Unit 2: Ratio and Rate Reasoning

Content Area: **Math**
Course(s):
Time Period: **Full Year**
Length: **7 Weeks**
Status: **Published**

Unit Rationale

This unit is designed to support students in ratios and proportional reasoning. Students will understand the concepts of a ratio and use ratio language to describe a ratio relationship between two quantities. Students will use tables to record ratios and to find missing quantities in ratios by comparing them to equivalent ratios. Students learn to find and use unit rates to solve problems. Students will solve real-world and mathematical problems involving ratios not given as unit rates and proportions that do not include unit rates. Students apply their understanding of ratios to interpret and construct circle graphs. Students will use ratio reasoning to convert measurement units. Students will examine relationships between two quantities described in words, with a table, or with a diagram. Students will examine tables of data to see if they show a proportional relationship. Students examine tables of data and graph them to see if all the points lie on a straight line and whether that line passes through the origin. Students will use proportions to convert between different unit rates, such as miles per hour or feet per second. Students will recognize that ratios, fractions, and percents are equivalent representations of the same mathematical relationship. Finally students will use proportional relationships to solve multi-step ratio and percent problems.

Essential Question

How do mathematicians understand and write ratios?

How do mathematicians use tables and graphs to represent ratios and rates?

How do mathematicians use a table to compare ratios and rates?

How do mathematicians find and use unit rates to solve problems?

How do mathematicians identify and generate equivalent expressions?

How do mathematicians use equivalent ratios to solve real-world problems?

How do mathematicians apply ratio reasoning to make and interpret circle graphs?

How do mathematicians convert units within a measurement system?

How do mathematicians use equivalent ratios to convert measurements between measurement systems?

How do mathematicians use patterns and unit rates to analyze and describe relationships?

How do mathematicians determine if a relationship represented in a table is proportional, identify the constant of proportionality, and write an equation in the form of y = kx?

How do mathematicians identify the characteristics of a proportional relationship when graphed?

How do mathematicians use a proportional relationship to solve multi-step problems?

How do mathematicians write a ratio as a percent?

How do mathematicians find a percent of a quantity?

How do mathematicians use percents to solve real-world problems?

Pre-Assessment

Module 5: Ratios and Proportional Reasoning "Are You Ready?" pg 138

Module 6: Apply Ratio and Rates to Measurement "Are You Ready?" pg 178

Module 7: Identify and Represent Proportional Relationships "Are You Ready?" pg 204

Summative/End Of Unit Assessment

Module 5: Module 5 Test Form A and Form B (TM p. 176A)
Module 6: Module 6 Test Form A and Form B (TM p. 202A)
Module 7: Module 7 Test Form A and Form B (TM p. 228A)

Benchmark Assessments

Into Math Benchmark BOY, MOY, and EOY growth measure.

Standards

NEW JERSEY STUDENT LEARNING STANDARDS: COMPUTER SCIENCE AND DESIGN THINKING

CS.6-8.DA	Data & Analysis
	Control structures are selected and combined in programs to solve more complex problems.

NEW JERSEY STUDENT LEARNING STANDARDS: CONTENT AREA

MA.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.
MA.6.RP.A.3b	Solve unit rate problems including those involving unit pricing and constant speed.
MA.6.RP.A.3d	Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.
MA.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.
MA.6.EE.A.1	Write and evaluate numerical expressions involving whole-number exponents.
MA.6.EE.A.2a	Write expressions that record operations with numbers and with letters standing for numbers.
MA.6.EE.A.2b	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.
MA.1.G.A.3	Partition circles and rectangles into two and four equal shares, describe the shares using the words halves, fourths, and quarters, and use the phrases half of, fourth of, and quarter of. Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.
MA.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).
MA.6.EE.A.3	Apply the properties of operations to generate equivalent expressions.
MA.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.
MA.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.
MA.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.
MA.6.EE.B.8	Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real- world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.
MA.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.

NEW JERSEY STUDENT LEARNING STANDARDS: CAREER READINESS, LIFE LITERACIES AND KEY SKILLS

WRK.9.2.8.CAP.2	Develop a plan that includes information about career areas of interest.
TECH.9.4.8.CT	Critical Thinking and Problem-solving

INTERDISCIPLINARY CONNECTIONS: NEW JERSEY STUDENT LEARNING STANDARDS FOR ELA, SOCIAL STUDIES, SCIENCE AND/OR MATHEMATICS New Section New Section

	Analyzing and Interpreting Data
SOC.5-8.1.1.1	Construct timelines of the events occurring during major eras including comparative events in world history for the different civilizations.

