MATHEMATICS

Grade 6: Unit 1
Operations and Reasoning about Ratios
Course Philosophy/Description

In mathematics, students will learn to address a range of tasks focusing on the application of concepts, skills and understandings. Students will be asked to solve problems involving the key knowledge and skills for their grade level as identified by the NJSLS; express mathematical reasoning and construct a mathematical argument and apply concepts to solve model real world problems. The conceptual-based model will be used as the basis for all mathematics instruction.

Sixth Grade Mathematics consists of the following domains: Ratios and Proportional Relationships (RP), The Number System (NS), Expressions and Equations (EE), Geometry (G), and Statistics and Probability (SP). In sixth grade, instructional time should focus on four critical areas: (1) connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems; (2) completing understanding of division of fractions and extending the notion of number to the system of rational numbers, which includes negative numbers; (3) writing, interpreting, and using expressions and equations; and (4) developing understanding of statistical thinking.

1) Students use reasoning about multiplication and division to solve ratio and rate problems about quantities. By viewing equivalent ratios and rates as deriving from, and extending, pairs of rows (or columns) in the multiplication table, and by analyzing simple drawings that indicate the relative size of quantities, students connect their understanding of multiplication and division with ratios and rates. Thus students expand the scope of problems for which they can use multiplication and division to solve problems, and they connect ratios and fractions. Students solve a wide variety of problems involving ratios and rates.

2) Students use the meaning of fractions, the meanings of multiplication and division, and the relationship between multiplication and division to understand and explain why the procedures for dividing fractions make sense. Students use these operations to solve problems. Students extend their previous understandings of number and the ordering of numbers to the full system of rational numbers, which includes negative rational numbers, and in particular negative integers. They reason about the order and absolute value of rational numbers and about the location of points in all four quadrants of the coordinate plane.

3) Students understand the use of variables in mathematical expressions. They write expressions and equations that correspond to given situations, evaluate expressions, and use expressions and formulas to solve problems. Students understand that expressions in different forms can be equivalent, and they use the properties of operations to rewrite expressions in equivalent forms. Students know that the solutions of an equation are the values of the variables that make the equation true. Students use properties of operations and the idea of maintaining the equality of both sides of an equation to solve simple one-step equations. Students construct and analyze tables, such as tables of quantities that are in equivalent ratios, and they use equations (such as $3x = y$) to describe relationships between quantities.

4) Building on and reinforcing their understanding of number, students begin to develop their ability to think statistically. Students recognize that a data distribution may not have a definite center and that different ways to measure center yield different values. The median measures center in the sense that it is roughly the middle value. The mean measures center in the sense that it is the value that each data point would take on if the total of the data values were redistributed equally, and also in the sense that it is a balance point. Students recognize that a
measure of variability (interquartile range or mean absolute deviation) can also be useful for summarizing data because two very different sets of data can have the same mean and median yet be distinguished by their variability.

Students learn to describe and summarize numerical data sets, identifying clusters, peaks, gaps, and symmetry, considering the context in which the data were collected. Students in Grade 6 also build on their work with area in elementary school by reasoning about relationships among shapes to determine area, surface area, and volume. They find areas of right triangles, other triangles, and special quadrilaterals by decomposing these shapes, rearranging or removing pieces, and relating the shapes to rectangles. Using these methods, students discuss, develop, and justify formulas for areas of triangles and parallelograms. Students find areas of polygons and surface areas of prisms and pyramids by decomposing them into pieces whose area they can determine. They reason about right rectangular prisms with fractional side lengths to extend formulas for the volume of a right rectangular prism to fractional side lengths. They prepare for work on scale drawings and constructions in Grade 7 by drawing polygons in the coordinate plane.
ESL Framework

This ESL framework was designed to be used by bilingual, dual language, ESL and general education teachers. Bilingual and dual language programs use the home language and a second language for instruction. ESL teachers and general education or bilingual teachers may use this document to collaborate on unit and lesson planning to decide who will address certain components of the SLO and language objective. ESL teachers may use the appropriate leveled language objective to build lessons for ELLs which reflects what is covered in the general education program. In this way, whether it is a pull-out or push-in model, all teachers are working on the same Student Learning Objective connected to the New Jersey Student Learning Standards. The design of language objectives are based on the alignment of the World-Class Instructional Design Assessment (WIDA) Consortium’s English Language Development (ELD) standards with the New Jersey Student Learning Standards (NJSLS). WIDA’s ELD standards advance academic language development across content areas ultimately leading to academic achievement for English learners. As English learners are progressing through the six developmental linguistic stages, this framework will assist all teachers who work with English learners to appropriately identify the language needed to meet the requirements of the content standard. At the same time, the language objectives recognize the cognitive demand required to complete educational tasks. Even though listening and reading (receptive) skills differ from speaking and writing (expressive) skills across proficiency levels the cognitive function should not be diminished. For example, an Entering Level One student only has the linguistic ability to respond in single words in English with significant support from their home language. However, they could complete a Venn diagram with single words which demonstrates that they understand how the elements compare and contrast with each other or they could respond with the support of their home language (L1) with assistance from a teacher, para-professional, peer or a technology program.

http://www.state.nj.us/education/modelcurriculum/ela/ELLOverview.pdf
# 6th Grade Pacing Chart – Unit 1

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<tr>
<th>#</th>
<th>Student Learning Objective</th>
<th>NJSLS</th>
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<tbody>
<tr>
<td>1</td>
<td>Compute quotients of fractions.</td>
<td>6.NS.A.1</td>
</tr>
<tr>
<td>2</td>
<td>Construct visual fraction models to represent quotients of fractions and use the relationship between multiplication and division to explain division of fractions.</td>
<td>6.NS.A.1</td>
</tr>
<tr>
<td>3</td>
<td>Solve real-world problems involving quotients of fractions and interpret the solutions in the context given.</td>
<td>6.NS.A.1</td>
</tr>
<tr>
<td>4</td>
<td>Fluently divide multi-digit numbers using the standard algorithms.</td>
<td>6.NS.B.2</td>
</tr>
<tr>
<td>5</td>
<td>Explain the relationship of two quantities in given ratio using ratio language.</td>
<td>6.RP.A.1</td>
</tr>
<tr>
<td>6</td>
<td>Use rate language, in the context of the ratio relationship, to describe a unit rate.</td>
<td>6.RP.A.2</td>
</tr>
<tr>
<td>7</td>
<td>Create and complete tables of equivalent ratios to solve real world and mathematical problems using ratio and rate reasoning that include making tables of equivalent ratios, solving unit rate problems, finding percent of a quantity as a rate per 100.</td>
<td>6.RP.A.3a, b, c</td>
</tr>
<tr>
<td>8</td>
<td>Use ratio and rate reasoning to convert measurement units and to transform units appropriately when multiplying or dividing quantities.</td>
<td>6.RP.A.3d</td>
</tr>
<tr>
<td>9</td>
<td>Fluently add, subtract, multiply and divide multi-digit decimals.</td>
<td>6.NS.B.3</td>
</tr>
<tr>
<td>10</td>
<td>Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two numbers less than or equal to 12.</td>
<td>6.NS.B.4</td>
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</tbody>
</table>

Instruction: 8 weeks  
Assessment: 1 week
Research about Teaching and Learning Mathematics

Structure teaching of mathematical concepts and skills around problems to be solved (Checkly, 1997; Wood & Sellars, 1996; Wood & Sellars, 1997)

Encourage students to work cooperatively with others (Johnson & Johnson, 1975; Davidson, 1990)

Use group problem-solving to stimulate students to apply their mathematical thinking skills (Artzt & Armour-Thomas, 1992)

Students interact in ways that support and challenge one another’s strategic thinking (Artzt, Armour-Thomas, & Curcio, 2008)

Activities structured in ways allowing students to explore, explain, extend, and evaluate their progress (National Research Council, 1999)

There are three critical components to effective mathematics instruction (Shellard & Moyer, 2002):

- Teaching for conceptual understanding
- Developing children’s procedural literacy
- Promoting strategic competence through meaningful problem-solving investigations

Teachers should be:

- Demonstrating acceptance and recognition of students’ divergent ideas.
- Challenging students to think deeply about the problems they are solving, extending thinking beyond the solutions and algorithms required to solve the problem
- Influencing learning by asking challenging and interesting questions to accelerate students’ innate inquisitiveness and foster them to examine concepts further.
- Projecting a positive attitude about mathematics and about students’ ability to “do” mathematics

