reassemble the puzzle by correctly matching each expression with its evaluated value. For example, one puzzle piece might contain "3^2 * 5^0," and students would need to match it with the piece showing "9." This activity helps reinforce students' understanding of the relationship between numerical expressions and their evaluated values.

6.EE.A.2

- **Expression Translation Relay**: Divide the class into teams and set up a relay race-style activity. Place a whiteboard or a large sheet of paper at the front of the room. Provide each team with a set of expression cards containing expressions with variables. One member from each team runs to the board, selects a card, and writes the expression in numerical form. Then, they run back and tag the next team member to repeat the process. The first team to correctly translate and evaluate all expressions wins. This activity helps students practice writing and evaluating expressions with variables.
- **Expression Puzzle Challenge**: Create a set of puzzle pieces, each containing an expression with variables. Cut the pieces apart and mix them up. Challenge students to reassemble the puzzle by correctly matching each expression with its simplified form. For example, one puzzle piece might

contain "3x + 2x," and students would need to match it with the piece showing "5x." This activity reinforces students' understanding of simplifying expressions by combining like terms.

6.EE.A.2a

- **Expression Building Activity**: Provide students with a set of number and variable cards. In pairs or small groups, students create expressions that record operations using these cards. For example, they might create the expression "2x + 3" using a card labeled "2," a card labeled "x," and a card labeled "+ 3." After creating their expressions, students exchange them with another group to evaluate. This activity encourages students to practice writing expressions that represent operations with both numbers and variables.
- **Expression Matching Game**: Create a set of cards, each containing an expression with both numbers and variables. Create a matching set of cards containing the simplified form of each expression. Students work individually or in pairs to match each expression card with its simplified counterpart. For example, they might match the expression "5x + 2x" with the simplified form "7x." This activity reinforces students' ability to write expressions that record operations with both numbers and variables.

6.EE.A.2c

- **Expression Bingo**: Create bingo cards with expressions containing variables instead of numbers. Provide students with a list of numerical values for the variables. Call out values, and students must evaluate the corresponding expression on their bingo cards. If they have the evaluated value on their card, they mark it. The first student to get bingo wins. This activity reinforces students' ability to evaluate expressions at specific values of their variables.
- **Expression Scavenger Hunt**: Hide cards around the classroom, each containing an expression with variables. Assign each card a numerical value for the variables. Students search for the cards and evaluate the expressions using the assigned values. They record their answers on a worksheet. After finding and evaluating all the expressions, students compare answers and discuss any discrepancies. This activity encourages students to practice evaluating expressions at specific values while also engaging them in physical movement and collaboration.

RESOURCES

Teacher Resources:

- Place Value Assessment Tool: PVAT
- iReady Teacher Toolbox
- Illustrative Math (IM) Unit # 1
- IM Student Work
- IM Blackline Masters
- Online District Approved Digital Resources

Equipment Needed:

- Manipulatives
- IM Student Workbooks
- Student Whiteboards
- Chart Paper
- Dry Erase Markers
- Chromebooks

UNIT OVERVIEW

Content Area: Mathematics

Unit Title: Introducing Ratios

Target Course/Grade Level: 6

Unit Summary: This unit introduces students to ratios and equivalent fractions. Students learn that a ratio is an association between two quantities, e.g., "1 teaspoon of drink mix to 2 cups of water." Students analyze contexts that are often expressed in terms of ratios, such as recipes, mixtures of different paint colors, constant speed (an association of time measurements with distance measurements), and uniform pricing (an association of item amounts with prices). This unit introduces *discrete diagrams* and *double number line diagrams*, representations that students use to support thinking about equivalent ratios before their work with tables of equivalent ratios.

Approximate Length of Unit: 5 Weeks

LEARNING TARGETS

NJ Student Learning Standards:
Mathematics:

6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."

6.RP.A.3 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.

a. Make tables of equivalent ratios relating quantities with whole number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.

b. Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?

c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means times the quantity); solve problems involving finding the whole, given a part and the percent.

d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

Interdisciplinary Connections and Standards:
English Language Arts:

SL.PE.6.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.

SL.II.6.2: Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.

Career Readiness, Life Literacies, and Key Skills:
9.1.8.CP.1: Compare prices for the same goods or services
9.4.5.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).
9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).
9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).
9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Technology:
8.1.2.DA.4: Make predictions based on data using charts or graphs.

Science & Engineering Practices:
Asking Questions and Defining Problems
Developing and Using Models
Constructing Explanations and Designing Solutions
Engaging in Argument from Evidence
Using Mathematics and Computational Thinking
Obtaining, Evaluating, and Communicating Information

Unit Understandings:

- Students learn to understand and use the terms "ratio," "rate," "equivalent ratios," "per," "at this rate," "constant speed," and "constant rate," and to recognize when two ratios are or are not equivalent.
- Students will represent ratios as expressions, and represent equivalent ratios with double number line diagrams, tape diagrams, and tables.
- Students use these terms and representations in reasoning about situations involving color mixtures, recipes, unit pricing, and constant speed.

Unit Essential Questions:

- How can ratios be used to describe associations between two quantities in real-world contexts like recipes, paint mixtures, and uniform pricing?
- What are the different contexts where ratios are commonly used, and how do these contexts vary in terms of their application of ratios?
- How do discrete diagrams and double number line diagrams help us understand equivalent ratios, and how do they support our thinking before working with tables of equivalent ratios?
- What strategies can we use to analyze and interpret ratios in various scenarios, such as constant speed and uniform pricing?
- How do equivalent ratios relate to the concept of proportionality, and how can we determine if two ratios are equivalent?
- How can we apply our understanding of ratios and equivalent ratios to solve problems involving real-world situations, such as adjusting recipes or comparing prices?

Knowledge and Skills:
Students will know...

- Ratio concepts and use ratio reasoning to solve problems.

Students will be able to...

- Understanding Ratios and Equivalent Ratios:
  - Students will comprehend the term "ratio" and the notation a:b to refer to an association between quantities.
  - Describe associations between quantities using written and oral language, coordinating diagrams and multiple sentences.
  - Draw discrete diagrams to represent situations involving ratios and practice reading and writing sentences describing ratios.
- Understand Equivalent Ratios and Representations:
  - Students will explain equivalent ratios in the context of recipes and color mixtures, understanding the concept of doubling or tripling a recipe and generating and justifying equivalent ratios.
  - Compare discrete diagrams and double number line diagrams, explaining how to use a double number line diagram to find equivalent ratios.
- Understanding Rate Problems and Solving Strategies:
  - Comprehend and solve problems involving equivalent ratios using tables, multipliers, and strategic choices.
  - Understand the structure of what-why info gap activities and apply reasoning to solve real-world problems.
- Understand Part-Part-Whole Ratios and Application:
  - Students will comprehend the term "parts" in sentences describing ratios and draw tape diagrams to solve problems involving ratios and the total amount.
  - Compare and contrast different representations and solution methods for the same problem.

EVIDENCE OF LEARNING

Assessment:
What evidence will be collected and deemed acceptable to show that students truly "understand"?

- Warm-ups
- Cool-downs
- Section Checkpoints
- Common Assessment: Illustrative Math End-of-Unit 2
- Daily Exit Slips
- Standards Mastery Assessment (iReady)

Learning Activities:
What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Online math games/activities
- Math Dialogue
- Thinking Classrooms
- Illustrative Mathematics (IM) 6.2 Lessons 1-17

6.RP.A.1:

- **Ratio Exploration Stations:**
    - Students explore various stations in the classroom where objects or pictures represent different ratio relationships.
    - They use ratio language to describe the relationship between the quantities represented at each station (e.g., wings to beaks in a birdhouse).

6.RP.A.2:

- **Unit Rate Recipe Activity:**
    - Students analyze different recipes with varying ratios of ingredients.
    - They calculate the unit rate for each ingredient and discuss how the unit rate relates to the ratio relationship in the recipe.

6.RP.A.3:

- **Real-World Problem Solving:**
    - Students work on real-world scenarios involving ratios and rates, such as unit pricing at a grocery store or calculating speed.
    - They apply ratio and rate reasoning to solve the problems using tools like tables of equivalent ratios, tape diagrams, or double number line diagrams.
- **Unit Rate Task Cards:**
    - Students solve task cards with various unit rate problems, including those involving unit pricing and constant speed.
    - They work independently or in pairs to apply their understanding of unit rates to different contexts.
- **Measurement Unit Conversion Activity:**
    - Students practice converting measurement units in real-world contexts, using ratio reasoning to manipulate and transform units appropriately.
    - They solve problems involving measurement unit conversion by applying their understanding of ratio reasoning.

RESOURCES

Teacher Resources:

- iReady Teacher Toolbox
- Illustrative Math (IM) Unit # 2
- IM Student Work
- IM Blackline Masters
- Online District Approved Digital Resources

Equipment Needed:

- Manipulatives
- IM Student Workbooks
- Student Whiteboards
- Chart Paper
- Dry Erase Markers
- Chromebooks

UNIT OVERVIEW

Content Area: Mathematics

Unit Title: Unit Rates and Percentages

Target Course/Grade Level: 6

Unit Summary: In this unit, students find the two values a/b and b/a that are associated with the ratio $a:b$, and interpret them as rates per 1. Students learn that one of the two values (a/b or b/a) may be more useful than the other in reasoning about a given situation. They find and use rates per 1 to solve problems set in contexts (MP2), attending to units and specifying units in their answers. Measurement conversions provide other opportunities to use rates.