Instructional Plan

Module 5

Lesson 5.1

Student Learning Intentions (SLI) WALT: (We are learning to…)	5.1 We are learning to understand and write ratios.
Student Learning Strategies	Calculate Birds per Birdhouse Use a Model
Success Criteria	I can find and express ratios.
Formative Assessment (drives instructional decisions)	Turn and Talk Questions (p. 139, 140) Check for Understanding (p. 141)
Activities and Resources	**Warm-up:** Activate Prior Knowledge (TM p. 139B) & Spark Your Learning (p. 139) **Mini-lesson**: Build Understanding (p. 140-141) **Guided Practice:** Check Understanding (p. 142) **Independent Practice**: On Your Own (p. 143) & Exit Ticket (TM p. 142) Teacher Resources: Into Math Teacher Edition Module 5 Online Resources
Suggested Modifications	Plan for Differentiated Instruction (TM p. 139C)

MA.6.RP.A.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
MA.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.
MA.6.NS.B.2	Fluently divide multi-digit numbers using the standard algorithm.
MA.6.NS.B.3	Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.
MA.6.NS.B.4	Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the

distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor.

Lesson 5.2

Student Learning Intentions (SLI) WALT: (We are learning to…)	5.2 We are learning to learn to use tables and graphs to represent ratios and rates.
Student Learning Strategies	Use Multiplication to Complete a Table Use Additive Reasoning to Complete a Table
Success Criteria	I can use tables and graphs to represent ratios and rates, and I can find equivalent ratios and unit rates.
Formative Assessment (drives instructional decisions)	Turn and Talk Questions (p. 145, 147, 148) Check for Understanding (p. 148)
Activities and Resources	**Warm-up:** Activate Prior Knowledge (TM p. 145B) & Spark Your Learning (p. 145) **Mini-lesson**: Build Understanding (p. 146-148) **Guided Practice:** Check Understanding (p. 148) **Independent Practice**: On Your Own (p. 149-150) & Exit Ticket (TM p. 150) Teacher Resources: Into Math Teacher Edition Module 5 Online Resources
Suggested Modifications	Plan for Differentiated Instruction (TM p. 145C)

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

Lesson 5.3

Student Learning Intentions (SLI) WALT: (We are learning to…)	5.3 We are learning to use a table to compare ratios and rates.

Student Learning Strategies	Use fractions. Estimate.
Success Criteria	I can analyze tables to compare ratios and rates.
Formative Assessment (drives instructional decisions)	Turn and Talk Questions (p. 153) Check for Understanding (p. 154)
Activities and Resources	**Warm-up:** Activate Prior Knowledge (TM p. 153B) & Spark Your Learning (p. 153) **Mini-lesson:** Build Understanding (p. 153-154) **Guided Practice:** Check Understanding (p. 155-156) **Independent Practice:** On Your Own (p. 157) & Exit Ticket (TM p. 156) Teacher Resources: Into Math Teacher Edition Module 5 Online Resources
Suggested Modifications	Plan for Differentiated Instruction (TM p. 153C)

MA.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.
MA.6.RP.A.3b	Solve unit rate problems including those involving unit pricing and constant speed.
MA.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.
MA.6.NS.B.3	Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.
MA.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.
MA.6.NS.C.7d	Distinguish comparisons of absolute value from statements about order.

Lesson 5.4

Student Learning Intentions (SLI) WALT: (We are learning to…)	5.4 We are learning to find and use unit rates to solve problems.
Student Learning Strategies	Use Fractions Use Estimation
Success Criteria	I can find and use unit rates.
Formative Assessment (drives instructional	Turn and Talk Questions (p. 159, 160)

decisions)	Check for Understanding (p. 161)
Activities and Resources	**Warm-up:** Activate Prior Knowledge (TM p. 159B) & Spark Your Learning (p. 159) **Mini-lesson:** Build Understanding (p. 160-161) **Guided Practice:** Check Understanding (p. 162) **Independent Practice:** On Your Own (p. 163-164) & Exit Ticket (TM p. 164) Teacher Resources: Into Math Teacher Edition Module 5 Online Resources
Suggested Modifications	Plan for Differentiated Instruction (TM p. 159C)

MA.6.RP.A	Understand ratio concepts and use ratio reasoning to solve problems.
MA.6.RP.A.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
MA.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.
MATH.7.RP.A.2	Recognize and represent proportional relationships between quantities.
MATH.7.RP.A.2.b	Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
MA.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.
MA.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.

