Grade 5 B.E.S.T. Instructional Guide for Mathematics

The B.E.S.T. Instructional Guide for Mathematics (B1G-M) is intended to assist educators with planning for student learning and instruction aligned to Florida’s Benchmarks for Excellent Student Thinking (B.E.S.T.) Standards. This guide is designed to aid high-quality instruction through the identification of components that support the learning and teaching of the B.E.S.T. Mathematics Standards and Benchmarks. The B1G-M includes an analysis of information related to the B.E.S.T. Standards for Mathematics within this specific mathematics course, the instructional emphasis and aligned resources. This document is posted on the B.E.S.T. Standards for Mathematics webpage of the Florida Department of Education’s website and will continue to undergo edits as needed.

Structural Framework and Intentional Design of the B.E.S.T. Standards for Mathematics

Florida’s B.E.S.T. Standards for Mathematics were built on the following.

- The coding scheme for the standards and benchmarks was changed to be consistent with other content areas. The new coding scheme is structured as follows: Content.GradeLevel.Strand.Standard.Benchmark.
- Strands were streamlined to be more consistent throughout.
- The standards and benchmarks were written to be clear and concise to ensure that they are easily understood by all stakeholders.
- The benchmarks were written to allow teachers to meet students’ individual skills, knowledge and ability.
- The benchmarks were written to allow students the flexibility to solve problems using a method or strategy that is accurate, generalizable and efficient depending on the content (i.e., the numbers, expressions or equations).
- The benchmarks were written to allow for student discovery (i.e., exploring) of strategies rather than the teaching, naming and assessing of each strategy individually.
- The benchmarks were written to support multiple pathways for success in career and college for students.
- The benchmarks should not be taught in isolation but should be combined purposefully.
- The benchmarks may be addressed at multiple points throughout the year, with the intention of gaining mastery by the end of the year.
- Appropriate progression of content within and across strands was developed for each grade level and across grade levels.
- There is an intentional balance of conceptual understanding and procedural fluency with the application of accurate real-world context intertwined within mathematical concepts for relevance.
- The use of other content areas, like science and the arts, within real-world problems should be accurate, relevant, authentic and reflect grade-level appropriateness.
Components of the B.E.S.T. Instructional Guide for Mathematics

The following table is an example of the layout for each benchmark and includes the defining attributes for each component. It is important to note that instruction should not be limited to the possible connecting benchmarks, related terms, strategies or examples provided. To do so would strip the intention of an educator meeting students’ individual skills, knowledge and abilities.

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Connecting Benchmarks/Horizontal Alignment</th>
<th>Terms from the K-12 Glossary</th>
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</thead>
<tbody>
<tr>
<td><strong>focal point for instruction within lesson or task</strong></td>
<td>This section includes the benchmark as identified in the B.E.S.T. Standards for Mathematics. The benchmark, also referred to as the Benchmark of Focus, is the focal point for student learning and instruction. The benchmark, and its related example(s) and clarification(s), can also be found in the course description. The 9-12 benchmarks may be included in multiple courses; select the example(s) or clarification(s) as appropriate for the identified course.</td>
<td>This section includes terms from Appendix C: K-12 Glossary, found within the B.E.S.T. Standards for Mathematics document, which are relevant to the identified Benchmark of Focus. The terms included in this section should not be viewed as a comprehensive vocabulary list, but instead should be considered during instruction or act as a reference for educators.</td>
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<td><strong>in other standards within the grade level or course</strong></td>
<td>This section includes a list of connecting benchmarks that relate horizontally to the Benchmark of Focus. Horizontal alignment is the intentional progression of content within a grade level or course linking skills within and across strands. Connecting benchmarks are benchmarks that either make a mathematical connection or include prerequisite skills. The information included in this section is not a comprehensive list, and educators are encouraged to find other connecting benchmarks. Additionally, this list will not include benchmarks from the same standard since benchmarks within the same standard already have an inherent connection.</td>
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</tbody>
</table>
Vertical Alignment

across grade levels or courses

This section includes a list of related benchmarks that connect vertically to the Benchmark of Focus. Vertical alignment is the intentional progression of content from one year to the next, spanning across multiple grade levels. Benchmarks listed in this section make mathematical connections from prior grade levels or courses in future grade levels or courses within and across strands. If the Benchmark of Focus is a new concept or skill, it may not have any previous benchmarks listed. Likewise, if the Benchmark of Focus is a mathematical skill or concept that is finalized in learning and does not have any direct connection to future grade levels or courses, it may not have any future benchmarks listed. The information included in this section is not a comprehensive list, and educators are encouraged to find other benchmarks within a vertical progression.