Students should be:

- Actively engaging in “doing” mathematics
- Solving challenging problems
- Investigating meaningful real-world problems
- Making interdisciplinary connections
- Developing an understanding of mathematical knowledge required to “do” mathematics and connect the language of mathematical ideas with numerical representations
- Sharing mathematical ideas, discussing mathematics with one another, refining and critiquing each other’s ideas and understandings
- Communicating in pairs, small group, or whole group presentations
- Using multiple representations to communicate mathematical ideas
- Using connections between pictures, oral language, written symbols, manipulative models, and real-world situations
- Using technological resources and other 21st century skills to support and enhance mathematical understanding
Mathematics is not a stagnate field of textbook problems; rather, it is a dynamic way of constructing meaning about the world around us, generating knowledge and understanding about the real world every day. Students should be metaphorically rolling up their sleeves and “doing mathematics” themselves, not watching others do mathematics for them or in front of them. (Protheroe, 2007)

**Conceptual-Based Model**

The purpose of the Conceptual-Based Model is to allow students the time to explore mathematical concepts to promote academic rigor and high level of student discourse to concurrently develop conceptual understanding, procedural fluency, and problem-solving skills. During the 90 minute block of mathematics instruction, teachers will select and set up a mathematical task that targets the mathematical goal(s) for the lesson. The teacher sets the stage for learning by ensuring the objective/rationale of the lesson is well-defined and connected to the task. The task should build on student’s prior knowledge, life experiences, and culture allowing students to share their prior knowledge and life/cultural experiences as it relates to the task to ensure that students understand the context of the problem. The instructional goal is to introduce the activity/task to the students allowing them to have access to learning while maintaining the cognitive demands of the task. Teachers will then support the students’ exploration of the task; this can be done independently, in pairs or in small groups or a combination of all. It is highly recommended that students be given the opportunity to privately work on a task to generate solutions on their own. Students are encouraged to share their findings with their peers in small group to compare their solutions. As students are actively engaged in constructing meaning of the mathematical concept(s) being taught and communicating their understanding of the concept(s) with their peers, the teacher monitors the development of student understanding by observing student thinking and using questions to stimulate thinking to drive students toward the aimed mathematical goal(s). The teacher assesses students’ understanding of key mathematical ideas, problem-solving strategies, and the use of and connection between models and representations to determine what the student knows. The teacher advances the students’ understanding to move the student beyond their present thinking and expand what they know to an additional situation. Teachers have been trained to strategically select groups of students who have different solution paths to the same task, different representations and errors/misconceptions to share, discuss, and analyze as a whole group. By providing these instructional opportunities, the teacher will then be able to orchestrate the class discussion by providing students with the opportunities to make their learning public as students share, discuss, analyze, clarify, extend, connect, strengthen, and record their thinking strategies. After students discuss, justify, and challenge the various solution paths that were shared, a summary of the learning is articulated and connected to the objective of the lesson. Students should be given an opportunity to close the lesson with a reflection on their learning.
<table>
<thead>
<tr>
<th>Effective Pedagogical Routines/Instructional Strategies</th>
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<tr>
<td><strong>Collaborative Problem Solving</strong></td>
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<tr>
<td>Connect Previous Knowledge to New Learning</td>
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<td>Making Thinking Visible</td>
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<td><strong>Develop and Demonstrate Mathematical Practices</strong></td>
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<tr>
<td>Inquiry-Oriented and Exploratory Approach</td>
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<tr>
<td>Multiple Solution Paths and Strategies</td>
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<tr>
<td>Use of Multiple Representations</td>
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<tr>
<td>Explain the Rationale of your Math Work</td>
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<tr>
<td>Quick Writes</td>
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<td>Pair/Trio Sharing</td>
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<td>Turn and Talk</td>
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<td>Charting</td>
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<td>Gallery Walks</td>
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<td>Small Group and Whole Class Discussions</td>
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<td>Student Modeling</td>
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<td><strong>Analyze Student Work</strong></td>
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<tr>
<td>Identify Student’s Mathematical Understanding</td>
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<td>Identify Student’s Mathematical Misunderstandings</td>
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<td>Interviews</td>
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<td>Role Playing</td>
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<tr>
<td>Diagrams, Charts, Tables, and Graphs</td>
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<tr>
<td>Anticipate Likely and Possible Student Responses</td>
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<tr>
<td>Collect Different Student Approaches</td>
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<tr>
<td>Multiple Response Strategies</td>
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<tr>
<td>Asking Assessing and Advancing Questions</td>
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<td>Revoicing</td>
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<td>Marking</td>
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<td>Recapping</td>
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<td>Challenging</td>
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<tr>
<td>Pressing for Accuracy and Reasoning</td>
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<td>Maintain the Cognitive Demand</td>
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## Educational Technology

### Standards

<table>
<thead>
<tr>
<th>8.1.8.A.1, 8.1.8.A.3, 8.1.8.E.1, 8.2.8.C.8</th>
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#### Technology Operations and Concepts
- Demonstrate knowledge of a real world problem using digital tools
  
  **Example:** Students can use [https://www.mathgames.com/skill/6.24-divide-by-fractions-with-models](https://www.mathgames.com/skill/6.24-divide-by-fractions-with-models) to reinforce division of fractions.

- Use and/or develop a simulation that provides an environment to solve a real world problem or theory.
  
  **Example:** Students can go to [http://www.mathplayground.com/thinkingblocks.html](http://www.mathplayground.com/thinkingblocks.html) to reinforce ratios.

#### Research and Information Fluency
- Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.
  
  **Example:** Students can search through Learnzillion, Khan Academy, and other interactive sites for appropriate instructional videos and/or information pertaining to strategies and modeling.

#### Design
- Develop a proposal for a chosen solution that include models (physical, graphical or mathematical) to communicate the solution to peers.
  
  **Example:** Students can use GeoGebra ([https://www.geogebra.org/m/KDxuVax6](https://www.geogebra.org/m/KDxuVax6)) to create double number lines to model and explain how to find the percent of a number.
Career Ready Practices

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

- **CRP2. Apply appropriate academic and technical skills.**
  Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

  **Example:** Students will apply prior knowledge when solving real world problems. Students will make sound judgements about the use of specific tools, such as creating tables and using the tools to explore and deepen the understanding of the concept of equivalent ratios.

- **CRP4. Communicate clearly and effectively and with reason.**
  Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others’ time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

  **Example:** Students on a daily basis will communicate their reasoning behind their solution paths by making connections to the context and the quantities, using proper vocabulary, along with decontextualizing and/or contextualizing the problem. Students will create representations using objects, drawings, diagrams, and/or actions, such as the number line to compute quotients of fractions. They will also explain the meaning behind the quantities and units involved. Students will also ask probing questions to clarify and improve arguments.

- **CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.**
  Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

  **Example:** Throughout their daily lessons, students will understand the meaning of a problem and look for entry points into solving their problems by analyzing the relationships of the quantities, constraints and goals of the task. Plans for solution paths will be made and have meaning. Students will self-monitor, evaluate and critique their process and progress as they are working and make changes as necessary.
Career Ready Practices

- **CRP12. Work productively in teams while using cultural global competence.**
  Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

  **Example:** Students will work in collaborative and whole group settings to develop various solutions to math tasks that are presented to them. They will work together to understand the terms of the problem, ask clarifying and challenging questions among each other, and develop agreed upon solutions using a variety of strategies and models. Students will listen to, read and discuss arguments with each other with respect and courtesy at all times and will be willing to assist those that may need assistance. In this unit, students will demonstrate and explain to a peer or small group how to convert measurement units and to transform units appropriately when multiplying or dividing quantities.
## WIDA Proficiency Levels

At the given level of English language proficiency, English language learners will process, understand, produce or use

### 6- Reaching
- Specialized or technical language reflective of the content areas at grade level
- A variety of sentence lengths of varying linguistic complexity in extended oral or written discourse as required by the specified grade level
- Oral or written communication in English comparable to proficient English peers

### 5- Bridging
- Specialized or technical language of the content areas
- A variety of sentence lengths of varying linguistic complexity in extended oral or written discourse, including stories, essays or reports
- Oral or written language approaching comparability to that of proficient English peers when presented with grade level material.