Students observe that if two ratios $a:b$ and $c:d$ are equivalent, then $ab=cd$. The values ab and cd are called *unit rates* because they can be interpreted in the context from which they arose as rates per unit. Students note that in a table of equivalent ratios, the entries in one column are produced by multiplying a unit rate by the corresponding entries in the other column. Students learn that "percent" means "per 100" and indicates a rate. Just as a unit rate can be interpreted in context as a rate per 1, a percentage can be interpreted in the context from which it arose as a rate per 100. The percentage—and the rate—indicate equivalent ratios of juice to beverage, e.g., 2 cups to 20 cups and 10 cups to 100 cups.

Tables and double number line diagrams are intended to help students connect percentages with equivalent ratios, and reinforce an understanding of percentages as rates per 100. Students should internalize the meaning of important benchmark percentages, for example, they should connect "75% of a number" with "3/4 times a number" and "0.75 times a number." Note that 75% ("seventy-five per hundred") does not represent a fraction or decimal (which are numbers), but that "75% of a number" is calculated as a *fraction of* or a *decimal times* the number.

Approximate Length of Unit: 5 Weeks

LEARNING TARGETS

NJ Student Learning Standards:
Mathematics:

6.RP.A.2 Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship. For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is ¾-cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."

6.RP.A.3 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.

a. Make tables of equivalent ratios relating quantities with whole number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.

b. Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?

c. Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means times the quantity); solve problems involving finding the whole, given a part and the percent.

d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

Interdisciplinary Connections and Standards:

English Language Arts:

SL.PE.6.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.

SL.II.6.2: Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.

Career Readiness, Life Literacies, and Key Skills:

9.4.5.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).

9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).

9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).

9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).

9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Technology:

8.1.2.DA.1: Collect and present data, including climate change data, in various visual formats.

8.1.2.DA.3: Identify and describe patterns in data visualizations.

8.1.2.DA.4: Make predictions based on data using charts or graphs.

Science & Engineering Practices:

Asking Questions and Defining Problems
Developing and Using Models
Constructing Explanations and Designing Solutions
Engaging in Argument from Evidence
Using Mathematics and Computational Thinking
Obtaining, Evaluating, and Communicating Information

Unit Understandings:

- Students learn to understand and use the terms “unit rate,” “speed,” “pace,” “percent,” and “percentage,” and recognize that equivalent ratios have equal unit rates.
- They represent percentages with tables, tape diagrams, and double number line diagrams, and as expressions.
- Students use these terms and representations in reasoning about situations involving unit price, constant speed, and measurement conversion.

Unit Essential Questions:

- How can we interpret rates per 1 in real-world situations, such as walking speeds or item prices, to make comparisons and decisions?
- When solving problems involving ratios and rates, how do we determine which value (a/b or b/a) is more useful in a given context?
- How can we use rates per 1 to solve measurement conversion problems effectively, considering units and specifying units in our answers?
- Why is it important to understand the concept of equivalent ratios and the relationship between them, especially when dealing with rates and percentages?
- How do unit rates and percentages relate to the concept of rates per 100, and how can they be interpreted in various contexts?
- How do tables and double number line diagrams help us visualize and understand the connection between percentages and equivalent ratios, reinforcing the idea of percentages as rates per 100?
- What are some benchmark percentages that are commonly used in real-world scenarios, and how can we connect them to fractions and decimals to solve problems efficiently?
- How do we distinguish between the percentage as a concept (representing a rate per 100) and the calculation of a specific percentage of a given quantity?

Knowledge and Skills:

Students will know…

- Ratio concepts and use ratio reasoning to solve problems.
- How to solve problems involving percentages.

Students will be able to...

- Connect the concept of rates and their importance in problem-solving.
- Develop strategies for solving problems involving unfamiliar rates and unit conversion.
- Compare different units of measure for length, volume, weight, and mass.
- Identify and approximate the size of various units.
- Determine the closest unit to measure given objects.
- Connect the concept that smaller units require more and larger units require fewer to measure the same quantity.
- Use estimation techniques for converting measurements between units.
- Use double number line diagrams and tables to solve unit conversion problems.
- Apply the concept of "rate per 1" to unit conversion.
- Recognize equivalent ratios based on the same rate per 1.
- Justify comparisons involving rates, speeds, or prices.
- Calculate and interpret unit rates associated with ratios.
- Apply unit rates to real-world scenarios involving speed, distance, and time.
- Interpret situations involving constant speeds and create visual representations.
- Complete tables of equivalent ratios using reasoning about unit rates.
- Demonstrate that equivalent ratios have the same rate per 1.
- Recognize the role of unit rate in tables of equivalent ratios.

- Apply reasoning about ratios and rates to solve practical problems, such as determining good deals.
- Practice arithmetic with fractions and decimals in real-world contexts.
- Connect percentages and their representation as rates per 100.
- Solve problems involving percentages using various diagrams and methods.
- Apply percentages to real-world scenarios, such as painting projects, to calculate costs and time requirements.

EVIDENCE OF LEARNING

Assessment:
What evidence will be collected and deemed acceptable to show that students truly "understand"?

- Warm-ups
- Cool-downs
- Section Checkpoints
- Common Assessment: Illustrative Math End-of-Unit 3
- Daily Exit Slips
- Standards Mastery Assessment (iReady)

Learning Activities:
What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Online math games/activities
- Math Dialogue
- Thinking Classrooms
- Illustrative Mathematics (IM) 6.3 Lessons 1-17

6.RP.A.2:

- **Unit Rate Recipe Activity:**
  - Students analyze different recipes with varying ratios of ingredients.
  - They calculate the unit rate for each ingredient and discuss how the unit rate relates to the ratio relationship in the recipe.

6.RP.A.3:

- **Kitchen Measurement Conversion:**
  - Provide students with recipes that use both metric and customary units of measurement.
  - Ask students to convert the measurements from one system to the other using ratio and rate reasoning.
  - Have students prepare the recipe using the converted measurements to see the practical application of unit conversion.
- **Unit Conversion Relay Race:**
  - Divide students into teams and set up stations with different measurement conversion tasks.
  - Each team member runs to a station, completes the conversion task, and runs back to tag the next team member.
  - The first team to complete all the conversion tasks correctly wins the relay race.

RESOURCES

Teacher Resources:

- iReady Teacher Toolbox
- Illustrative Math (IM) Unit # 3
- IM Student Work
- IM Blackline Masters
- Online District Approved Digital Resources

Equipment Needed:

- Manipulatives
- IM Student Workbooks
- Student Whiteboards
- Chart Paper
- Dry Erase Markers
- Chromebooks

UNIT OVERVIEW

Content Area: Mathematics

Unit Title: Dividing Fractions

Target Course/Grade Level: 6

Unit Summary: In this unit, students examine how the relative sizes of numerator and denominator affect the size of their quotient when numerator or denominator (or both) is a fraction. Students acquire the understanding that dividing a number by a fraction a/b is the same outcome as multiplying that number by b/a. They compute quotients of fractions. They solve problems involving lengths and areas of figures with fractional side lengths and extend the formula for the volume of a right rectangular prism to prisms with fractional edge lengths and use it to solve problems. Students use tape diagrams, equations, and expressions to represent situations involving partitive or quotitive interpretations of division with fractions. Given a multiplication or division equation or expression with fractions, students describe a situation that it could represent. They use tape diagrams and equations in reasoning about situations that involve multiplication and division of fractions.

Approximate Length of Unit: 5 Weeks

LEARNING TARGETS

NJ Student Learning Standards:
Mathematics:
6.NS.A Apply and extend previous understandings of multiplication and division to divide fractions by fractions.
6.NS.A.1 Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem.
6.G.A.1 Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.
6.G.A.2 Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas and to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.
6.EE.A.2b a. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity.

Interdisciplinary Connections and Standards:
English Language Arts:
SL.PE.6.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.

SL.II.6.2: Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.

Career Readiness, Life Literacies, and Key Skills:
9.4.5.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).
9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).
9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).
9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Science & Engineering Practices:
Asking Questions and Defining Problems
Developing and Using Models
Constructing Explanations and Designing Solutions
Engaging in Argument from Evidence
Using Mathematics and Computational Thinking
Obtaining, Evaluating, and Communicating Information

Unit Understandings:

- Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

Unit Essential Questions:

- How does the relationship between the numerator and denominator in a fraction affect the magnitude of the quotient when dividing?
- What is the significance of dividing by a fraction, and how does it relate to multiplying by the reciprocal?
- How do we compute quotients involving fractions, and what strategies can we employ to simplify such calculations?
- In what ways can we apply the concept of dividing fractions to solve problems related to lengths, areas, and volumes of geometric figures?
- How can tape diagrams, equations, and expressions be utilized to represent scenarios involving partitive or quotitive interpretations of division with fractions?
- Given a multiplication or division equation or expression involving fractions, how can we conceptualize a real-world situation that it could represent?
- How do tape diagrams and equations contribute to our reasoning process when dealing with situations that involve multiplication and division of fractions?

Knowledge and Skills:
Students will know...

- How to apply and extend previous understandings of multiplication and division to divide fractions by fractions.
- How to compute with accuracy and efficiency with multi-digit numbers and find common factors and multiples.
- How to apply and extend previous understandings of numbers to the system of rational numbers.

Students will be able to...