Purpose and Instructional Strategies

This section includes further narrative for instruction of the benchmark and vertical alignment. Additionally, this section may also include the following:

- explanations and details for the benchmark;
- vocabulary not provided within Appendix C;
- possible instructional strategies and teaching methods; and
- strategies to embed potentially related Mathematical Thinking and Reasoning Standards (MTRs).

Common Misconceptions or Errors

This section will include common student misconceptions or errors and may include strategies to address the identified misconception or error. Recognition of these misconceptions and errors enables educators to identify them in the classroom and make efforts to correct the misconception or error. This corrective effort in the classroom can also be a form of formative assessment within instruction.

Instructional Tasks

demonstrate the depth of the benchmark and the connection to the related benchmarks

This section will include example instructional tasks, which may be open-ended and are intended to demonstrate the depth of the benchmark. Some instructional tasks include integration of the Mathematical Thinking and Reasoning Standards (MTRs) and related benchmark(s). Enrichment tasks may be included to make connections to benchmarks in later grade levels or courses. Tasks may require extended time, additional materials and collaboration.

Instructional Items

demonstrate the focus of the benchmark

This section will include example instructional items which may be used as evidence to demonstrate the students’ understanding of the benchmark. Items may highlight one or more parts of the benchmark.

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.*
Mathematical Thinking and Reasoning Standards  
*MTRs: Because Math Matters*

Florida students are expected to engage with mathematics through the Mathematical Thinking and Reasoning Standards (MTRs) by utilizing their language as a self-monitoring tool in the classroom, promoting deeper learning and understanding of mathematics. The MTRs are standards which should be used as a lens when planning for student learning and instruction of the B.E.S.T. Standards for Mathematics.

**Structural Framework and Intentional Design of the Mathematical Thinking and Reasoning Standards**

The Mathematical Thinking and Reasoning Standards (MTRs) are built on the following.

- The MTRs have the same coding scheme as the standards and benchmarks; however, they are written at the standard level because there are no benchmarks.
- In order to fulfill Florida’s unique coding scheme, the 5th place (benchmark) will always be a “1” for the MTRs.
- The B.E.S.T. Standards for Mathematics should be taught through the lens of the MTRs.
- At least one of the MTRs should be authentically and appropriately embedded throughout every lesson based on the expectation of the benchmark(s).
- The bulleted language of the MTRs were written for students to use as self-monitoring tools during daily instruction.
- The clarifications of the MTRs were written for teachers to use as a guide to inform their instructional practices.
- The MTRs ensure that students stay engaged, persevere in tasks, share their thinking, balance conceptual understanding and procedures, assess their solutions, make connections to previous learning and extended knowledge, and apply mathematical concepts to real-world applications.
- The MTRs should not stand alone as a separate focus for instruction, but should be combined purposefully.
- The MTRs will be addressed at multiple points throughout the year, with the intention of gaining mastery of mathematical skills by the end of the year and building upon these skills as they continue in their K-12 education.
MA.K12.MTR.1.1 Actively participate in effortful learning both individually and collectively.

Mathematicians who participate in effortful learning both individually and with others:

- Analyze the problem in a way that makes sense given the task.
- Ask questions that will help with solving the task.
- Build perseverance by modifying methods as needed while solving a challenging task.
- Stay engaged and maintain a positive mindset when working to solve tasks.
- Help and support each other when attempting a new method or approach.

Clarifications:

Teachers who encourage students to participate actively in effortful learning both individually and with others:

- Cultivate a community of growth mindset learners.
- Foster perseverance in students by choosing tasks that are challenging.
- Develop students’ ability to analyze and problem solve.
- Recognize students’ effort when solving challenging problems.

MA.K12.MTR.2.1 Demonstrate understanding by representing problems in multiple ways.