### 4- Expanding
- Specific and some technical language of the content areas
- A variety of sentence lengths of varying linguistic complexity in oral discourse or multiple, related sentences or paragraphs
- Oral or written language with minimal phonological, syntactic or semantic errors that may impede the communication, but retain much of its meaning, when presented with oral or written connected discourse, with sensory, graphic or interactive support

### 3- Developing
- General and some specific language of the content areas
- Expanded sentences in oral interaction or written paragraphs
- Oral or written language with phonological, syntactic or semantic errors that may impede the communication, but retain much of its meaning, when presented with oral or written, narrative or expository descriptions with sensory, graphic or interactive support

### 2- Beginning
- General language related to the content area
- Phrases or short sentences
- Oral or written language with phonological, syntactic, or semantic errors that often impede the communication when presented with one to multiple-step commands, directions, or a series of statements with sensory, graphic or interactive support

### 1- Entering
- Pictorial or graphic representation of the language of the content areas
- Words, phrases or chunks of language when presented with one-step commands directions, WH-, choice or yes/no questions, or statements with sensory, graphic or interactive support
## Differentiated Instruction

### Accommodate Based on Students Individual Needs: Strategies

<table>
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<th>Time/General</th>
<th>Processing</th>
<th>Comprehension</th>
<th>Recall</th>
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</thead>
<tbody>
<tr>
<td>Extra time for assigned tasks</td>
<td>Extra Response time</td>
<td>Precise processes for conceptual</td>
<td>Teacher-made checklist</td>
</tr>
<tr>
<td>Adjust length of assignment</td>
<td>Have students verbalize steps</td>
<td>model</td>
<td>Use visual graphic</td>
</tr>
<tr>
<td>Timeline with due dates for reports</td>
<td>Repeat, clarify or reword directions</td>
<td>Short manageable tasks</td>
<td>graphic organizers</td>
</tr>
<tr>
<td>and projects</td>
<td>Mini-breaks between tasks</td>
<td>Brief and concrete directions</td>
<td>Reference resources to</td>
</tr>
<tr>
<td>Communication system</td>
<td>Provide a warning for transitions</td>
<td>Provide immediate feedback</td>
<td>promote independence</td>
</tr>
<tr>
<td>between home and school</td>
<td>Partnering</td>
<td>Small group instruction</td>
<td>Visual and verbal reminders</td>
</tr>
<tr>
<td>Provide lecture notes/outline</td>
<td></td>
<td>Emphasize multi-sensory learning</td>
<td>Graphic organizers</td>
</tr>
</tbody>
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<tr>
<th>Assistive Technology</th>
<th>Tests/Quizzes/Grading</th>
<th>Behavior/Attention</th>
<th>Organization</th>
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<tr>
<td>Computer/whiteboard</td>
<td>Extended time</td>
<td>Consistent daily structured</td>
<td>Individual daily planner</td>
</tr>
<tr>
<td>Tape recorder</td>
<td>Study guides</td>
<td>routine</td>
<td>Display a written agenda</td>
</tr>
<tr>
<td>Video Tape</td>
<td>Shortened tests</td>
<td>Simple and clear classroom</td>
<td>Note-taking assistance</td>
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<tr>
<td></td>
<td>Read directions aloud</td>
<td>rules</td>
<td>Color code materials</td>
</tr>
</tbody>
</table>

### Additional Resources

- Computer/whiteboard
- Tape recorder
- Video Tape

- Teacher-made checklist
- Use visual graphic organizers
- Reference resources to promote independence
- Visual and verbal reminders
- Graphic organizers

- Individual daily planner
- Display a written agenda
- Note-taking assistance
- Color code materials
## Differentiated Instruction

### Accommodate Based on Content Specific Needs: Strategies

- Anchor charts to model strategies and use of formulas
- Reference sheets that list formulas, step-by-step procedures and model strategies
- Conceptual word wall that contains definition, translation, pictures and/or examples
- Graphic organizers (Examples include: Venn diagram, Four Square, K-W-L)
- Translation dictionary
- Teacher modeling
- Four-Function calculator to assist with computations
- Students can utilize math journals to write notes, copy solution steps, and translate terms and key vocabulary
- Highlight and label the solution steps for multi-step problems in different colors
- Utilize technological programs which provide verbal and visual instruction in native and/or second language
- Horizontal and vertical number line for finding the quotient of fractions, locating positive and negative numbers
- Fraction Bars to assist with division of fractions
- Place value chart to assist with division and multiplication and percent
- Divisibility rules to assist with division
- Tape model/Bar model for finding the quotient of fractions and ratios
- Tables for converting units of measure and finding unit rate
- List of prime and composite numbers to assist with division
- Decimal Bar Chart
- Double number line to assist with finding unit rate and conversion of measurements
- Conversion charts to assist with converting measurements
- Multiplication chart to assist with division, equivalent ratios and finding rate
- Double number lines to assist with finding rate and conversion of measurements
Interdisciplinary Connections

*Model interdisciplinary thinking to expose students to other disciplines.*

**Physical Education Connection:**

*Batting Average (2.1ABCDE & 2.2ABCDE)*

- Students will determine the batting average of the given player. The teacher can give them other data of current players for them to determine the batting averages. The students can then determine who has the best batting average and why.

**Home Economics Connection:**

*Baking Cookies (CRP1, CRP2, CRP3, CRP6, CRP8, CRP12)*

*Cups of Rice (CRP1, CRP2, CRP3, CRP6, CRP8, CRP12)*

- Students will look at recipes and determine how many servings the recipes will make. This will allow students to see the importance of following recipes and if they want to make changes to it, or determine how much the ingredients will make.

**Art Connection:**

*Art Murals (1.3.8.D.3)*

- Students will determine the number of small squares that need to be used to cover the mural. Teachers can explain what a mural is and be shown various murals.

**ELA Connection:**

*Various Tasks: (RL.6.1 & RI.6.1)*

- Students will be able to read, analyze, and cite informational text to solve problems and explain their reasoning of how the task was solved. Students will also focus on vocabulary, mechanics and grammar in effective writing.
What is the purpose of Enrichment?

- The purpose of enrichment is to provide extended learning opportunities and challenges to students who have already mastered, or can quickly master, the basic curriculum. Enrichment gives the student more time to study concepts with greater depth, breadth, and complexity.
- Enrichment also provides opportunities for students to pursue learning in their own areas of interest and strengths.
- Enrichment keeps advanced students engaged and supports their accelerated academic needs.
- Enrichment provides the most appropriate answer to the question, “What do you do when the student already knows it?”

Enrichment is…

- Planned and purposeful
- Different, or differentiated, work – not just more work
- Responsive to students’ needs and situations
- A promotion of high-level thinking skills and making connections within content
- The ability to apply different or multiple strategies to the content
- The ability to synthesize concepts and make real world and cross-curricular connections.
- Elevated contextual complexity
- Sometimes independent activities, sometimes direct instruction
- Inquiry based or open ended assignments and projects
- Using supplementary materials in addition to the normal range of resources.
- Choices for students
- Tiered/Multi-level activities with Flexible groups (may change daily or weekly)

Enrichment is not…

- Just for gifted students (some gifted students may need intervention in some areas just as some other students may need frequent enrichment)
- Worksheets that are more of the same (busywork)
- Random assignments, games, or puzzles not connected to the content areas or areas of student interest
- Extra homework
- A package that is the same for everyone
- Thinking skills taught in isolation
- Unstructured free time
Assessments

**Required District/State Assessments**
Unit # 1 Assessment
  - PARCC
  - SGOB Baseline

**Suggested Formative/Summative Classroom Assessments**
  - Describe Learning Vertically
  - Identify Key Building Blocks
  - Make Connections (between and among key building blocks)
  - Short/Extended Constructed Response Items
  - Multiple-Choice Items (where multiple answer choices may be correct)
  - Drag and Drop Items
  - Use of Equation Editor
  - Quizzes
  - Journal Entries/Reflections/Quick-Writes
  - Accountable talk
    - Projects
    - Portfolio
    - Observation
  - Graphic Organizers/Concept Mapping
  - Presentations
  - Role Playing
  - Teacher-Student and Student-Student Conferencing
  - Homework
# New Jersey Student Learning Standards

**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 \((2/3) \div (3/4)\) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that \((2/3) \div (3/4) = 8/9\) because \(3/4\) of \(8/9\) is \(2/3\). (In general, \((a/b) \div (c/d) = ad/bc\).) 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.2**
Fluently divide multi-digit numbers using the standard algorithm.