Lesson 5.5

Student Learning Intentions (SLI) WALT: (We are learning to…)	5.5 We are learning to use equivalent ratios to solve real-world problems.
Student Learning Strategies	Use Estimation. Use Fractions.
Success Criteria	I can use ratio reasoning to solve problems.
Formative Assessment (drives instructional decisions)	Turn and Talk Questions (p.167+168) Check for Understanding (p. 169)
Activities and Resources	**Warm-up:** Activate Prior Knowledge (TM p. 167B) & Spark Your Learning (p. 167) **Mini-lesson:** Build Understanding (p. 167-169)

	Guided Practice: *Check Understanding (p. 169)* **Independent Practice**: *On Your Own (p. 170-171) & Exit Ticket (TM p. 172)* *Teacher Resources: Into Math Teacher Edition Module 5 Online Resources*
Suggested Modifications	Plan for Differentiated Instruction (TM p. 167C)

MA.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.
MA.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.
MA.6.RP.A.3b	Solve unit rate problems including those involving unit pricing and constant speed.
MA.6.NS.B.3	Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.
MA.6.NS.B.4	Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor.
MA.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.

Module 6

Module 6: APPLY RATIOS AND RATES TO MEASUREMENT

Lesson 6.1

Student Learning Intentions (SLI) WALT: **(We are learning to…)**	6.1 We are learning to apply ratio reasoning to make and interpret circle graphs.
Student Learning Strategies	Use Fraction Operations to Solve Problems Use Equivalent Fractions
Success Criteria	I can use reasoning about equivalent ratios to make and interpret a circle graph.

Formative Assessment (drives instructional decisions)	Turn and Talk (pg 179, pg 181) Check Understanding (pg 181) Exit Ticket (TM pg 182)
Activities and Resources	**Warm-Up**: Activate Prior Knowledge (TM pg 179B) **Mini-Lesson**: Spark Your Learning (pg 179, 181), Build You Understanding (pg 180-181) **Guided Practice**: Check Understanding (pg 182) **Independent Practice**: On Your Own (pg 183-184) and Exit Ticket (TM pg 182) Teacher Resources Into Math Teacher Edition Module 6 & Online Resources
Suggested Modifications	Plan For Differentiated Instruction (TM pg 179C)

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

Lesson 6.2

Student Learning Intentions (SLI) WALT: (We are learning to…)	6.2 We are learning to convert units within a measurement system.
Student Learning Strategies	Change Mixed Numbers to Fractions and Multiply Use a Visual Model
Success Criteria	I can convert measurements within a measurement system by using equivalent ratios or conversion factors.
Formative Assessment (drives instructional decisions)	Turn and Talk (pg 185, pg 186) Check Understanding (pg 188) Exit Ticket (TM pg 190)
Activities and Resources	**Warm-Up**: Activate Prior Knowledge (TM pg 185B) **Mini-Lesson**: Spark Your Learning (pg 185), Build Your

	Understanding (pg 186) **Guided Practice**: Check Understanding (pg 188) **Independent Practice**: On Your Own (pg 189) and Exit Ticket (TM pg 190) Teacher Resources Into Math Teacher Edition Module 6 & Online Resources
Suggested Modifications	Plan For Differentiated Instruction (TM pg 185C)

MA.6.RP.A.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
MA.6.RP.A.3b	Solve unit rate problems including those involving unit pricing and constant speed.
MA.6.RP.A.3d	Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.
MA.6.NS.B.3	Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