Mathematicians who demonstrate understanding by representing problems in multiple ways:

- Build understanding through modeling and using manipulatives.
- Represent solutions to problems in multiple ways using objects, drawings, tables, graphs and equations.
- Progress from modeling problems with objects and drawings to using algorithms and equations.
- Express connections between concepts and representations.
- Choose a representation based on the given context or purpose.

Clarifications:

Teachers who encourage students to demonstrate understanding by representing problems in multiple ways:

- Help students make connections between concepts and representations.
- Provide opportunities for students to use manipulatives when investigating concepts.
- Guide students from concrete to pictorial to abstract representations as understanding progresses.
- Show students that various representations can have different purposes and can be useful in different situations.
MA.K12.MTR.3.1 Complete tasks with mathematical fluency.

Mathematicians who complete tasks with mathematical fluency:
- Select efficient and appropriate methods for solving problems within the given context.
- Maintain flexibility and accuracy while performing procedures and mental calculations.
- Complete tasks accurately and with confidence.
- Adapt procedures to apply them to a new context.
- Use feedback to improve efficiency when performing calculations.

Clarifications:
Teachers who encourage students to complete tasks with mathematical fluency:
- Provide students with the flexibility to solve problems by selecting a procedure that allows them to solve efficiently and accurately.
- Offer multiple opportunities for students to practice efficient and generalizable methods.
- Provide opportunities for students to reflect on the method they used and determine if a more efficient method could have been used.

MA.K12.MTR.4.1 Engage in discussions that reflect on the mathematical thinking of self and others.

Mathematicians who engage in discussions that reflect on the mathematical thinking of self and others:
- Communicate mathematical ideas, vocabulary and methods effectively.
- Analyze the mathematical thinking of others.
- Compare the efficiency of a method to those expressed by others.
- Recognize errors and suggest how to correctly solve the task.
- Justify results by explaining methods and processes.
- Construct possible arguments based on evidence.

Clarifications:
Teachers who encourage students to engage in discussions that reflect on the mathematical thinking of self and others:
- Establish a culture in which students ask questions of the teacher and their peers, and error is an opportunity for learning.
- Create opportunities for students to discuss their thinking with peers.
- Select, sequence and present student work to advance and deepen understanding of correct and increasingly efficient methods.
- Develop students’ ability to justify methods and compare their responses to the responses of their peers.
MA.K12.MTR.5.1 Use patterns and structure to help understand and connect mathematical concepts.

Mathematicians who use patterns and structure to help understand and connect mathematical concepts:

- Focus on relevant details within a problem.
- Create plans and procedures to logically order events, steps or ideas to solve problems.
- Decompose a complex problem into manageable parts.
- Relate previously learned concepts to new concepts.
- Look for similarities among problems.
- Connect solutions of problems to more complicated large-scale situations.

Clarifications:
Teachers who encourage students to use patterns and structure to help understand and connect mathematical concepts:

- Help students recognize the patterns in the world around them and connect these patterns to mathematical concepts.
- Support students to develop generalizations based on the similarities found among problems.
- Provide opportunities for students to create plans and procedures to solve problems.
- Develop students’ ability to construct relationships between their current understanding and more sophisticated ways of thinking.

MA.K12.MTR.6.1 Assess the reasonableness of solutions.

Mathematicians who assess the reasonableness of solutions:

- Estimate to discover possible solutions.
- Use benchmark quantities to determine if a solution makes sense.
- Check calculations when solving problems.
- Verify possible solutions by explaining the methods used.
- Evaluate results based on the given context.

Clarifications:
Teachers who encourage students to assess the reasonableness of solutions:

- Have students estimate or predict solutions prior to solving.
- Prompt students to continually ask, “Does this solution make sense? How do you know?”
- Reinforce that students check their work as they progress within and after a task.
- Strengthen students’ ability to verify solutions through justifications.
MA.K12.MTR.7.1 Apply mathematics to real-world contexts.

Mathematicians who apply mathematics to real-world contexts:
- Connect mathematical concepts to everyday experiences.
- Use models and methods to understand, represent and solve problems.
- Perform investigations to gather data or determine if a method is appropriate.
- Redesign models and methods to improve accuracy or efficiency.