- Connect the terms "dividend" and "divisor" in the context of division problems and estimate quotients based on their relative sizes.
- Identify equivalent multiplication and division expressions, interpret tape diagrams representing equal-sized groups, and recognize different interpretations of division expressions.
- Create equations and diagrams for multiplication and division involving fractions, interpret verbal descriptions of multiplication situations, and solve problems with unit and non-unit fraction divisors.
- Utilize tape diagrams for division by fractions, coordinate strategies for dividing by fractions, and generalize the process.
- Apply division by fractions to solve problems involving lengths, areas, and volumes of geometric figures, and generalize volume calculations for rectangular prisms with fractional edge lengths.
- Apply operations with fractions to solve real-world problems, generate equations representing situations with fractions, and justify chosen operations and solutions.

EVIDENCE OF LEARNING

Assessment:

What evidence will be collected and deemed acceptable to show that students truly "understand"?

- Warm-ups
- Cool-downs
- Section Checkpoints
- Common Assessment: Illustrative Math End-of-Unit 4
- Daily Exit Slips
- Standards Mastery Assessment (iReady)

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Online math games/activities
- Math Dialogue
- Thinking Classrooms
- Illustrative Mathematics (IM) 6.4 Lessons 6.4 Lessons 1-17

6.NS.A & 6.NS.A.1

- Fraction Division Exploration
    - Begin by reviewing the concept of division of fractions using visual models and equations.
    - Provide students with fraction manipulatives and ask them to explore dividing fractions by fractions. Encourage them to use the manipulatives to represent the division process visually.
    - Guide students to interpret and compute quotients of fractions by fractions using the manipulatives.
    - Present students with word problems involving division of fractions by fractions. Have them represent the problems using visual fraction models and equations.

- Allow students to solve the word problems individually or in small groups, discussing their reasoning and strategies.
- Conclude by summarizing key concepts and strategies learned during the activity.

6.G.A.1

- **Finding Area with Geometric Shapes**
  - Review the concept of finding the area of geometric shapes, focusing on right triangles, other triangles, special quadrilaterals, and polygons.
  - Provide students with various geometric shapes cutouts and ask them to compose them into rectangles or decompose them into triangles and other shapes to find their areas.
  - Guide students through the process of finding the area of each shape by composing or decomposing it.
  - Present students with real-world and mathematical problems involving finding the area of geometric shapes. Encourage them to apply the techniques learned to solve these problems.
  - Allow students to work individually or in pairs to solve the problems, discussing their approaches and solutions.
  - Conclude by discussing different strategies used to find the area of geometric shapes and summarizing key concepts learned during the activity.

6.G.A.2

- **Exploring Volume of Rectangular Prisms with Fractional Edge Lengths**
  - Begin by reviewing the concept of volume and the formula for finding the volume of a right rectangular prism.
  - Provide students with unit cubes and rectangular prism models with fractional edge lengths. Ask them to pack the prisms with unit cubes to find their volumes.
  - Guide students through the process of determining the volume of each prism by counting the unit cubes.
  - Present students with real-world and mathematical problems involving finding the volume of right rectangular prisms with fractional edge lengths. Encourage them to apply the formulas and techniques learned to solve these problems.
  - Allow students to work individually or in pairs to solve the problems, discussing their approaches and solutions.
  - Conclude by summarizing key concepts learned during the activity and discussing the relationship between packing with unit cubes and using formulas to find volume.

6.EE.A.2b

- **Understanding Parts of an Expression**
  - Begin by reviewing the terms sum, term, product, factor, quotient, and coefficient with the students.
  - Provide examples of each term using simple expressions, and ensure students understand the role of each term in an expression.
  - Allow students to to work independently or in pairs to identify and underline each part of the expression using appropriate terms.
  - Have students write their answers on the board or chart paper and explain their choice of terms.
  - Conclude by reviewing ek concepts and terms covered during activity.

RESOURCES

Teacher Resources:

- iReady Teacher Toolbox
- Illustrative Math (IM) Unit # 4
- IM Student Work
- IM Blackline Masters
- Online District Approved Digital Resources

Equipment Needed:

- Manipulatives
- IM Student Workbooks
- Student Whiteboards
- Chart Paper
- Dry Erase Markers
- Chromebooks

UNIT OVERVIEW

Area: Mathematics

Unit Title: Arithmetic in Base Ten

Target Course/Grade Level: Math/ 6

Unit Summary: In this unit, students learn an efficient algorithm for division and extend their use of other base-ten algorithms to decimals of arbitrary length. Because these algorithms rely on the structure of the base-ten system, students build on the understanding of place value and the properties of operations developed during earlier grades (MP7). Students will extend algorithms for addition, subtraction, and multiplication, which they used with whole numbers in earlier grades, to decimals of arbitrary length. Students will extend their use of efficient algorithms for multiplication from whole numbers to decimals. Next the students will learn long division by tackling quotients of whole numbers that result in decimals, quotients of decimals and whole numbers, and finally quotients of decimals. Finally, students will use calculations with decimals to solve problems set in real-world contexts.

Approximate Length of Unit: 5 Weeks

LEARNING TARGETS

NJ Student Learning Standards:
Mathematics:

6.NS.A.1 Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc). How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4- cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?

6.NS.B.3 With accuracy and efficiency add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

Interdisciplinary Connections and Standards:
English Language Arts:
SL.PE.6.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.
SL.II.6.2: Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.

Career Readiness, Life Literacies, and Key Skills:
9.4.5.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).
9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).
9.4.5.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity.
9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).
9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Science & Engineering Practices:
Asking Questions and Defining Problems
Developing and Using Models
Constructing Explanations and Designing Solutions
Engaging in Argument from Evidence
Using Mathematics and Computational Thinking
Obtaining, Evaluating, and Communicating Information

Technology:
8.1.2.DA.1: Collect and present data, including climate change data, in various visual formats.
8.1.2.DA.3: Identify and describe patterns in data visualizations.
8.1.2.DA.4: Make predictions based on data using charts or graphs.

Unit Understandings:
- Students compute sums, differences, products, and quotients of multi-digit whole numbers and decimals, using efficient algorithms.
- They use calculations with whole numbers and decimals to solve problems set in real-world contexts.

Unit Essential Questions:
- How can you accurately and efficiently add, subtract, multiply, and divide decimals?
- How do you know which operation to choose when solving a real-life problem?
- How can you use addition, subtraction multiplication or division to solve equations?
- What is the relationship between multiplication and division in fraction models and how does that connect to decimals?

Knowledge and Skills:
Students will know…

- How to apply and extend previous understandings of multiplication and division to divide fractions by fractions.
- How to compute with accuracy and efficiency with multi-digit numbers and find common factors and multiples.

Students will be able to...

- Calculate sums and products of decimals in the context of money, and explain (orally and in writing) the calculation strategy.
- Estimate sums, differences, products, and quotients of decimals in the context of money, and explain (orally) the estimation strategy.
- Explain (in words and through other representations) that adding and subtracting decimals requires combining digits that represent like base-ten units.
- Add or subtract decimals, and explain the reasoning.
- Add or subtract decimals with multiple non-zero digits, and explain (orally) the solution method.
- Generalize (orally and in writing) that the number of decimal places in a product is related to the number of decimal places in the factors.
- Interpret different methods for computing the product of decimals.
- Draw and label a diagram to check the answer to a decimal multiplication problem.
- Interpret a description (in written language) of a real-world situation involving multiplication of decimals, and write a multiplication problem to represent it.
- Use an algorithm to calculate the product of two decimals, and explain (orally) the solution method.
- Recognize and explain (orally) that long division is an efficient strategy for dividing numbers, especially with multi-digit dividends.
- Use long division to divide whole numbers that result in a whole-number quotient, and multiply the quotient by the divisor to check the answer.
- Use long division to divide whole numbers that result in a quotient with a decimal.
- Divide decimals by whole numbers.
- Divide whole numbers or decimals by decimals.
- Choose whether an exact answer or an estimate is appropriate for a given problem.

EVIDENCE OF LEARNING

Assessment:
What evidence will be collected and deemed acceptable to show that students truly "understand"?

- Warm-ups
- Cool-downs
- Section Checkpoints
- Common Assessment: Illustrative Math Mid-Unit 5 Assessment
- Common Assessment: Illustrative Math End-of-Unit Assessment 5
- Daily Exit Slips
- Standards Mastery Assessment (iReady)

Learning Activities:

What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Online math games/activities
- Math Dialogue
- Thinking Classrooms
- Illustrative Mathematics (IM) 6.5 Lessons 1-15

6.NS.A.1

- **Fraction Pizzas:** Divide circles (pizzas!) into fractional slices. Students can solve word problems by acting them out. If there is a pizza cut into eighths, and you want to share it among 3 people, how much pizza does each person get?
- **Fraction Race:** Create a game board with fraction denominators (2nds, 3rds, etc.) as spaces. Players roll a die and divide a fraction (given or chosen by the teacher) by the number rolled. The first player to reach the whole number wins!
- **Fraction Riddles:** Write riddles where the answer is a fraction you get by dividing two other fractions. For example, "I am half of 3/4. What am I?" (This would be 3/8)

6.NS.B.3

- **Decimal Board Games:** Create a board game where players must solve decimal addition, subtraction, multiplication, or division problems to move forward. You can use dice to determine the numbers involved in the operation.
- **Decimal Grocery Shopping:** Simulate a grocery shopping trip. Students can create a shopping list with items priced in decimals. They then practice adding the prices, subtracting any coupons, and calculating the total cost.
- **"Real World" Word Problems:** Incorporate word problems that involve decimals into everyday scenarios. This could involve calculating recipe ingredients, figuring out travel distances, or determining sale prices.
- **Decimal Jeopardy:** Turn decimal practice into a game show! Divide the class into teams and create categories for addition, subtraction, multiplication, and division of decimals. Students compete to solve problems and earn points.