**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. *(benchmarked)*

**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?*
New Jersey Student Learning Standards

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.RP.A.3d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

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

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.
### Mathematical Practices

1. Make sense of problems and persevere in solving them.

2. Reason abstractly and quantitatively.

3. Construct viable arguments and critique the reasoning of others.

4. Model with mathematics.

5. Use appropriate tools strategically.

6. Attend to precision.

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.
Grade: Six  
Unit: 1 (One)  
Topic: Operations and Reasoning about Ratios

NJSLS:  6.NS.A.1, 6.NS.B.2, 6.RP.A.1, 6.RP.A.2, 6.RP.A.3a,b,c,d, 6.NS.B.3, 6.NS.B.4

Unit Focus:
- Apply and extend previous understandings of multiplication and division to divide fractions by fractions
- Compute fluently with multi-digit numbers and find common factors and multiples
- Understand ratio concepts and use ratio reasoning to solve problems

New Jersey Student Learning Standard(s):
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?

Student Learning Objective 1: Compute quotients of fractions.

Modified Student Learning Objectives/Standards:
M.EE.6.NS.A.1: Compare the relationships between two unit fractions

<table>
<thead>
<tr>
<th>MPs</th>
<th>Evidence Statement Key/Clarifications</th>
<th>Skills, Strategies &amp; Concepts</th>
<th>Essential Understandings/Questions (Accountable Talk)</th>
<th>Tasks/Activities</th>
</tr>
</thead>
</table>
| MP 4 | 6.C.2  
       6.C.3  
       6.NS.1-2 | In 5th grade students divided whole numbers by unit fractions and divided unit fractions by whole numbers.  
 Divide a fraction by a fraction. | Why does the division of fractions algorithm work (i.e., multiplying by the reciprocal)?  
 How can the fractional portion of a mixed number be | Share My Candy  
 How Many ___ Are In?  
 Dan’s Division |
- Only the answer is required. For the explanations and representations aspect of 6.NS.1-2, see 6.C.2 and 6.C.3.
- Note that the italicized examples correspond to three meanings/uses of division: (1) equal sharing; (2) measurement; (3) unknown factor. These meanings/uses of division should be sampled equally.
- Tasks may involve fractions and mixed numbers but not decimals.

<table>
<thead>
<tr>
<th>Represent division of fractions using visual models.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interpret quotients of fractions in the context of the problem.</td>
</tr>
<tr>
<td>Compute quotients of fractions in order to solve word problems.</td>
</tr>
<tr>
<td>Write equations to solve word problems involving division of fraction by a fraction.</td>
</tr>
<tr>
<td>Use the relationship between multiplication and division to explain division of fractions.</td>
</tr>
</tbody>
</table>

**SPED Strategies:**
- Use fraction bars to provide a visual and tactile model of fractions.
- Create a story context for division of fractions.
- Create a divisional fraction model to show the quotient.
- Create/use various methods to compute quotients of fractions.
- Create pictures that represent problems making it easier to see and prove the solutions.

**Strategy**
- What real life situations can be modeled by dividing a fraction by a fraction?
- How is division of fractions used in the real world?
- When I divide one number by another number, do I always get a quotient smaller than my original number?
- When I divide a fraction by a fraction what do the dividend, quotient and divisor represent?
Use vocabulary picture cards of fractional amounts.

**Resources (UDL - Visual and Auditory Learner(s))**:

- Interpret and compute quotients of fractions
  [https://youtu.be/n-AAs5wwRvY](https://youtu.be/n-AAs5wwRvY)

- Interpreting and Computing Division of a Fraction by a Fraction—More Models - [https://youtu.be/hX4xMDoGvNU](https://youtu.be/hX4xMDoGvNU)

- Divide whole numbers by non-unit fractions
  [https://youtu.be/_YFM97_9IWw](https://youtu.be/_YFM97_9IWw)

**ELL Strategies**
Interactive tools which demonstrate examples of fraction quotients.

- Word Walls with translation side by side.

- List of sample equations, resolved in multiple ways.

- Math word bank/translated/copied for students.

- Provide Math reference sheets.

- Small group work, pairs/triad.
Provide vocabulary picture cards.

Create visual equivalent of terms and sample problems.

**New Jersey Student Learning Standard(s):**

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 \((2/3) \div (3/4)\) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that \((2/3) \div (3/4) = 8/9\) because \(3/4\) of \(8/9\) is \(2/3\). (In general, \((a/b) \div (c/d) = ad/bc\).) 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?

**Student Learning Objective 2:** Construct visual fraction models to represent quotients of fractions and use the relationship between multiplication and division to explain division of fractions.

**Modified Student Learning Objectives/Standards:**

M.EE.6.NS.A.1: Compare the relationships between two unit fractions.

<table>
<thead>
<tr>
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<th>Tasks/Activities</th>
</tr>
</thead>
</table>
| MP 4 | 6.C.2  
6.C.3  
6.NS.1-2  
- Only the answer is required. For the explanations and representations aspect of 6.NS.1-2, see 6.C.2 and 6.C.3.  
- Note that the italicized examples correspond to three | Students continue to compute quotients of fractions by using visual models and equations to divide whole numbers by fractions and fractions by fractions.  
Students need to know how to use the number line and tape diagram/bar model.  
Students need to know how to use the relationship between multiplication and division to explain division of fractions.  
**SPED Strategies:** Use fraction bars to provide a visual and tactile model of fractions. | How do visual fraction models explain the relationship between multiplication and division of fractions?  
How can you model on the number line?  
How can the tape diagram help you with the number line?  
How does division of fractions relate to multiplication of fractions? | Traffic Jam  
Making Hot Chocolate 1  
Making Hot Chocolate 2  
How Many Containers in One Cup/Cups in One Container?  
Cutting Bracelet String  
How Many Servings? |
<table>
<thead>
<tr>
<th>means/uses of division: (1) equal sharing; (2) measurement; (3) unknown factor. These means/uses of division should be sampled equally.</th>
<th>Create a story context for division of fractions. Create a divisional fraction model to show the quotient. Create use various methods to compute quotients of fractions. Create pictures that represent problems making it easier to see and prove the solutions. Use vocabulary picture cards of fractional amounts. Resources (UDL - Visual and Auditory Learner(s):</th>
<th>How Many Cookies?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Tasks may involve fractions and mixed numbers but not decimals.</td>
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<td></td>
</tr>
<tr>
<td><strong>Resources (UDL - Visual and Auditory Learner(s):</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Interpret and compute quotients of fractions <a href="https://youtu.be/n-AAs5wwRvY">https://youtu.be/n-AAs5wwRvY</a></td>
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<td>• Interpreting and Computing Division of a Fraction by a Fraction—More Models - <a href="https://youtu.be/hX4xMDGvNU">https://youtu.be/hX4xMDGvNU</a></td>
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<td></td>
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<tr>
<td>• Divide whole numbers by non-unit fractions <a href="https://youtu.be/_YFM97_9IWw">https://youtu.be/_YFM97_9IWw</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ELL Strategies:</strong> Provide interactive tools which demonstrate examples of fraction</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
|              | quotations. Provide word walls with translation side by side.  
|              | Provide list of sample equations, solved in multiple ways.  
|              | Use of Math word bank/translated/copied for students.  
|              | Use of Math reference sheets.  
|              | Provide vocabulary picture cards.  
|              | Create visual equivalent of terms and sample problems. |
New Jersey Student Learning Standard(s):

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 \( \frac{2}{3} \div \frac{3}{4} \) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that \( \frac{2}{3} \div \frac{3}{4} = \frac{8}{9} \) because \( \frac{3}{4} \) of \( \frac{8}{9} \) is \( \frac{2}{3} \). (In general, \( \frac{a}{b} \div \frac{c}{d} = \frac{ad}{bc} \).) How much chocolate will each person get if 3 people share \( \frac{1}{2} \) lb of chocolate equally? How many \( \frac{3}{4} \)-cup servings are in \( \frac{2}{3} \) of a cup of yogurt? How wide is a rectangular strip of land with length \( \frac{3}{4} \) mi and area \( \frac{1}{2} \) square mi?

Student Learning Objective 3: Solve real-world problems involving quotients of fractions and interpret the solutions in the context given.

Modified Student Learning Objectives/Standards:

M.EE.6.NS.A.1: Compare the relationships between two unit fractions.