Clarifications:
Teachers who encourage students to apply mathematics to real-world contexts:
- Provide opportunities for students to create models, both concrete and abstract, and perform investigations.
- Challenge students to question the accuracy of their models and methods.
- Support students as they validate conclusions by comparing them to the given situation.
- Indicate how various concepts can be applied to other disciplines.
Examples of Teacher and Student Moves for the MTRs

Below are examples that demonstrate the embedding of the MTRs within the mathematics classroom. The provided teacher and student moves are examples of how some MTRs could be incorporated into student learning and instruction. The information included in this table is not a comprehensive list, and educators are encouraged to incorporate other teacher and student moves that support the MTRs.

<table>
<thead>
<tr>
<th>MTR</th>
<th>Student Moves</th>
<th>Teacher Moves</th>
</tr>
</thead>
</table>
| MA.K12.MTR.1.1 Actively participate in effortful learning both individually and collectively. | • Student asks questions to self, others and teacher when necessary.  
  • Student stays engaged in the task and helps others during the completion of the task.  
  • Student analyzes the task in a way that makes sense to themselves.  
  • Student builds perseverance in self by staying engaged and modifying methods as they solve a problem. | • Teacher builds a classroom community by allowing students to build their own set of “norms.”  
  • Teacher creates a culture in which students are encouraged to ask questions, including questioning the accuracy within a real-world context.  
  • Teacher chooses differentiated, challenging tasks that fit the students’ needs to help build perseverance in students.  
  • Teacher builds community of learners by encouraging students and recognizing their effort in staying engaged in the task and celebrating errors as an opportunity for learning. |
| MA.K12.MTR.2.1 Demonstrate understanding by representing problems in multiple ways. | • Student chooses their preferred method of representation.  
  • Student represents a problem in more than one way and is able to make connections between the representations. | • Teacher plans ahead to allow students to choose their tools.  
  • While sharing student work, teacher purposefully shows various representations to make connections between different strategies or methods.  
  • Teacher helps make connections for students between different representations (i.e., table, equation or written description). |
<p>| MA.K12.MTR.3.1 Complete tasks with mathematical fluency. | • Student uses feedback from teacher and peers to improve efficiency. | • Teacher provides opportunity for students to reflect on the method they used, determining if there is a more efficient way depending on the context. |</p>
<table>
<thead>
<tr>
<th>MTR</th>
<th>Student Moves</th>
<th>Teacher Moves</th>
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</thead>
<tbody>
<tr>
<td>MA.K12.MTR.4.1 Engage in discussions that reflect on the mathematical thinking of self and others.</td>
<td>• Student effectively justifies their reasoning for their methods.</td>
<td>• Teacher purposefully groups students together to provide opportunities for discussion.</td>
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<td>• Student can identify errors within their own work and create possible explanations.</td>
<td>• Teacher chooses sequential representation of methods to help students explain their reasoning.</td>
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<td>• When working in small groups, student recognizes errors of their peers and offers suggestions.</td>
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<td>• Student communicates mathematical vocabulary efficiently to others.</td>
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<td>MA.K12.MTR.5.1 Use patterns and structure to help understand and connect mathematical concepts.</td>
<td>• Student determines what information is needed and logically follows a plan to solve problems piece by piece.</td>
<td>• Teacher allows for students to engage with information to connect current understanding to new methods.</td>
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<td>• Student is able to make connections from previous knowledge.</td>
<td>• Teacher provides opportunities for students to discuss and develop generalizations about a mathematical concept.</td>
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<td>• Teacher provides opportunities for students to develop their own steps in solving a problem.</td>
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<tr>
<td>MA.K12.MTR.6.1 Assess the reasonableness of solutions.</td>
<td>• Student provides explanation of results.</td>
<td>• Teacher encourages students to check and revise solutions and provide explanations for results.</td>
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<td></td>
<td>• Student continually checks their calculations.</td>
<td>• Teacher allows opportunities for students to verify their solutions by providing justifications to self and others.</td>
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<td>• Student estimates a solution before performing calculations.</td>
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<tr>
<td>MA.K12.MTR.7.1 Apply mathematics to real-world contexts.</td>
<td>• Student relates their real-world experience to the context provided by the teacher during instruction.</td>
<td>• Teacher provides real-world context in mathematical problems to support students in making connections using models and investigations.</td>
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<td>• Student performs investigations to determine if a scenario can represent a real-world context.</td>
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</table>
Grade 5 Areas of Emphasis

In grade 5, instructional time will emphasize five areas:

(1) multiplying and dividing multi-digit whole numbers, including using a standard algorithm;
(2) adding and subtracting fractions and decimals with procedural fluency, developing an understanding of multiplication and division of fractions and decimals;
(3) developing an understanding of the coordinate plane and plotting pairs of numbers in the first quadrant;
(4) extending geometric reasoning to include volume; and
(5) extending understanding of data to include the mean.