RESOURCES

Teacher Resources:

- iReady Teacher Toolbox
- Place Value Assessment Tool (PVAT)
- Illustrative Math (IM) Unit # 5
- IM Student Work
- IM Blackline Masters
- Online District Approved Digital Resources

Equipment Needed:

- Manipulatives
- IM Student Workbooks
- Student Whiteboards
- Chart Paper
- Dry Erase Markers
- Chromebooks

UNIT OVERVIEW

Area: Mathematics

Unit Title: Expressions and Equations

Target Course/Grade Level: Math/ 6

Unit Summary: In this unit, students learn to understand and use the terms "variable," "coefficient," "solution," "equivalent expressions," "exponent," "independent variable," and "dependent variable." They begin to write coefficients next to variables without a multiplication symbol, e.g., $10x$ rather than $10 \cdot x$, and note that x is $1 \cdot x$. Students learn other situations in which the multiplication symbol can be omitted, e.g., $6 \cdot (3+2)$ can be written as $6(3+2)$. They work with expressions that have positive whole-number exponents and whole-number, fraction, or variable bases, using properties of exponents strategically to evaluate these expressions, given a value for the variable.

Students find solutions for linear equations in one variable and simple equations that include exponents, e.g., $2^x = 32$ and $100 = x^2$. They use these terms and representations (including expressions with two variables) in reasoning about real-world and geometrical situations, understanding that some values of variables may not make sense in a given context. Students represent collections of equivalent ratios as equations and use and make connections between tables, graphs, and linear equations that represent the same relationships.

Approximate Length of Unit: 5 Weeks

LEARNING TARGETS

NJ Student Learning Standards:
Mathematics:

6.EE.A.1 Write and evaluate numerical expressions involving whole-number exponents.

6.EE.A.2a Write expressions that record operations with numbers and with letters standing for numbers. For example, express the calculation "Subtract y from 5" as 5 – y.

6.EE.A.2c 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). For example, use the formulas $V = s^3$ and $A = 6s^2$ to find the volume and surface area of a cube with sides of length $s = ½$.

6.EE.A.3 Apply the properties of operations to generate equivalent expressions. For example, apply the distributive property to the expression 3 (2 + x) to produce the equivalent expression 6 + 3x; apply the

distributive property to the expression 24x + 18y to produce the equivalent expression 6 (4x + 3y); apply properties of operations to y + y + y to produce the equivalent expression 3y.

6.EE.A.4 Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for.

6.EE.B.5 Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

6.EE.B.7 Solve real-world and mathematical problems by writing and solving equations of the form x + p = q and px = q for cases in which p, q and x are all nonnegative rational numbers.

6.EE.C.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time.

6.NS.B.3 With accuracy and efficiency add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."

6.RP.A.3a Make tables of equivalent ratios relating quantities with whole number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios.

6.RP.A.3b Solve unit rate problems including those involving unit pricing and constant speed. For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?

6.RP.A.3c Find a percent of a quantity as a rate per 100 (e.g. 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.

Interdisciplinary Connections and Standards:

English Language Arts:

SL.PE.6.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.

SL.II.6.2: Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.

Career Readiness, Life Literacies, and Key Skills:

9.4.5.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).

9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).

9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).

9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).

9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Science & Engineering Practices:

Asking Questions and Defining Problems
Developing and Using Models
Constructing Explanations and Designing Solutions
Engaging in Argument from Evidence
Using Mathematics and Computational Thinking
Obtaining, Evaluating, and Communicating Information

Technology:

8.1.2.DA.1: Collect and present data, including climate change data, in various visual formats.

8.1.2.DA.3: Identify and describe patterns in data visualizations.

8.1.2.DA.4: Make predictions based on data using charts or graphs.

Unit Understandings:

- Students learn to understand and use the terms "variable," "coefficient," "solution," "equivalent expressions," "exponent," "independent variable," and "dependent variable."
- Students create expressions and equations to represent different real-world scenarios presented.
- Students simplify expressions and solve equations using order of operations.
- Students extend their learning to identify and create equivalent expressions and equations.
- They use these terms and representations (including expressions with two variables) in reasoning about real-world and geometrical situations, understanding that some values of variables may not make sense in a given context.

Unit Essential Questions:

- How are expressions different from equations?
- What does a variable represent in an expression?
- How can we write expressions to represent real-life situations?
- Why is the order of operations important when evaluating expressions?
- How can we use exponents to write expressions more concisely?
- How can we evaluate expressions with variables when we are given specific values for those variables?
- Why is it important to simplify expressions whenever possible?
- How can we use the properties of operations (commutative, associative, distributive) to simplify expressions?
- What does it mean to solve an equation?
- How can we represent real-life situations with equations?
- What are some strategies for solving equations (e.g., guess and check, using a balance model)?
- How can we check if a solution actually works for an equation?
- How can we write an equation to represent a situation described by an expression?
- How can we write an expression to represent the solution of an equation?

- How are equivalent expressions related to equivalent equations?

Knowledge and Skills:

Students will know…

- How to apply and extend previous understandings of arithmetic to algebraic expressions.
- How to reason about and solve one-variable equation
- How to represent and analyze quantitative relationships between dependent and independent variables.
- How to 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.

Students will be able to...

- Interpret (orally and in writing) tape diagrams that represent equations of the form $p+x=q$ or $px=q$.
- Use tape diagrams to find unknown values in equations of the forms $x+p=q$ and $px=q$ and explain (orally) the solution method.
- Comprehend the word "variable" to refer to a letter standing in for a number and recognize that a coefficient next to a variable indicates multiplication (in spoken and written language).
- Generate values that make an equation true or false and justify (orally and in writing) whether they are "solutions" to the equation.
- Use substitution to determine whether a given number makes an equation true.
- Interpret hanger diagrams (orally and in writing) and write equations that represent relationships between the weights on a balanced hanger diagram.
- Use balanced hangers to explain (orally and in writing) how to find solutions to equations of the form $x+p=q$ or $px=q$.
- Interpret and coordinate sentences, equations, and diagrams that represent the same addition or multiplication situation.
- Solve equations of the form $x+p=q$ or $px=q$ and explain (in writing) the solution method.
- Comprehend that the notation a/b can be used to represent division generally, and the numerator and denominator can include fractions, decimals, or variables.
- Describe (orally) a situation that could be represented by a given equation of the form $x+p=q$ or $px=q$.
- Express division as a fraction (in writing) when solving equations of the form $px=q$.
- Explain (orally) how to create and solve an equation that represents a situation with an unknown amount.
- Write an expression with a variable to generalize the relationship between quantities in a situation.
- State explicitly what the chosen variable represents when creating an equation.
- Use equations to solve problems involving percentages and explain (orally) the solution method.
- Write equations of the form $px=q$ or equivalent to represent situations where the amount that corresponds to 100% is unknown.
- Explain (in writing) that some pairs of expressions are equal for one value of their variable but not for other values.
- Generate equivalent numerical expressions that are related by the distributive property, and explain (orally or using other representations) the reasoning.
- Use an area diagram to make sense of equivalent numerical expressions that are related by the distributive property.
- Generate algebraic expressions that represent the area of a rectangle with an unknown length.

- Justify (orally and using other representations) that algebraic expressions that are related by the distributive property are equivalent.
- Describe (orally and in writing) a pattern that could be expressed using repeated multiplication.
- Generate and evaluate numerical expressions involving whole-number exponents.
- Interpret expressions with exponents larger than 3, and comprehend the phrase “to the power” or “to the” (in spoken language).
- Interpret expressions with exponents that represent the surface area or volume of a cube.
- Evaluate expressions that have a variable, an exponent, and one other operation for a given value of the variable, carrying out the operations in the conventional order.
- Comprehend the terms “independent variable” and “dependent variable” (in spoken and written language).
- Identify (in writing) the independent and dependent variable in an equation.

EVIDENCE OF LEARNING

Assessment:
What evidence will be collected and deemed acceptable to show that students truly “understand”?

- Warm-ups
- Cool-downs
- Section Checkpoints
- Common Assessment: Illustrative Math Mid-Unit 6 Assessment
- Common Assessment: Illustrative Math End-of-Unit Assessment 6
- Daily Exit Slips
- Standards Mastery Assessment (iReady)

Learning Activities:
What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Online math games/activities
- Math Dialogue
- Thinking Classrooms
- Illustrative Mathematics (IM) 6.6 Lessons 1-19

6.EE.A.1: Order of Operations

- **Order of Operations Relay Race:** Divide students into teams and give them expressions with mixed operations. Each team member solves a part (PEMDAS order) and passes the answer to the next teammate. The first team to finish correctly wins!
- **Expression Challenge:** Write expressions on the board with missing parentheses. Students race to come up with the correct placement to get a specific answer.
- **PEMDAS Puzzle:** Create a puzzle with PEMDAS order steps. Students need to arrange the steps in the correct order to complete the puzzle.

6.EE.A.2: Writing Expressions with Variables

- **"Translation Station" Activity:** Set up stations with real-world scenarios (baking cookies, buying groceries). Students translate the scenarios into variable expressions.
- **"Variable Scavenger Hunt":** Hide clues around the classroom with variable expressions. Students need to solve them to find the next clue, leading to a hidden treasure!

- **"Emoji Expressions":** Assign emoji meanings to variables (happy = +5, sad = -2). Students create and solve expressions using emoji combinations.

6.EE.A.3 & 6.EE.A.4: Properties of Operations

- **Matching Game:** Create cards with expressions showcasing properties (commutative, associative, distributive) and their equivalent forms. Students match the expressions.
- **"Build an Equivalent Expression" Activity:** Provide students with manipulatives (counters, blocks) and have them build an expression. Then, challenge them to use properties to create an equivalent expression with a different structure.