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>MP 4</td>
<td>6.C.2 6.C.3 6.NS.1-2</td>
<td>Students continue to compute quotients of fractions by using visual models and equations to solve word problems. Students develop an understanding of the relationship between multiplication and division. Students will interpret quotients of fractions in the context of the problem. Students will write equations to solve word problems involving division of fraction by a fraction. <strong>SPED Strategies:</strong> Use fraction bars to provide a visual and tactile model of fractions. Create a story context for division of</td>
<td>What real life situations can be modeled by dividing a fraction by a fraction? What is the relationship between multiplication and division of fractions? What does the quotient represent? What kind of models can I use to show solutions to word problems involving fractions?</td>
<td>Cup of Rice Baking Cookies Drinking Juice 2 Drinking Juice 3 Video Game Credits Running to School 3 Building Projects with Fractions Making Sandwiches Art Murals</td>
</tr>
</tbody>
</table>
of division should be sampled equally.

- Tasks may involve fractions and mixed numbers but not decimals.

<table>
<thead>
<tr>
<th>Fractions.</th>
</tr>
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<tbody>
<tr>
<td>Create a divisional fraction model to show the quotient.</td>
</tr>
<tr>
<td>Use various methods to compute quotients of fractions.</td>
</tr>
<tr>
<td>Create pictures that represent problems making it easier to see and prove the solutions.</td>
</tr>
<tr>
<td>Use vocabulary picture cards of fractional amounts.</td>
</tr>
</tbody>
</table>

**Resources (UDL - Visual and Auditory Learner(s))**:

- Interpret and compute quotients of fractions  
  [https://youtu.be/n-AAs5wwRvY](https://youtu.be/n-AAs5wwRvY)

- Interpreting and Computing Division of a Fraction by a Fraction—More Models  
  [https://youtu.be/hX4xMDoGvNU](https://youtu.be/hX4xMDoGvNU)

- Divide whole numbers by non-unit fractions  
  [https://youtu.be/_YFM97_9IWw](https://youtu.be/_YFM97_9IWw)

**ELL Strategies**:

Provide interactive tools which demonstrate examples of fraction quotients.
Provide word walls with translation side by side.

Provide list of sample equations, solved in multiple ways.

Use of Math word bank/translated/copied for students.

Use of Math reference sheets.

Small Group work, Pairs/Triad.

Provide vocabulary Picture Cards.

Create visual equivalent of terms and sample problems.

**New Jersey Student Learning Standard(s):**

6.NS.B.2: Fluently divide multi-digit numbers using the standard algorithm.

**Student Learning Objective 4:** Fluently divide multi-digit numbers using the standard algorithms.

**Modified Student Learning Objectives/Standards:**

M.EE.6.NS.B.2: Apply the concept of fair share and equal shares to divide.

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>MP 6</td>
<td>6.NS.2</td>
<td>In the elementary grades, students were introduced to division through concrete models and various strategies to develop an understanding of this mathematical operation (limited to 4-digit numbers divided by 2-digit numbers).</td>
<td>Which properties are being used to solve the problems? Do these answers look reasonable?</td>
<td>How Many Staples? Getting It Wrong Soccer Rosters Packing Beads</td>
</tr>
<tr>
<td></td>
<td>• The given dividend and divisor require an efficient/standard algorithm (e.g., 40584 ÷ 76).</td>
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</tr>
<tr>
<td>Tasks do not have a context.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only the answer is required.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Tasks have a maximum of five-digit dividends and a maximum of two-digit divisors.</td>
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<tr>
<td>Tasks may or may not have a remainder. Students understand that remainders can be written as fractions or decimals.</td>
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</tbody>
</table>

| In 6th grade, students become fluent in the use of the standard division algorithm to divide multi-digit numbers with speed and accuracy. They continue to use their understanding of place value to describe what they are doing. Place value has been a major emphasis in the elementary standards. |
| This standard at the end of this progression to address students’ understanding of place value. |
| Students should use the standard algorithm to divide multi-digit numbers with speed and accuracy. |

**SPED Strategies:**
- Provide a decimal bar chart to provide a visual reference for students.
- Provide a list of prime and composite numbers.
- Use of pneumonic devices (i.e. DMSCB/DMSB – Does McDonald’s sell Burgers).
- Use of grid paper (i.e. lining digits up).
- Create a divisibility rules chart.
- Create and review place value chart.

| How can you use estimation to determine if your answer is correct? |
Create concrete models or drawings.

Create a LCM and GCF graphic organizer & Anchor Chart

**Instructional Resources (UDL - Visual and Auditory Learner(s)):**

- 6.NS.B2 Dividing Multi-digit Numbers
  [https://youtu.be/iB-kFfQfNM](https://youtu.be/iB-kFfQfNM)
- 6.NS.2 Divide Multi-Digit Numbers

**ELL Strategies:**

Pre-teach new vocabulary and meaning of symbols.

Provide translations of all content and general vocabulary words.

Use sentence frames which include relevant terms in text.

Break down terms to familiar parts, suffixes or prefixes.

Provide flash cards (digital and tactile).

Use of translation dictionary or software.

**Website:** Teachers First: Adapt a Strategy. Adjusting Lessons for ESL/ELL students
[http://www.teachersfirst.com/content/esl/adaptstrat.cfm](http://www.teachersfirst.com/content/esl/adaptstrat.cfm)
New Jersey Student Learning Standard(s):
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."

Modified Student Learning Objectives/Standards:
M.EE.6.RP.A.1: Demonstrate a simple ratio relationship.

<table>
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<tr>
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<th>Tasks/Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP 2</td>
<td>6.RP.1</td>
<td>A ratio shows relative sizes or values of two quantities. Students will be able to describe a ratio relationship between two quantities using ratio language. A ratio is the comparison of two quantities or measures. The comparison can be part-to-whole or part-to-part. Example, &quot;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.&quot; Students should be able to identify and describe any ratio using “For every ___, there are ____.” Example: &quot;For every vote candidate A received, candidate C received nearly three votes.”</td>
<td>What is a ratio? What are some ways I can think about ratios? How are fractions and ratios related? What conditions help to recognize and represent proportional relationships between quantities? How are proportional relationships used to solve multistep ratio and percent problems? What kinds of problems can I solve?</td>
<td>IFL Task(s) – Unit of ARCs named “Ratio and Proportional Relationships” Additional Tasks Voting for Two Voting for Two; Voting for Two Games at Recess Apples to Apples Many Ways to Say It</td>
</tr>
</tbody>
</table>
**SPED Strategies:**

Provide manipulatives such as two sided counters or linking cubes to students.

Utilize high contrast between text and background to support retention (access prior knowledge).

Use skip counting as a technique to determine if ratios are equal.

Labeling units helps students organize the quantities when writing proportions.

Using hue/color intensity is a visual way to examine ratios of part-to-part. Students can compare the intensity of the color green and relate that to the ratio of colors used. For example, have students mix green paint into white paint in the following ratios: 1 part green to 5 parts white, 2 parts green to 3 parts white, and 3 parts green to 7 parts white. Compare the green color intensity with their ratios.

Connect to real-life experiences.

Instructional Resources (UDL - Visual and Auditory Learner(s)):

Introduction to Ratios (6.RP.1)

[https://youtu.be/v2lHGvCEuzo](https://youtu.be/v2lHGvCEuzo)

<table>
<thead>
<tr>
<th>How can I tell if a relationship is multiplicative?</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the difference between a multiplicative and an additive relationship?</td>
</tr>
<tr>
<td>What information do I get when I compare two numbers using a ratio?</td>
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<tr>
<td>Express a ratio in the simplest form - 6.RP.1</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Students working in small group/ triads, group high-level and low-level ELL students.</td>
</tr>
<tr>
<td>Use of word/picture wall.</td>
</tr>
<tr>
<td>Use L1 text and/or support.</td>
</tr>
<tr>
<td>Use illustrations/diagrams/drawings.</td>
</tr>
<tr>
<td>Provide white boards for students to practice problem solving.</td>
</tr>
<tr>
<td>Provide math journals for students to practice writing skills with math terminology.</td>
</tr>
<tr>
<td>Use of cloze sentences with relevant terms included in text.</td>
</tr>
<tr>
<td>Use of translation dictionary or software.</td>
</tr>
<tr>
<td>Model by playing role of student and gradually fade to level of student working independently</td>
</tr>
</tbody>
</table>
New Jersey Student Learning Standard(s): 
6.RP.A.2. Understand the concept of a unit rate \( \frac{a}{b} \) 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 \( \frac{3}{4} \) cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."