The purpose of the areas of emphasis is not to guide specific units of learning and instruction, but rather provide insight on major mathematical topics that will be covered within this mathematics course. In addition to its purpose, the areas of emphasis are built on the following.

- Supports the intentional horizontal progression within the strands and across the strands in this grade level or course.
- Student learning and instruction should not focus on the stated areas of emphasis as individual units.
- Areas of emphasis are addressed within standards and benchmarks throughout the course so that students are making connections throughout the school year.
- Some benchmarks can be organized within more than one area.
- Supports the communication of the major mathematical topics to all stakeholders.
- Benchmarks within the areas of emphasis should not be taught within the order in which they appear. To do so would strip the progression of mathematical ideas and miss the opportunity to enhance horizontal progressions within the grade level or course.

The table below shows how the benchmarks within this mathematics course are embedded within the areas of emphasis.

<table>
<thead>
<tr>
<th>Number Sense and Operations</th>
<th>Multiplying and dividing multi-digit whole numbers</th>
<th>Adding and subtracting fractions and decimals, multiplication and division of fractions and decimals</th>
<th>Developing understanding of the coordinate plane</th>
<th>Extending geometric reasoning to include volume</th>
<th>Extending understanding of data to include mean</th>
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<tbody>
<tr>
<td>MA.5.NSO.1.1</td>
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<td>MA.5.NSO.1.2</td>
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<td>MA.5.NSO.1.3</td>
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<td>MA.5.NSO.1.4</td>
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<td>MA.5.NOS.1.5</td>
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<td>Multiplying and dividing multi-digit whole numbers</td>
<td>Adding and subtracting fractions and decimals, multiplication and division of fractions and decimals</td>
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<td>Fractions</td>
<td>MA.5.NSO.2.4 X</td>
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<td>MA.5.NSO.2.5 X</td>
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<td>MA.5.FR.1.1 X</td>
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<td>MA.5.FR.2.3 X</td>
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<td>MA.5.FR.2.4 X</td>
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<td>Algebraic Reasoning</td>
<td>MA.5.AR.1.1 X</td>
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<td>Measurement</td>
<td>MA.5.M.1.1 X</td>
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<td>Geometric Reasoning</td>
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<td>Data Analysis &amp; Probability</td>
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<td>MA.5.DP.1.2 X</td>
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</table>
MA.5.NSO.1 Understand the place value of multi-digit numbers with decimals to the thousandths place.

MA.5.NSO.1.1

Benchmark

Express how the value of a digit in a multi-digit number with decimals to the thousandths changes if the digit moves one or more places to the left or right.

Related Benchmarks/Horizontal Alignment

- MA.5.NSO2.4/2.5
- MA.5.AR.2.1/2.2/2.3
- MA.5.M.1.1
- MA.5.M.2.1

Terms from the K-12 Glossary

Vertical Alignment

Previous Benchmarks
- MA.4.NSO.1.1

Next Benchmarks
- MA.6.NSO.2.1

Purpose and Instructional Strategies

This purpose of this benchmark is for students to reason about the magnitude of digits in a number. This benchmark extends the understanding from Grade 4 (MA.4.NSO.1.1), where students expressed their understanding that in multi-digit whole numbers, a digit in one place represents 10 times what it represents in the place to its right and \( \frac{1}{10} \) of what it represents in the place to its left. All of this work forms the foundation for arithmetic and algorithms with decimals which is completed in Grade 6 (MA.6.NSO.2.1).