6.EE.B.6 (Using Variables and Writing Expressions):

- **Variable Hunt:** Around the classroom or playground, hide cards with different scenarios, like "The temperature went up by x degrees today" or "John has y marbles." Students write expressions to represent each situation using a variable.
- **Mystery Bags:** Fill bags with objects and have students write expressions to show how many objects would be in the bag if there were x objects. They can then check their answers by counting the real objects.
- **Menu Math:** Create a pretend menu with variable prices (burgers cost b dollars, fries are f dollars). Students can write expressions to show the total cost of different meal combinations.

6.EE.B.7 (Solving Equations with One Variable):

- **Balance Beam:** Set up a balance beam with math problems on each side (e.g., $x + 5 = 10$). Students add or subtract manipulatives (counters, blocks) to one side until the balance is equal, finding the solution to the equation.
- **Escape Room Challenge:** Create a math-themed escape room where students have to solve one-step equations to get clues and "escape."
- **Equation Relay Race:** Divide the class into teams. Write one-step equations on the board. The first student from each team runs up, solves the equation, and tags the next teammate. The first team to finish wins.

6.EE.C

- **Expression Relay Race:** Divide students into teams. Each team gets a set of variable cards and numbers. The first student picks a card, a number card, and performs the indicated operation on the variable. (e.g., $x + 3$). They pass the result to the next student who picks another card and number, continuing the expression. The first team to complete the expression correctly wins.
- **Digital Escape Room:** Create a digital escape room where students need to solve problems involving evaluating expressions to progress through the game. Online platforms like Google Forms or escape room builder websites can be helpful for this.
- **Word Problem Scavenger Hunt:** Hide word problems around the classroom that involve evaluating expressions in real-world contexts (e.g., finding the total cost of groceries with variable prices). Students need to solve the problems and find the hidden locations.

6.NS.B.3

- **Decimal Board Game:** Design a board game with squares that have addition, subtraction, multiplication, or division problems with decimals. Players take turns solving the problems to move their game pieces.
- **Fraction to Decimal Relay Race:** Divide the class into teams. Give each team a fraction on a card. Students take turns converting the fraction to a decimal, practicing their place value understanding. The first team to finish correctly wins!
- **Decimal Estimation Challenge:** Present students with addition, subtraction, multiplication, and division problems with decimals. Challenge them to estimate the answer before calculating the exact answer. This helps with understanding the magnitude of the answer.

6.RP.A.1

- **Legos and Ratios:** Give students Legos in different colors and challenge them to build structures with specific ratios of colors (e.g., build a tower with a 1:2 ratio of red to blue Legos). This is a fun way to practice representing ratios visually.
- **Ratio Matching Game:** Create cards with pictures or descriptions on one side representing a ratio (e.g., 3 slices of pizza) and cards with numbers representing the other part of the ratio (e.g., 1 person). Students flip cards and try to find matches, practicing identifying ratios.

6.RP.3a, 6.RP.3b, 6.RP.3c

- **Ratio Table Challenge:** Divide students into groups. Give each group a scenario (e.g., cookies baked by 2 chefs) and data points for one ratio (e.g., Chef A: 3 cookies, Chef B: 4 cookies). Challenge them to create a table listing at least 3 equivalent ratios.
- **Shopping Spree:** Create a shopping scenario with unit prices for various items (price per pound, price per ounce). Students can calculate the best deals and compare unit rates for different quantities of the same product.
- **Discount Frenzy:** Simulate a shopping experience with discounts. Provide price tags with original prices and discount percentages. Students can then calculate the discounted price and final cost.
- **Percent Puzzles:** Create puzzles where students need to solve percent problems (finding the whole, given a part and the percent) to reveal a hidden message or image.

RESOURCES

Teacher Resources:

- iReady Teacher Toolbox
- Place Value Assessment Tool (PVAT)
- Illustrative Math (IM) Unit #6
- IM Student Work
- IM Blackline Masters
- Online District Approved Digital Resources

Equipment Needed:

- Manipulatives
- IM Student Workbooks
- Student Whiteboards
- Chart Paper
- Dry Erase Markers
- Chromebooks

UNIT OVERVIEW

Area: Mathematics

Unit Title: Rational Numbers

Target Course/Grade Level: 6

Unit Summary: In this unit, students interpret signed numbers in contexts (e.g., temperature above or below zero, elevation above or below sea level). They understand and use the terms "positive number," "negative number," "rational number," "opposite," "sign," "absolute value," "a solution to an inequality," "less than," "greater than," and the corresponding symbols. Students plot points with signed rational number coordinates on the number line, and recognize and use the connection between relative position of two points on the number line and inequalities involving the coordinates of the points.

Students understand and use absolute value notation, understanding that the absolute value of a number is its distance from zero on the number line. They graph inequalities in one variable on number line diagrams, using a circle or disk to indicate when a given point is, respectively, excluded or included. Students solve simple inequalities, understanding that there may be infinitely many solutions, and show solutions symbolically and on the number line. They interpret solutions of inequalities in contexts, understanding that some solutions do not make sense in some contexts. Students plot pairs of signed number coordinates in the plane, understanding the relationship between the signs of a pair of coordinates and the quadrant of the corresponding point, and use coordinates to calculate horizontal and vertical distances between two points.

Students understand and use the terms "common factor," "greatest common factor," "common multiple," and "least common multiple," and solve problems set in real-world contexts in which common factors or multiples occur.

Approximate Length of Unit: 5 Weeks

LEARNING TARGETS

NJ Student Learning Standards:
Mathematics:

6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

6.NS.C.6 Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

6.NS.C.6c Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

6.NS.C.7a Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. For example, interpret *-3 > -7* as a statement that *-3* is located to the right of *-7* on a number line oriented from left to right.

6.NS.C.7b Write, interpret, and explain statements of order for rational numbers in real-world contexts. For example, write *–3*℃ > *–7*℃ to express the fact that *–3*℃ is warmer than *–7*℃.

6.NS.C.7c Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. For example, for an account balance of –30 dollars, write |–30| = 30 to describe the size of the debt in dollars.

6.NS.C.7d Distinguish comparisons of absolute value from statements about order. For example, recognize that an account balance less than –30 dollars represents a debt greater than 30 dollars.

6.NS.C.8 Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

6.G.A.3 Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.

6.EE.B.5 Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.

Interdisciplinary Connections and Standards:

English Language Arts:

SL.PE.6.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.

SL.II.6.2: Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.

Career Readiness, Life Literacies, and Key Skills:

9.4.5.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).

9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).

9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).

9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).

9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Science & Engineering Practices:

Asking Questions and Defining Problems
Developing and Using Models
Constructing Explanations and Designing Solutions
Engaging in Argument from Evidence
Using Mathematics and Computational Thinking
Obtaining, Evaluating, and Communicating Information

Technology:
8.1.2.DA.3: Identify and describe patterns in data visualizations.
8.1.2.DA.4: Make predictions based on data using charts or graphs.

Unit Understandings:

- Interpret signed numbers in contexts (e.g., temperature above or below zero, elevation above or below sea level) and plot points in all four quadrants of the coordinate plane for the first time.
- Position integers and rational numbers on vertical and horizontal number lines.
- Solve simple inequalities and show the solution in the context of a number line.

Unit Essential Questions:

- How can the distributive property be used to simplify expressions with common factors?
- How can we use a number line to represent rational numbers (including fractions and decimals)?
- What does the opposite sign of a number tell us about its location on the number line?
- How can we extend the number line concept to create a coordinate plane?
- What does the sign of a coordinate tell us about its location on the plane?
- How can we use coordinates to represent real-world situations?

Knowledge and Skills:
Students will know…

- How to apply and extend previous understandings of numbers to the system of rational numbers.
- How to reason about and solve one-variable equations and inequalities

Students will be able to...

- Comprehend the words “positive” and “negative” (in spoken and written language) and the symbol “-” (in written language). Say “negative” when reading numbers written with the “-” symbol.
- Interpret positive and negative numbers that represent temperature or elevation, and understand the convention of what “below zero” typically means in each of these contexts.
- Recognize that the number line can be extended to represent negative numbers.
- Comprehend that two numbers are called “opposites” when they are the same distance from zero, but on different sides of the number line.
- Interpret a point on the number line that represents a positive or negative rational number.
- Plot a point on a number line to represent a positive or negative rational number.
- Compare rational numbers in the context of temperature or elevation, and express the comparisons (in writing) using the symbols > and <.
- Critique (orally and in writing) statements comparing rational numbers, including claims about relative position and claims about distance from zero.
- Compare rational numbers without a context and express the comparisons using the terms “greater than,” “less than,” and “opposite” (orally and in writing).
- Comprehend that all negative numbers are less than all positive numbers.
- Order rational numbers from least to greatest, and explain (orally and through other representations) the reasoning.
- Recognize that signed numbers can be useful to represent changes in a quantity in opposite directions, e.g., money received and money paid, inventory bought and inventory sold, etc.
- Compare rational numbers and their absolute values, and explain (orally and in writing) the reasoning.
- Comprehend the phrase “absolute value” and the symbol || to refer to a number’s distance from zero on the number line.