**Student Learning Objective 6:** Use rate language, in the context of the ratio relationship, to describe a unit rate.

**Modified Student Learning Objectives/Standards:** N/A

<table>
<thead>
<tr>
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<th>Tasks/Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP 2</td>
<td>6.RP.2</td>
<td>A rate is a ratio comparing two different types of quantities. Students will be able to determine the unit rate given a ratio relationship and describe a unit rate relationship between two quantities using rate language. A unit rate expresses a ratio as part-to-one, comparing a quantity in terms of one unit of another quantity. Students are able to name the amount of either quantity in terms of the other quantity. Students will begin to notice that related unit rates (i.e. miles / hour and hours / mile) are reciprocals as in the second example below. At this level, students should use reasoning to find these unit rates instead of an algorithm or rule. In 6th grade, students are not expected to work with unit rates expressed as complex fractions. Both the numerator and denominator should be whole numbers.</td>
<td>What information do I get when I compare two numbers using a ratio? What kinds of problems can I solve by using ratios? What are rates? How are unit rates helpful in solving real-world problems? How are ratios and rates similar and different?</td>
<td>IFL Task(s) – Unit of ARCs named “Ratio and Proportional Relationships” PBA: Comparing Cars Additional Tasks Price per pound and pounds per dollar Mangos for Sale Hippos Love Pumpkins</td>
</tr>
</tbody>
</table>
denominator of the original ratio will be whole numbers.

**SPED Strategies:**
Provide manipulatives such as two sided counters or linking cubes to students.

Utilize high contrast between text and background to support retention (access prior knowledge).

Use skip counting as a technique to determine if ratios are equal.

Labeling units helps students organize the quantities when writing proportions.

Using hue/color intensity is a visual way to examine ratios of part-to-part. Students can compare the intensity of the color green and relate that to the ratio of colors used. For example, have students mix green paint into white paint in the following ratios: 1 part green to 5 parts white, 2 parts green to 3 parts white, and 3 parts green to 7 parts white. Compare the green color intensity with their ratios.

Connect to real-life experiences.

**Instructional Resources (UDL - Visual and Auditory Learner(s)):**

- 6.RP.2/3 Unit Rates Tape
**Diagram/Bar Model Math LAB 2.1**
https://youtu.be/2y2w3WFxH3w

**ELL Strategies:**
Use of manipulatives that show measurement rates and conversions.

Students work in small group/ triads, group high-level and low-level ELL students.

Use of word/picture wall.

L1 text and/or support.

Illustrations/diagrams/drawings provided.

Use of white boards for students to practice problem solving.

Use of math journals for students to practice writing skills with math terminology.

Cloze sentences with relevant terms included in text should be provided.

Use of translation dictionary or software.

Model by playing role of student and gradually fade to level of student working independently.
New Jersey Student Learning Standard(s):
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. *(benchmarked)*

- **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.

**Student Learning Objective 7:** Create and complete tables of equivalent ratios to solve real world and mathematical problems using ratio and rate reasoning that include making tables of equivalent ratios, solving unit rate problems, finding percent of a quantity as a rate per 100.

**Modified Student Learning Objectives/Standards:** N/A

<table>
<thead>
<tr>
<th>MPs</th>
<th>Evidence Statement Key/Clarifications</th>
<th>Skills, Strategies &amp; Concepts</th>
<th>Essential Understandings/Questions (Accountable Talk)</th>
<th>Tasks/Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP 2</td>
<td>6.RP.3a</td>
<td>Students will use ratio and rate reasoning to create tables of equivalent ratios relating quantities with whole number measurements, find missing values in tables and plot pairs of values. Previously, students have used additive reasoning in tables to solve problems. To begin the shift to proportional reasoning, students need to begin using multiplicative reasoning. To aid in the development of proportional reasoning the cross-product algorithm is not expected at this level. When working with ratio tables and</td>
<td>What information do I get when I compare two numbers using a ratio? What kinds of problems can I solve by using ratios? Why are tables important in solving real world mathematical problems? What are equivalent ratios? What are percentages?</td>
<td>IFL Task(s) – Unit of ARCs named “Ratio and Proportional Relationships” PBA Comparing Cars Additional Tasks Buying Soup Shirt Sale</td>
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<tr>
<td>MP 4</td>
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<td>MP 5</td>
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<td>MP 6</td>
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<td>MP 7</td>
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<tr>
<td>MP 8</td>
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</tbody>
</table>
The initial numerator and denominator should be whole numbers.

6.RP.3c-1
- Tasks may or may not contain context.
- Expectations for ratios in this grade are limited to ratios of non-complex fractions. The initial numerator and denominator should be whole numbers.

6.RP.3c-2
- Expectations for ratios in this grade are limited to ratios of non-complex fractions. The initial numerator and denominator should be whole numbers.

Graphs, whole number measurements are the expectation for this standard. This will allow students to understand how to compare ratios using tables of equivalent ratios.

Solving real world and mathematical problems involving unit rate (including unit price and constant speed).

Calculate a percent of a quantity and solve problems by finding the whole when given the part and the percent.

**SPED Strategies:**
Create tables of equivalent ratios relating quantities with whole-number measurements.

Apply problem solving with ratios to situations of high interest for students.

Encourage students to use models and manipulative and explain their thinking process while solving ratio problems in context.

**Instructional Resources (UDL - Visual and Auditory Learner(s):**
- Rate and Proportion with Student Bob, CCSS 6.RP.A.3 and 7.RP.A.1.

| Mowing Lawns | Apple Farm | Sewing |
ELL Strategies:
Use of manipulatives that show measurement rates and conversions.

Students work in small group/ triads, group high-level and low-level ELL students.

Use of word/picture wall.

L1 text and/or support.

Illustrations/diagrams/drawings provided.

Use of white boards for students to practice problem solving.

Use of math journals for students to practice writing skills with math terminology.

Cloze sentences with relevant terms included in text should be provided.

Use of translation dictionary or software.

Model by playing role of student and gradually fade to level of student working independently.
**New Jersey Student Learning Standard(s):**
6.RP.A.3d: Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

**Student Learning Objective 8:** Use ratio and rate reasoning to convert measurement units and to transform units appropriately when multiplying or dividing quantities.

**Modified Student Learning Objectives/Standards:** N/A

<table>
<thead>
<tr>
<th>MPs</th>
<th>Evidence Statement Key/Clarifications</th>
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<th>Essential Understandings/Questions (Accountable Talk)</th>
<th>Tasks/Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP 2</td>
<td>6.RP.3d</td>
<td>A ratio can be used to compare measures of two different types, such as inches per foot, milliliters per liter and centimeters per inch. Students convert measurement units using ratio reasoning and transform units appropriately when multiplying and dividing quantities. Students recognize that a conversion factor is a fraction equal to 1 since the numerator and denominator describe the same quantity. For example, 12 inches/1 foot is a conversion factor since the numerator and denominator</td>
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<tr>
<td>MP 4</td>
<td></td>
<td>How can ratios be used to convert measurement units? What information do I need to convert measurement units?</td>
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<tr>
<td>MP 5</td>
<td></td>
<td>IFL Task(s) – Unit of ARCs named “Ratio and Proportional Relationships”</td>
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<tr>
<td>MP 6</td>
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<td>PBA: Comparing Cars</td>
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<tr>
<td>MP 7</td>
<td></td>
<td>Additional Tasks Walking Club</td>
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<tr>
<td>MP 8</td>
<td></td>
<td>Making Juice</td>
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<td></td>
<td></td>
<td>Unit Conversions</td>
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</tbody>
</table>
should be whole numbers. denominator equals the same amount. Since the ratio is equivalent to 1, the identity property of multiplication allows an amount to be multiplied by the ratio. Also, the value of the ratio can also be expressed as 1 foot/12 inches allowing for the conversion ratios to be expressed in a format so that units will “cancel”.

Students use ratios as conversion factors and the identity property for multiplication to convert ratio units.

**SPED Strategies:**
Model the thinking behind the conversion of units and document these in an anchor chart or graphic organizer.

Provide a reference sheet for conversion factors.

Use high interest scenarios when applying conversion of units to problem solving situations.