Lesson 6.3

Student Learning Intentions (SLI) WALT: (We are learning to…)	6.3 We are learning to use equivalent ratios to convert measurements between measurement systems.
Student Learning Strategies	Convert the Mixed Number to a Fraction and Divide Use a Model
Success Criteria	I can convert measurements between measurement systems by using equivalent rates or conversion factors.
Formative Assessment (drives instructional decisions)	Turn and Talk (pg193-195) Check Understanding (pg 196) Exit Ticket (TM pg 198)
Activities and Resources	**Warm-Up**: Activate Prior Knowledge (TM pg 196B) **Mini-Lesson**: Spark Your Learning (pg 196-197), Build Your Understanding (pg 194-195) **Guided Practice**: Check Understanding (pg 196) **Independent Practice**: On Your Own (pg 197) and Exit Ticket (TM pg 198) Teacher Resources Into Math Teacher Edition Module 6 & Online Resources

Suggested Modifications	Plan For Differentiated Instruction (TM pg 196C)

MA.6.RP.A.3b	Solve unit rate problems including those involving unit pricing and constant speed.
MA.6.RP.A.3d	Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.
MA.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.
MA.6.NS.B.3	Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

Module 7

Module 7: UNDERSTAND AND APPLY PERCENT

Lesson 7.1

Student Learning Intentions (SLI) WALT: (We are learning to…)	7.1 We are learning to write a ratio as a percent.
Student Learning Strategies	Use 10x10 grid
Success Criteria	I can convert ratios to percents by applying one strategy and I can explain my method to others.
Formative Assessment (drives instructional decisions)	Turn and Talk (pg 205, 206) Check Understanding (pg 208) Exit Ticket (TM pg 210)
Activities and Resources	**Warm-Up**: Activate Prior Knowledge (TM pg 205B) **Mini-Lesson**: Spark Your Learning (pg 205) Build Understanding (pg 206) Step It Out (pg 207-208) **Guided Practice**: Check Understanding (pg 208) **Independent Practice**: On Your Own (pg 209-210) and Exit Ticket (TM pg 210)
Suggested Modifications	Plan For Differentiated Instruction (TM pg 205C)

MATH.6.RP.A.3.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.

MATH.6.RP.A.3.c	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.
MA.6.NS.B.3	Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.
MA.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.

Lesson 7.2

Student Learning Intentions (SLI) WALT: (We are learning to…)	7.2 We are learning to find a percent of a quantity.
Student Learning Strategies	Use an Equation with Equivalent Ratios Use Models to Find Equivalent Ratios
Success Criteria	I can use three different methods to write a ratio as a percent.
Formative Assessment (drives instructional decisions)	Turn and Talk (pg 213, 215) Check Understanding (pg 216) Exit Ticket (TM pg 218)
Activities and Resources	**Warm-Up**: Activate Prior Knowledge (TM pg 213B) **Mini-Lesson**: Spark Your Learning (pg 215) Build Understanding (pg 214) Step It Out (pg 215-216) **Guided Practice**: Check Understanding (pg 217) **Independent Practice**: On Your Own (pg217) and Exit Ticket (TM pg 219)
Suggested Modifications	Plan For Differentiated Instruction (TM pg 213)

MA.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.
MA.6.NS.B.2	Fluently divide multi-digit numbers using the standard algorithm.
MA.6.NS.C.7b	Write, interpret, and explain statements of order for rational numbers in real-world contexts.

Lesson 7.3

Student Learning Intentions (SLI) WALT: (We are learning to…)	7.3 We are learning to use percents to solve real-world problems.
Student Learning Strategies	Use an Equation with Equivalent Ratios Use Models to Find Equivalent Ratios
Success Criteria	I can solve real-world percent problems that require me to find the part, the percent, or the whole.
Formative Assessment (drives instructional decisions)	Turn and Talk (pg 221, 222) Check Understanding (pg 222) Exit Ticket (TM pg 224)
Activities and Resources	**Warm-Up**: Activate Prior Knowledge (TM pg 221B) **Mini-Lesson**: Spark Your Learning (pg 221) Build Understanding (pg 223) Step It Out (pg 222) **Guided Practice**: Check Understanding (pg 225) **Independent Practice**: On Your Own (pg223-224) and Exit Ticket (TM pg 224)
Suggested Modifications	Plan For Differentiated Instruction (TM pg 221C)

MA.6.RP.A.3b	Solve unit rate problems including those involving unit pricing and constant speed.
MA.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.
MA.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.
MA.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 $V = lwh$ and $V = Bh$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.