- Interpret rational numbers and their absolute values in the context of elevation or temperature.
- Critique comparisons (expressed using words or symbols) of rational numbers and their absolute values.
- Generate values that meet given conditions for their relative position and absolute value, and justify the comparisons (using words and symbols).
- Recognize that the value of $-a$ can be positive or negative, depending on the value of a.
- Coordinate verbal, algebraic, and number line representations of inequalities.
- Critique (orally and in writing) possible values given for a situation with a constraint, including determining whether the boundary value is included and making sense of situations with discrete quantities.
- Interpret phrases that describe a quantity constrained by a maximum or minimum acceptable value, e.g. “at least,” “at most,” “up to,” “more than,” “less than”, etc., and write an inequality statement to represent the constraint.
- Draw and label a number line diagram to represent the solutions to an inequality.
- Recognize and explain (orally and in writing) that an inequality may have infinitely many solutions.
- Use substitution to justify (orally) whether a given value is a “solution” to a given inequality.
- Critique (orally and in writing) possible values given for a situation with more than one constraint, including whether fractional or negative values are reasonable.
- Interpret unbalanced hanger diagrams (orally and in writing) and write inequality statements to represent relationships between the weights on an unbalanced hanger diagram.
- Write and interpret inequality statements that include more than one variable.
- Generalize about the signs of coordinates that represent locations in each “quadrant” of the coordinate plane.
- Plot a point given its coordinates or identify the coordinates of a given point on the coordinate plane.
- Recognize that the axes of the coordinate plane can be extended to represent negative numbers.
- Compare and contrast different scales for the axes of the coordinate plane.
- Compare points on a graph, including statements about relative position and the vertical distance between points.
- Describe (using words and inequality symbols) and interpret the range of coordinates on a graph, including the meaning of y-values that are negative.
- Identify and interpret points on a graph to answer questions about situations involving temperature or money.
- Compare and contrast (orally and in writing) the coordinates for points in different locations on the coordinate plane.
- Determine the vertical or horizontal distance between two points on the coordinate plane that share the same x- or y-coordinate.
- Generalize (orally) about the coordinates of points that are reflected across the x- or y-axis.
- Determine the total length of multiple horizontal and vertical segments in the coordinate plane that are connected end-to-end.
- Draw a polygon in the coordinate plane given the coordinates for its vertices.
- Explain (orally) that coordinates can be a useful way of describing geometric figures or modeling real-world locations.
- Comprehend (orally and in writing) the terms “factor,” “common factor,” and “greatest common factor.”
- Explain (orally and in writing) how to determine the greatest common factor of two whole numbers less than 100.
- List the factors of a number and identify common factors for two numbers in a real-world situation.

- Comprehend (orally and in writing) the terms “multiple,” “common multiple,” and “least common multiple.”
- Explain (orally and in writing) how to calculate the least common multiple of 2 whole numbers.
- List the multiples of a number and identify common multiples for two numbers in a real-world situation.
- Choose to calculate the greatest common factor or least common multiple to solve a problem about a real-world situation, and justify (orally) the choice.
- Generate a list of ordered pairs to create an image in the coordinate plane, and explain (orally) the reasoning.

EVIDENCE OF LEARNING

Assessment:
What evidence will be collected and deemed acceptable to show that students truly “understand”?

- Warm-ups
- Cool-downs
- Section Checkpoints
- Common Assessment: Illustrative Math Mid-Unit 7 Assessment
- Common Assessment: Illustrative Math End-of-Unit 7 Assessment
- Daily Exit Slips
- Standards Mastery Assessment (iReady)

Learning Activities:
What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Online math games/activities
- Math Dialogue
- Thinking Classrooms
- Illustrative Mathematics (IM) 6.7 Lessons 1-19

6.NS.B.3 & 4:

- **Decimal Grocery Store:** Set up a pretend store with items priced in decimals. Students can create shopping lists, calculate totals (including tax!), and practice adding, subtracting, multiplying, and dividing decimals with real-world application.
- **"Think Like a Chef" Activity:** Present recipes with ingredients listed as fractions. Students can find the GCF of ingredient amounts to see if they can reduce the recipe and practice applying the distributive property to simplify expressions.
- **Decimal Word Problems:** Create word problems that involve all four operations with decimals. These could involve grocery shopping, calculating travel distances, or figuring out recipe conversions. Finding the GCF or LCM could be helpful steps in solving some problems.

6.NS.B.5

- **Decimal to Fraction Matching Game:** Create cards with decimals (terminating and repeating) on one side and equivalent fractions on the other. Students can match the cards or use them for a memory game, reinforcing the connection between the two representations.
- **"Decimal Decoder" Worksheets:** Provide students with worksheets where they have to convert between fractions with a denominator of 10 and decimals. These can include both terminating and repeating decimals.

6.NS.B.6c

- **Number Line Race:** Create a large number line on the floor or use a long strip of paper. Divide students into teams and give each team a rational number (fraction, decimal, or mixed number). Students take turns placing their number on the correct spot on the number line. The first team to correctly place all their numbers wins.
- **"Fraction Folds" Activity:** Provide students with grid paper or fraction manipulatives. Ask them to fold the paper or manipulate the fraction pieces to represent different fractions and compare their sizes visually.
- **"Guess the Number" Game:** One student thinks of a rational number within a designated range. The other students ask yes/no questions to try and guess the number. These questions should focus on comparing the hidden number to specific benchmarks or other numbers (e.g., "Is your number greater than 1/2?").

6.NS.B.7a-d

- **"Fraction Pizza Party" Activity:** Divide students into groups and provide them with large paper circles representing pizzas. Distribute fraction cards with the same denominator (e.g., fourths). Students take turns drawing cards, adding/subtracting the fractions to represent slices eaten, and calculating the remaining pizza.
- **"Fraction Train" Activity:** Connect train cars with fractions written on them. Encourage students to rearrange the cars to find equivalent fractions with common denominators before adding/subtracting.
- **Mixed Number Dominoes:** Create dominoes with mixed numbers on each end. Students can only connect dominoes where the whole numbers or the fractional parts add up to the same value.
- **"Cash Register Challenge" Activity:** Set up a pretend cash register with play money. Students take turns acting as cashier and customer, practicing adding/subtracting decimals to calculate purchases and provide change.

6.NS.B.8

- **"Battleship" Coordinate Game:** Adapt the classic game "Battleship" to the coordinate plane. Players place their "ships" (represented by squares) at designated coordinates and then take turns calling out coordinates to try and "sink" their opponent's ships.
- **"Mystery Picture" Activity:** Provide students with a set of coordinates and corresponding instructions to plot points on a coordinate plane. Once all points are plotted and connected, a mystery picture will emerge, reinforcing their understanding of using coordinates for location.
- **"Cityscape Mapping" Activity:** Present students with a simple map of a fictional city with streets represented by lines. They can then translate the map information into coordinates, plotting key locations like parks, schools, and landmarks on a coordinate plane.

6.EE.A.2b

- **"Building Block Expressions":** Provide students with manipulatives like algebra tiles (representing variables and constants) and operation signs (+, -, x, ÷). Students can build expressions following instructions or create their own, identifying the different terms (building blocks) within the expression.
- **"Color-Coded Expressions":** Assign different colors to different parts of the expression (e.g., blue for variables, green for constants, red for operation signs). Students write expressions using these color codes, promoting visual identification of terms.
- **"Expression Bingo":** Create bingo cards with different terms or single variables written on the squares. The teacher reads out expressions one by one. Students mark the cards if they find a term that is part of the expression being read. The first student to complete a row, column, or diagonal wins.

6.EE.B.5

- **"True or False" with Inequalities:** Write inequalities on cards (e.g., $x - 3 < 1$). Students pick cards and evaluate whether substituting a given number into the inequality makes it true or false. This reinforces understanding of how inequalities work and finding solutions within a specific set.
- **"Inequality-Values Matching":** Create cards with inequalities on one side and sets of values (containing the solution and some non-solutions) on the other. Students need to match the inequality with the set that includes its solution.

6.EE.B.6

- **"Variable Relay Race":** Divide the class into teams. Each team member is given a part of a word problem or situation (e.g., total cost, unknown distance). The first student runs to the board and writes the variable that represents the unknown quantity. The next teammate adds an operation sign based on the context, and so on, building the expression together relay-style. The first team to create a correct expression wins.
- **"Modeling with Manipulatives":** Use algebra tiles (representing variables and constants) and operation signs to physically build models of expressions based on real-world scenarios. This hands-on approach can solidify the connection between word problems and algebraic representations.

6.EE.B.8

- **"Inequality Wall":** Create a large bulletin board or designated space as the "Inequality Wall." Students can take turns coming up with inequalities and using string or yarn to section off the part of the number line that satisfies the inequality (e.g., shading to the right of a specific number). This visual representation helps them see the range of solutions.
- **"Number Line Drawings":** Provide students with inequalities and ask them to draw a number line on their own paper. They can then shade or mark the part of the number line that corresponds to the solution set of the inequality. Encourage them to label the number line with tick marks and any relevant values.
- **"Inequality SCOOT":** Prepare cards with inequalities on them. Students sit in a circle and have a worksheet with various solution sets represented on a number line (shaded regions). On a signal, students rotate to the next card, writing the corresponding inequality next to the matching solution set on their worksheet.

6.G.A.3

- **"Coordinate Plane Relay Race":**
    - Divide the class into teams.
    - Set up a large coordinate plane or use an online graphing tool.
    - Each team is given a set of coordinates for the vertices of a polygon (e.g., triangle, square).
    - One student from each team runs to the board (or manipulates the online tool) and plots one point at a time, following the order of the coordinates.
    - The first team to correctly connect all the points and form the polygon wins.