**Instructional Resources (UDL - Visual and Auditory Learner(s):**

- Rate and Proportion with Student Bob, CCSS 6.RP.A.3 and 7.RP.A.1. [https://youtu.be/pIMNpu7mGY8](https://youtu.be/pIMNpu7mGY8)
- 6.RP.2/3 Unit Rates Tape Diagram/Bar Model MaTh LAB 2.1

| Simple Unit Conversion Using Ratio Reasoning | Snail Pace |
| **ELL Strategies:** |  |
|---------------------|-----------------
| Use of manipulatives that show measurement rates and conversions. |  |
| Students work in small group/ triads, group high-level and low-level ELL students. |  |
| Use of word/picture wall. |  |
| L1 text and/or support. |  |
| Illustrations/diagrams/drawings provided. |  |
| Use of white boards for students to practice problem solving. |  |
| Use of math journals for students to practice writing skills with math terminology. |  |
| Cloze sentences with relevant terms included in text should be provided. |  |
| Use of translation dictionary or software. |  |
| Model by playing role of student and gradually fade to level of student working independently. |  |
New Jersey Student Learning Standard(s):  
6.NS.B.3: Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

Student Learning Objective 9: Fluently add, subtract, multiply and divide multi-digit decimals.

Modified Student Learning Objectives/Standards:  
M.EE.6.NS.B.3: Solve two-factor multiplication problems with products up to 50 using concrete objects and/or a calculator.

<table>
<thead>
<tr>
<th>MPs</th>
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</thead>
<tbody>
<tr>
<td>MP 6</td>
<td>6.NS.3-1</td>
<td>Procedural fluency is defined by the Common Core as “skill in carrying out procedures flexibly, accurately, efficiently and appropriately”. In 4th and 5th grades, students added and subtracted decimals. Multiplication and division of decimals were introduced in 5th grade (decimals to the hundredth place). At the elementary level, these operations were based on concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.</td>
<td>Which strategies are helpful when performing operations on multi-digit decimals? Which properties are being used to solve the problems? Do these answers look reasonable? How can you use estimation to determine if your answer is correct? How can place value assist you with division of decimals? Why is the quotient greater than the divided when dividing by a value less than one? Which strategies are helpful when dividing multi-digit numbers?</td>
<td>Setting Goals Reasoning about Multiplication and Division and Place Value 1 Reasoning about Multiplication and Division and Place Value 2 Selecting Steaks Swimming Relay Pricing Packages Juice Boxes Gifts from Grandma Batting Average Movie Tickets</td>
</tr>
</tbody>
</table>

In 6th grade, students become fluent in the use of the standard algorithms of each of these operations. The use of estimation strategies supports student understanding of decimal operations. Students will add, subtract, multiply and divide multi-digit decimals.
| 72.635). | divide multi-digit decimals with accuracy and efficiency. |
| The subtrahend and minuend are each greater than or equal to 0.001 and less than or equal to 99.999. Positive differences only. | **SPED Strategies:**  
Include multiplication chart.  
Use of a decimal bar chart.  
Provide a list of prime and composite numbers.  
Provide pneumonic device (i.e. DMSCB/DMSB – Does McDonald’s sell Burgers).  
Provide grid paper (i.e. lining digits up).  
Create a divisibility rules chart.  
Create and review place value chart.  
Create concrete models or drawings.  
**Instructional Resources (UDL - Visual and Auditory Learner(s)):**  

| 6.NS.3-3 | **ELL Strategies:**  
Pre-teach new vocabulary and meaning of symbols.  
Provide translations of all content and |
algorithm (e.g., $177.3 \div 0.36$).
- Tasks are either 4-digit $\div$ 2-digit or 3-digit $\div$ 3-digit. (For example, $14.28 \div 0.68$ or $2.39 \div 0.684$).
- Every quotient is a whole number or a decimal terminating at the tenths, hundredths, or thousandths place.

<table>
<thead>
<tr>
<th>General vocabulary words.</th>
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<tbody>
<tr>
<td>Use sentence frames which include relevant terms in text.</td>
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<tr>
<td>Break down terms to familiar parts, suffixes or prefixes.</td>
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<tr>
<td>Provide flash cards (digital and tactile).</td>
</tr>
<tr>
<td>Use of translation dictionary or software.</td>
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</tbody>
</table>

**Website:** Teachers First
Adapt a Strategy. Adjusting Lessons for ESL/ELL students
http://www.teachersfirst.com/content/esl/adaptstrat.cfm

**New Jersey Student Learning Standard(s):**
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.

**Student Learning Objective 10:** Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two numbers less than or equal to 12.

**Modified Student Learning Objectives/Standards:** N/A

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>MP 7</td>
<td><strong>6.NS.4-I</strong></td>
<td>In elementary school, students identified primes, composites and factor pairs (4.OA.4).</td>
<td>What are common factors and common multiples?</td>
<td>Field Day Groups Adding Multiples</td>
</tr>
<tr>
<td>6.NS.4-2</td>
<td>Tasks do not have a context.</td>
<td>Tasks require writing or finding the equivalent expression with the greatest common factor</td>
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<tr>
<td>Create lists of factors for two whole numbers less than or equal to 100; find the largest factor common to both lists.</td>
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<tr>
<td>Create lists of multiples for two whole numbers less than or equal to 12; find the smallest multiple common to both lists.</td>
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<tr>
<td>Students also understand that the greatest common factor of two prime numbers is 1.</td>
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<tr>
<td><strong>SPED Strategies:</strong></td>
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<tr>
<td>Include multiplication chart.</td>
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<tr>
<td>Include decimal bar chart.</td>
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<tr>
<td>Provide list of prime and composite numbers.</td>
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<tr>
<td>Use of pneumonic devices (i.e. DMSCB/DMSB – Does McDonald’s sell Burgers).</td>
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<tr>
<td>Provide grid paper (i.e. lining digits up).</td>
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<tr>
<td>Create a divisibility rules chart.</td>
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<tr>
<td>Create and review place value chart.</td>
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<tr>
<td>Create concrete models or drawings.</td>
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<tr>
<td>Create a LCM and GCF graphic organizer &amp; anchor chart as a tool for students to refer to.</td>
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<tr>
<td><strong>Instructional Resources (UDL - Visual)</strong></td>
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<tr>
<td>How is least common multiple and greatest common factor used to solve problems?</td>
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<tr>
<td>What can factors and multiples tell me about a number?</td>
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<tr>
<td>What is the difference between factors and multiples?</td>
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<tr>
<td>What are some other characteristics numbers can have?</td>
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<tr>
<td>How are multiples applicable in everyday life?</td>
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<tr>
<td>How can I use models to represent multiples of a number?</td>
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<tr>
<td>Why would it be useful to know the greatest common factor of a set of numbers?</td>
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<tr>
<td>Why would it be useful to know the least common multiple of a set of numbers?</td>
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<tr>
<td>How can the distributive property help me with computation?</td>
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</tbody>
</table>

| Arranging Chairs |
| Grouping Students |
| The Florist Shop |
| Bake Sale |
| Back to School |
| Counting and Building Rectangles |
| Multiples and Common Multiples |
| Factors and Common Factors |
and Auditory Learner(s):

- Greatest Common Factor (6.NS.B.4)
  [https://youtu.be/_dunyzV030U](https://youtu.be/_dunyzV030U)

**ELL Strategies:**
Pre-teach new vocabulary and meaning of symbols.

Provide translations of all content and general vocabulary words.

Provide sentence frames which include relevant terms in text.

Break down terms to familiar parts, suffixes or prefixes.

Provide flash cards (digital and tactile).

Use of translation dictionary or software

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Adapt a Strategy. Adjusting Lessons for ESL/ELL students
[http://www.teachersfirst.com/content/esl/adaptstrat.cfm](http://www.teachersfirst.com/content/esl/adaptstrat.cfm)
Integrated Evidence Statements

6.Int.1: Solve two-step word problems requiring operations on multi-digit whole numbers or decimals.
- Operations are no more complex than those specified for 6.NS.2, 6.NS.3-1, 6.NS.3-2, 6.NS.3-3, and 6.NS.3-4 with the exception of 3-digit x 3-digit.
- For purposes of assessment, the possibilities for multiplication are 1-digit x 2-digit, 1-digit x 3-digit, 2-digit x 3-digit, 2-digit x 4-digit, 2-digit x 5-digit, or 3-digit x 3-digit (For example, 7.68 x 15.3 or 0.35 x 18.241.)