RESOURCES

Teacher Resources:

- iReady Teacher Toolbox
- Place Value Assessment Tool (PVAT)
- Illustrative Math (IM) Unit #7
- IM Student Work
- IM Blackline Masters
- Online District Approved Digital Resources

Equipment Needed:

- Manipulatives
- IM Student Workbooks
- Student Whiteboards
- Chart Paper
- Dry Erase Markers
- Chromebooks

UNIT OVERVIEW

Area: Mathematics

Unit Title: Data Sets and Distributions

Target Course/Grade Level: 6

Unit Summary: In this unit, students learn about populations and study variables associated with a population. They understand and use the terms “numerical data,” “categorical data,” “survey” (as noun and verb), “statistical question,” “variability,” “distribution,” and “frequency.” Students make and interpret histograms, bar graphs, tables of frequencies, and box plots.

Students describe distributions (shown on graphical displays) using terms such as “symmetrical,” "peaks," “gaps,” and “clusters.” They work with measures of center—understanding and using the terms “mean,” “average,” and “median.” Students work with measures of variability—understanding and using the terms “range,” ”mean absolute deviation” or MAD, “quartile,” and “interquartile range” or IQR. They interpret measurements of center and variability in contexts.

Approximate Length of Unit: 5 Weeks

LEARNING TARGETS

NJ Student Learning Standards:
Mathematics:

6.SP.A.1 Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. For example, “How old am I?” is not a statistical question, but “How old are the students in my school?” is a statistical question because one anticipates variability in students’ ages.

6.SP.A.2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

6.SP.A.3 Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.

6.SP.B.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

6.SP.B.5 Summarize numerical data sets in relation to their context, such as by:

a. Reporting the number of observations.

b**.** Describing the nature of the attribute under investigation, including how it was measured and its units of measurement.

c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.

6.SP.B.5d Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.

Interdisciplinary Connections and Standards:
English Language Arts:
SL.PE.6.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.
SL.II.6.2: Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.

Career Readiness, Life Literacies, and Key Skills:
9.4.5.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).
9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).
9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).
9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Science & Engineering Practices:
Asking Questions and Defining Problems
Developing and Using Models
Constructing Explanations and Designing Solutions
Engaging in Argument from Evidence
Using Mathematics and Computational Thinking
Obtaining, Evaluating, and Communicating Information

Technology:
8.1.2.DA.1: Collect and present data, including climate change data, in various visual formats.
8.1.2.DA.3: Identify and describe patterns in data visualizations.
8.1.2.DA.4: Make predictions based on data using charts or graphs.

Unit Understandings:
- Students learn about populations and study variables associated with a population.
- Students understand and use the terms "numerical data," "categorical data," "survey" (as noun and verb), "statistical question," "variability," "distribution," and "frequency."
- Students work with measures of central tendency.
- Students represent data with different data displays.

Unit Essential Questions:
- What makes a good statistical question? (How can we tell a question will result in data with variability?)
- How can we collect data in a fair and unbiased way?
- Why is it important to consider variability when interpreting data?
- How can we describe data sets using measures of center (mean, median, mode)?
- How can we describe the spread of data using measures of variation (range, interquartile range)?
- How can we choose the most appropriate measure of center or variation for a data set?
- How can we visually represent data using graphs and plots (dot plots, histograms, box plots)?

Knowledge and Skills:

Students will know…

- How to develop understanding of statistical variability
- How to summarize and describe distributions.
- How to calculate measures of central tendency.

Students will be able to...

- Ask survey questions (orally) and record responses (in writing). Include units of measurement when reporting numerical data (orally and in writing).
- Comprehend and use the terms “numerical” and “categorical” to describe data sets (orally and in writing).
- Interpret various representations of data sets and determine whether it is reasonable that a verbal description represents a given numerical data set.
- Justify (orally) whether a question is “statistical” based on whether variability is expected in the data that could be collected.
- Match survey questions to datasets representing possible responses and justify (in writing) why they match.
- Comprehend the word “frequency” to refer to the number of times a particular value occurs in a data set.
- Create and interpret a dot plot to answer statistical questions about a numerical data set.
- Justify (in writing) whether a dot plot is an appropriate way to display a given data set, paying attention to whether the data set is numerical or categorical.
- Describe (orally and in writing) a distribution represented by a dot plot, including informal observations about its center and spread.
- Interpret a dot plot to answer (in writing) statistical questions about a data set and to identify (orally) what values are “typical” for the distribution.
- Compare and contrast (orally and in writing) dot plots that represent two different data sets measuring the same quantity, paying attention to the “center” and “spread” of each distribution.
- Critique or justify (orally and in writing) claims about the center of a distribution represented on a dot plot.
- Compare and contrast (orally) dot plots and histograms in terms of how useful they are for answering different statistical questions.
- Create a histogram to represent a data set.
- Interpret a histogram to answer (in writing) statistical questions about a data set.
- Compare and contrast (in writing) histograms that represent two different data sets measuring the same quantity.
- Critique (orally) a description of a distribution, recognizing that there are multiple valid ways to describe its center and spread.
- Describe (orally and in writing) the distribution shown on a histogram, including making claims about the center and spread.
- Compare and contrast (orally) bar graphs and histograms, recognizing that descriptions of shape, center, and spread don’t pertain to bar graphs.
- Describe (orally and in writing) the overall shape and features of a distribution represented on a histogram, including peaks, clusters, gaps, and symmetry.
- Identify histograms that display distributions with specific features.
- Comprehend the words “mean” and “average” as a measure of center that summarizes the data using a single number.
- Explain (using words and other representations) how to calculate the mean for a numerical data set.

- Interpret diagrams that represent finding the mean as a process of leveling out the data to find a "fair share."
- Calculate and interpret (orally and in writing) distances between data points and the mean of the data set.
- Interpret diagrams that represent the mean as a "balance point" for both symmetrical and non-symmetrical distributions.
- Represent the mean of a data set on a dot plot and interpret it in the context of the situation.
- Calculate the mean absolute deviation (MAD) for a data set and interpret what it tells us about the situation.
- Compare and contrast (in writing) distributions that have the same mean, but different amounts of variability.
- Comprehend that "mean absolute deviation (MAD)" is a measure of variability, i.e., a single number summarizing how spread out the data set is.
- Compare (orally and in writing) the means and mean absolute deviations of different distributions, specifically those with the same MAD but different means.
- Interpret the mean and mean absolute deviation (MAD) in the context of the data.
- Comprehend that the "median" is another measure of center, which uses the middle of all the values in an ordered list to summarize the data.
- Identify and interpret the median of a data set given in a table or on a dot plot.
- Informally estimate the center of a data set and then compare (orally and in writing) the mean and median with this estimate.
- Choose which measure of center to use to describe a given data set and justify (orally and in writing) the choice.
- Explain (orally) that the median is a better estimate of a typical value than the mean for distributions that are not symmetric or contain values far from the center.
- Generalize how the shape of the distribution affects the mean and median of a data set.
- Calculate the range and interquartile range (IQR) of a data set and interpret (orally and in writing) what they tell us about the situation.
- Comprehend that "interquartile range (IQR)" is another measure of variability that describes the span of the middle half of the data.
- Identify and interpret (in writing) the numbers in the five-number summary for a data set, i.e., the minimum, first quartile (Q1), median (Q2), third quartile (Q3), and maximum.
- Compare and contrast (orally) a dot plot and a box plot that represent the same data set.
- Create a box plot to represent a data set.
- Describe (orally) the parts of a box plot that correspond with each number in the five-number summary, the range, and the IQR of a data set.
- Compare and contrast (orally and in writing) box plots that represent different data sets, including ones with the same median but very different IQRs and vice versa.
- Determine what information is needed to solve problems about comparing box plots. Ask questions to elicit that information.
- Interpret a box plot to answer (orally) statistical questions about a data set.
- Recognize that different graphical displays offer different insights into a distribution. Choose an appropriate graphical display to represent a data set, and justify the choice (orally and in writing).
- Recognize that different measures of center and variability offer different insights into a data set. Choose an appropriate measure of center and variability to describe a data set, and justify the choice (orally and in writing).

EVIDENCE OF LEARNING

Assessment:
What evidence will be collected and deemed acceptable to show that students truly "understand"?

- Warm-ups
- Cool-downs
- Section Checkpoints
- Common Assessment: Illustrative Math Mid-Unit 8 Assessment
- Common Assessment: Illustrative Math End-of-Unit 8 Assessment
- Daily Exit Slips
- Standards Mastery Assessment (iReady)

Learning Activities:
What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Online math games/activities
- Math Dialogue
- Thinking Classrooms
- Illustrative Mathematics (IM) 6.8 Lessons 1-18

6.SP.A Representing and Interpreting Data focuses on understanding what data is and how it can be represented. Here are some engaging activities to try:

- **Citizen Scientist:** Many organizations collect data on weather, animals, or the environment. Choose a topic that interests you and find a citizen science project that collects data. Participate in the project and then create a graph to represent the data you collected. This could be a bar chart, pie chart, or pictograph.

- **Data Detective:** Find a dataset online about a topic that interests you, such as sports statistics or historical weather data. Once you have your data, summarize the important information in a written report. What are the highest and lowest values? Is there a trend over time?

- **Simulation Station:** Probability can be tricky to understand. Try a simulation to see it in action. Roll a die 100 times and record the results. Then create a bar chart to show how many times each number rolled. This will help you see how probability works in real life.

6.SP.B Statistical Analysis deals with analyzing data to understand what it means. Here are some activities to get you started:

- **Survey Says!:** Conduct a survey of your classmates about their favorite subject in school. You can use a simple tally chart or online survey tool to collect your data. Once you have your data, find the mean (average), median (middle number), and mode (most frequent answer).