6.C.8.1: Present solutions to multi-step problems in the form of valid chains of reasoning, using symbols such as equals signs appropriately (for example, rubrics award less than full credit for the presence of nonsense statements such as 1 + 4 = 5 + 7 = 12, even if the final answer is correct), or identify or describe errors in solutions to multi-step problems and present corrected solutions. Content Scope: Knowledge and skills articulated in 6.RP.A
- Expectations for ratios in this grade are limited to ratios of non-complex fractions. The initial numerator and denominator should be whole numbers.

6.C.9: Distinguish correct explanation/reasoning from that which is flawed, and – if there is a flaw in the argument – present corrected reasoning. (For example, some flawed ‘student’ reasoning is presented and the task is to correct and improve it.) Content Scope: Knowledge and skills articulated in 5.NBT, 5.MD.C.
- Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 6.

6.D.1: Solve multi-step contextual word problems with degree of difficulty appropriate to Grade 6, requiring application of knowledge and skills articulated in Type I, Sub-Claim A Evidence Statements.
- Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 6.

6.D.2: Solve multi-step contextual problems with degree of difficulty appropriate to Grade 6, requiring application of knowledge and skills articulated in 5.NBT.B, 5.NF, 5.MD, and 5.G.A.
- Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 6.

- Tasks may have scaffolding, if necessary, in order to yield a degree of difficulty appropriate to Grade 6.
## Unit 1 Vocabulary

<table>
<thead>
<tr>
<th>Number Sense</th>
<th>Ratios and Proportions</th>
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</thead>
<tbody>
<tr>
<td>Area Model</td>
<td>Prime Numbers</td>
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<tr>
<td>Decimal</td>
<td>Product</td>
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<tr>
<td>Denominator</td>
<td>Proportion</td>
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<td>Difference</td>
<td>Quotient</td>
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<td>Distributive Property</td>
<td>Reciprocal</td>
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<tr>
<td>Dividend</td>
<td>Simplest form</td>
</tr>
<tr>
<td>Double number line</td>
<td>Simplify</td>
</tr>
<tr>
<td>Evaluate</td>
<td>Sum</td>
</tr>
<tr>
<td>Expression</td>
<td>Tape diagram</td>
</tr>
<tr>
<td>Factor</td>
<td>Equivalent ratios</td>
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<tr>
<td>Factors</td>
<td>Number line</td>
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<tr>
<td>Fraction</td>
<td>Part-to-whole</td>
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<tr>
<td>Fraction bar</td>
<td>Part-to-part</td>
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<tr>
<td>Fraction greater than one</td>
<td>Ratio</td>
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<tr>
<td>Fraction less than one</td>
<td>Rate</td>
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<tr>
<td>Greatest common factor</td>
<td>Tape diagram</td>
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<tr>
<td>Inverse operations</td>
<td>Unit rate</td>
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<td>Least common multiple</td>
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<tr>
<td>Least Common Multiple</td>
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<td>Multi-digit</td>
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<tr>
<td>Multiple</td>
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<td>Multiplicative inverses</td>
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<tr>
<td>Number Line</td>
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<tr>
<td>Numerator</td>
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<tr>
<td>Numerical expressions</td>
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<td>Percent</td>
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<tr>
<td>Prime factorization</td>
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</tbody>
</table>

- Bar model
- Conversion factor
- Double number line
- Equivalent ratios
- Number line
- Part-to-whole
- Part-to-part
- Ratio
- Rate
- Tape diagram
- Unit rate
# References & Suggested Instructional Websites

North Carolina Department of Public Instruction – Common Core standards “unpacked” for 6th Grade Mathematics  

Georgia Department of Education – Various Common Core resources  
[https://www.georgiastandards.org/Common-Core/Pages/Math-6-8.aspx](https://www.georgiastandards.org/Common-Core/Pages/Math-6-8.aspx)

Illustrative Mathematics – Common Core tasks  
[https://www.illustrativemathematics.org/](https://www.illustrativemathematics.org/)

Learnzillion – Common Core lessons and presentations  
[https://learnzillion.com/](https://learnzillion.com/)

Inside Mathematics – Various Common Core resources  

EngageNY – Common Core lessons and resources  
[https://www.engageny.org/](https://www.engageny.org/)

Common Core Math Tasks – Common Core tasks  
[http://commoncoremathtasks.wikispaces.com/6.NS.2-4](http://commoncoremathtasks.wikispaces.com/6.NS.2-4)

PARCC Math Evidence Statements – Grade 6  

Youtube.com

Teachertube.com

Khan Academy  
[https://www.khanacademy.org/commoncore/grade-6-RP](https://www.khanacademy.org/commoncore/grade-6-RP)
**Field Trip Ideas**

**THE BOUNCE FACTORY (Warren, NJ)** - STEM- Inspired FUN Field Trips The Bounce Factory. Bricks 4 Kidz of Hunterdon Somerset and Team Makers of North Jersey have combined to create a unique and exciting Field Trip for students in grades 1st – 8th. It integrates STEM learning with fun, hands on activities that will focus on Science, Engineering and Math concepts. The students will build motorized models with LEGO® bricks and discuss engineering and physics principals; enter the Bounce rooms for activities that will set in motion discussions of how physics impacts their play; learn about Math and Science concepts while playing integrative teambuilding activities that build their skills and promote working together; learn strategy and the power of collaboration while playing laser tag in a state of the art facility
http://www.bouncefactorynj.com/

http://lsc.org/plan-your-visit/

**NATIONAL MUSEUM OF MATHEMATICS (New York, NY)** - Mathematics illuminates the patterns and structures all around us. Our dynamic exhibits, gallery, and programs will stimulate inquiry, spark curiosity, and reveal the wonders of mathematics. MoMath has innovative exhibits that will engage folks from 105 to 5 years old (and sometimes younger), but with a special emphasis on activities for 4th through 8th graders. **Requires approval from Unit Superintendent**
http://momath.org/

**MUSEUM OF AMERICAN FINANCE (New York, NY)** – For more than 20 years, educators from around the country have been bringing students to the Museum to help them understand how finance impacts their daily lives. The Museum offers discounted admission for pre-booked groups of eight or more, as well as a variety of classes for students in middle school through college.
http://www.moaf.org/index

**NEW JERSEY JACKALS** (Little Falls, NJ) – Students will be able to watch a live minor league baseball game while figuring out the players batting averages, the earned run average, determine the win to loss ratio for the season, the pitch count, and other player statistics.
http://www.canamleague.com/teams/newjersey.php

**LEGOLAND DISCOVERY CENTER (Yonkers, NY)** – Merry-Go-Round Workshop (Engineering Design, Mathematics, Listening and Speaking) This workshop provides a fun, hand-on way to get students excited about engineering, design, and mathematics. Students build a LEGO merry-go-round to explore gear ratios then experiment with gear trains to see which combination enables their ride to spin the fastest. **Requires approval from Unit Superintendent**
https://www.legolanddiscoverycenter.com/westchester/education/elementary-school.aspx
Field Trip Ideas

**BUEHLER’S CHALLENGER & SCIENCE CENTER (Paramus, NJ)** - Fly a space mission beyond your wildest dreams in the challenger simulator! Students will work on teams to complete their mission, while conducting experiments, monitoring life support, and implementing navigation orders. In this dynamic environment, students use principles of science, mathematics, and technology to complete their tasks. There are 3 missions to choose from: “Rendezvous with Comet Halley”, “Return to the Moon”, “Voyage to Mars”.

**Requires approval from Unit Superintendent**
http://www.bcsc.org/5-9th-grade/

**BRANCH BROOK PARK SKATING RINK (Newark, NJ)** - A unique educational experience that gets students excited about learning! Students will learn how the concepts of Science, Technology, Engineering and Math can be found in everyday experiences, even FUN experiences like roller skating! Our professional STEM Educators teach visiting students about how STEM principles exist in just about every part of life. The lessons focus on hands on activities that are both educational and fun! Lessons are customized based on teachers needs to directly relate back to classroom learning making this program completely unique! Following the completion of the 1hour STEM Lesson, the students roller skate for physical fitness. While Roller Skating the concepts students learned are continually reinforced. Our lessons are designed not only to help students overcome their fear of learning STEM concepts but to show how STEM is both FUN & EXCITING!