- **Game Show:** Play a simple game of chance, like flipping a coin or spinning a spinner. Record the results of 50 trials. Then calculate the experimental probability of each outcome. This is the

number of times the event happened divided by the total number of trials. How close does it come to the theoretical probability?

- **Paper Airplane Engineers:** Design and build ten paper airplanes. Then, measure the wingspan of each airplane. Find the range (difference between the highest and lowest wingspans), interquartile range (IQR - the middle 50% of the data), and any outliers (data points that fall outside the IQR).

RESOURCES

Teacher Resources:

- iReady Teacher Toolbox
- Place Value Assessment Tool (PVAT)
- Illustrative Math (IM) Unit # 8
- IM Student Work
- IM Blackline Masters
- Online District Approved Digital Resources

Equipment Needed:

- Manipulatives
- IM Student Workbooks
- Student Whiteboards
- Chart Paper
- Dry Erase Markers
- Chromebooks

UNIT OVERVIEW

Area: Mathematics

Unit Title: Putting It All Together

Target Course/Grade Level: 6

Unit Summary: In this optional unit, students use concepts and skills from previous units. In solving Fermi problems, they use measurement conversions together with their knowledge of volumes or surface areas of right rectangular prisms or the relationship of distance, rate, and time. In answering questions about ratios of two populations, they work with percentages that include numbers expressed in the form a/b or as decimals. In answering questions about diagrams of rectangles with whole-number dimensions, they connect arithmetic features of the dimensions such as remainder or greatest common factor with geometric features of the diagrams. In answering questions about votes, voting methods, and equitable distribution, they use their knowledge of equivalent ratios, part–part ratios, percentages, and unit rates.

Approximate Length of Unit: 4

LEARNING TARGETS

NJ Student Learning Standards:
Mathematics:

6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."

6.RP.A.2 Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠0, and use rate language in the context of a ratio relationship. For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."

6.RP.A.3 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.

6.RP.A.3c Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.

6.NS.B.3 With accuracy and efficiency add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

6.G.A Solve real-world and mathematical problems involving area, surface area, and volume.

Interdisciplinary Connections and Standards:
English Language Arts:
SL.PE.6.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly.
SL.II.6.2: Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.

Career Readiness, Life Literacies, and Key Skills:
9.1.8.CP.1: Compare prices for the same goods or services
9.4.5.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).
9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).
9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).
9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Science & Engineering Practices:
Asking Questions and Defining Problems
Developing and Using Models
Constructing Explanations and Designing Solutions
Engaging in Argument from Evidence
Using Mathematics and Computational Thinking
Obtaining, Evaluating, and Communicating Information

Technology:
8.1.2.DA.3: Identify and describe patterns in data visualizations.
8.1.2.DA.4: Make predictions based on data using charts or graphs.

Unit Understandings:
- Continuation of student development of contextual understanding of ratios, data distributions, percentages, part-part ratios, equivalent ratios, and unit rates, as well as measurement conversions in the context of surface area and volume of three-dimensional figures.

Unit Essential Questions:
- How can we represent and interpret fractions in different ways (models, number lines, etc.)?
- What does it mean to divide by a fraction, and how is it connected to multiplication?
- How can we solve word problems involving dividing fractions by fractions?
- How are fractions used in real-life situations?
- How is the concept of place value extended to decimals?
- How do we perform operations (addition, subtraction, multiplication, division) with decimals accurately?
- How are decimals related to fractions?
- When are decimals the most appropriate way to represent a quantity?
- How is the concept of place value extended to decimals?
- How do we perform operations (addition, subtraction, multiplication, division) with decimals accurately?

- How are decimals related to fractions?
- When are decimals the most appropriate way to represent a quantity?
- How can we classify and identify different types of polygons?
- What are the properties of angles and how do they relate to each other on a polygon?
- How can we use the coordinate plane to represent and locate points?
- How can geometric concepts be used to solve real-world problems (area, perimeter, etc.)?

Knowledge and Skills:

Students will …

- How to compute with accuracy and efficiency and efficiency with multi-digit numbers and find common factors and multiples.
- How to understand ratio concepts and use ratio reasoning to solve problems.
- How to solve real-world and mathematical problems involving area, surface area, and volume.

Students will be able to…

- Estimate quantities in a real-world situation and explain (orally and in writing) the estimation strategy.
- Justify (orally) why it is unreasonable to have an exact answer for a situation that involves estimation, and critique (orally) different estimates.
- Make simplifying assumptions and determine what information is needed to solve a Fermi problem about distance, volume, or surface area
- Apply reasoning about percentages and equivalent ratios to analyze and approximate characteristics of the world's population.
- Generate (orally and in writing) mathematical questions about the world's population, e.g., "How many people . . . ?"
- Present (using words and other representations) a comparison that uses the number of students in the class to represent the proportion of the world's population with a particular characteristic.
- Coordinate diagrams and expressions involving equivalent fractions.
- Interpret and create diagrams involving a rectangle decomposed into squares.
- Recognize that decomposing rectangles into squares is a geometric way to determine the greatest common factor of two numbers.
- Apply reasoning about ratios and percentages to analyze (orally and in writing) voting situations involving two choices.
- Comprehend the terms "majority" and "supermajority" (in spoken and written language).
- Critique (using words and other representations) a statement reporting the results of a vote.
- Apply reasoning about ratios and percentages to analyze (orally and in writing) voting situations involving more than two choices.
- Choose and justify (orally) which voting system seems the fairest for dealing with more than two choices.
- Compare and contrast (orally and in writing) different voting systems for dealing with more than two choices, i.e., plurality, runoff, and instant runoff.
- Compare and contrast different ways to distribute representatives, and recognize that changing the way the votes are grouped can affect the outcome.
- Critique (orally and in writing) whether a method for distributing representatives is fair.
- Suggest a method for distributing representatives and justify (orally) why is it fair.

EVIDENCE OF LEARNING

Assessment:
What evidence will be collected and deemed acceptable to show that students truly "understand"?

- Warm-ups
- Cool-downs
- Section Checkpoints
- Common Assessment: Illustrative Math Mid-Unit 9 Assessment
- Common Assessment: Illustrative Math End-of-Unit 9 Assessment
- Daily Exit Slips
- Standards Mastery Assessment (iReady)

Learning Activities:
What differentiated learning experiences and instruction will enable all students to achieve the desired results?

- Online math games/activities
- Math Dialogue
- Thinking Classrooms
- Illustrative Mathematics (IM) 6.9 Lessons 1-6

6.NS.B.3

- **Place Value Race:** Create decimal number cards (including whole numbers with decimals) and divide students into teams. Each team lines up with their cards in the correct order (greatest to least or least to greatest). Call out addition, subtraction, multiplication, or division problems and have students race to arrange their cards to show the answer.
- **"Mystery Number" Challenge:** Give students clues about a mystery decimal number (e.g., it's greater than 3.2 but less than 3.25, add 0.07 and you get 3.32). Students use addition, subtraction, multiplication, and division with decimals to solve for the mystery number.

6.RP.A.1

- **Ratio Pictures:** Show students pictures with clear ratios (fruit bowls, sports teams, etc.) and have them identify the quantities being compared. Encourage them to express the ratio in multiple ways (fractional notation, colon notation, "part-to-whole" language).
- **"I Spy" Ratios:** Take students on a "ratio walk" around the schoolyard or classroom. Students take turns calling out things they see and expressing the ratio between two observable features (e.g., "I spy 5 swings to 2 slides, a ratio of 5:2").

6.RP.A.2

- **The "Best Buy" Challenge:** Present students with grocery flyers or online store listings that show different quantities of the same product at different prices. Challenge them to find the "best buy" by calculating the unit price for each option. This reinforces the concept of using unit rates to make informed decisions.
- **Real-World Rates:** Brainstorm a list of real-world scenarios involving rates (e.g., miles per hour, dollars per gallon, etc.). Have students discuss how these rates are used and why they are important.

6.RP.A.3a

- **Fraction-Percent-Decimal Connections:** Create a visual representation where students can see the relationship between fractions, decimals, and percents. This can be a chart, a number line, or manipulatives like fraction strips and hundred grids. Use this visual aid to demonstrate how 30% is equivalent to 30/100 (as a rate per 100) and 0.3 (as a decimal).
- **"What's the Percent?" Mystery Bags:** Place different quantities of objects (pencils, erasers, etc.) in bags. Students take turns reaching in without looking and estimate what percent of the bag their handful represents. Then, they count the objects and calculate the actual percentage. This activity encourages estimation and reinforces the concept of percent as a part of a whole.

6.G.A

- **"Mystery Polygon" Game:** Describe a polygon verbally, focusing on its properties (e.g., "I have 4 equal sides and 4 right angles"). Students have to guess the mystery polygon and explain their reasoning.
- **"I Spy" Angles:** Play "I spy" but focus on angles in the classroom environment. For example, "I spy a right angle between the whiteboard and the wall!" This reinforces the concept of identifying angles in everyday surroundings.
- **Coordinate Plane Graphing Challenge:** Give students sets of coordinates and challenge them to graph the points on a coordinate plane. They can then connect the points to reveal a hidden picture (e.g., a simple shape, a letter).

RESOURCES

Teacher Resources:

- iReady Teacher Toolbox
- Place Value Assessment Tool (PVAT)
- Illustrative Math (IM) Unit # 9
- IM Student Work
- IM Blackline Masters
- Online District Approved Digital Resources

Equipment Needed:

- Manipulatives
- IM Student Workbooks
- Student Whiteboards
- Chart Paper
- Dry Erase Markers
- Chromebooks