- To help students understand the meaning of the 10 times and \( \frac{1}{10} \) of relationship, students can use base ten manipulatives or simply bundle classroom objects (e.g., paper clips, pretzel sticks). Students should name numbers and use verbal descriptions to explain the relationship between numbers (e.g., “6 is 10 times greater than 6 tenths, and 6 tenths is \( \frac{1}{10} \) of 6”). In addition to physical manipulatives, place value charts help students understand the relationship between digits in different places. (MTR.2.1)

- Instruction of this benchmark should connect with student work with whole numbers. For example, students who understand \( 35 \times 2 = 70 \) can reason that \( 3.5 \times 2 = 7 \) because 3.5 is \( \frac{1}{10} \) of 35, therefore its product with 2 will be \( \frac{1}{10} \) of 70. (MTR.5.1)
Common Misconceptions or Errors

- Students can misunderstand what “\( \frac{1}{10} \) of” a number represents. Teachers can connect \( \frac{1}{10} \) of to “ten times less” or “dividing by 10” to help students connect \( \frac{1}{10} \) of a number to 10 times greater.
- Students who use either rule “move the decimal point” or “shift the digits” without understanding when multiplying by a power of ten can easily make errors. Students need to understand that from either point of view, the position of the decimal point marks the transition between the ones and the tenths place.

Instructional Tasks

Instructional Task 1

At the Sunshine Candy Store, salt water taffy costs $0.18 per piece.

Part A. How much would 10 pieces of candy cost?
Part B. How much would 100 pieces of candy cost?
Part C. How much would 1000 pieces of candy cost?
Part D. At the same store, you can buy 100 chocolate coins for $89.00. How much does each chocolate coin cost? Explain how you know.

Instructional Items

Instructional Item 1

Which statement correctly compares 0.034 and 34?

a. 0.034 is 10 times the value of 34.
b. 0.034 is \( \frac{1}{10} \) the value of 34.
c. 0.034 is \( \frac{1}{100} \) the value of 34.
d. 0.034 is \( \frac{1}{1000} \) the value of 34.

Instructional Item 2

What number is 100 times the value of 45.03?

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.

MA.5.NSO.1.2

Benchmark

MA.5.NSO.1.2 Read and write multi-digit numbers with decimals to the thousandths using standard form, word form and expanded form.

Example: The number sixty-seven and three hundredths written in standard form is 67.03 and in expanded form is \( 60 + 7 + 0.03 \) or \( (6 \times 10) + (7 \times 1) + \left( 3 \times \frac{1}{100} \right) \).
Related Benchmarks/Horizontal Alignment

- MA.5.NSO.2.4/2.5
- MA.5.AR.2.1/2.2/2.3
- MA.5.M.2.1

Terms from the K-12 Glossary

Vertical Alignment

<table>
<thead>
<tr>
<th>Previous Benchmarks</th>
<th>Next Benchmarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA.4.NSO.1.2</td>
<td>MA.6.AR.1.1</td>
</tr>
</tbody>
</table>

Purpose and Instructional Strategies

The purpose of this benchmark is for students to read numbers appropriately and to write numbers in all forms. Utilizing place value, students are expected to understand the value of tenths, hundredths, and thousandths, extending from their work to read and write whole numbers in any form in Grade 4 (MA.4.NSO.1.2). Writing numbers in expanded form can help students see the relationship between decimals and fractions. (MTR.5.1). Translating from written form to symbolic form builds the foundation for moving from written to algebraic form in Grade 6 (MA.6.AR.1.1).

- Representing numbers in flexible ways will help students name, order, compare and operate with decimals. (MTR.3.1)
- During instruction, teachers should relate all three forms using place value charts and base ten manipulatives (e.g., blocks). (MTR.3.1, MTR.4.1, MTR.5.1)

Common Misconceptions or Errors

- Students may incorrectly read and write from expanded form if one of the digits is 0, like in the number 67.03 as used in the benchmark example. A common mistake that students make is to name the number as 67.3 because they do not see that 3 is the value of hundredths.

Instructional Tasks

Instructional Task 1

Use the number cards below to write a number in standard, word and expanded forms. You can use the cards in any order to make your number, but it must have a digit other than zero in the thousandths place.

```
8 0 3 .
6 5
```
Instructional Items

Instructional Item 1
Which shows the number below in word form?

\[(7 \times 100) + (2 \times 1) + \left(5 \times \frac{1}{10}\right) + \left(9 \times \frac{1}{1000}\right)\]

a. Seventy – two and fifty – nine thousandths
b. Seven hundred two and fifty – nine hundredths
c. Seven hundred two and five hundred nine thousandths
d. Seventy – two and five hundred nine thousandths

Instructional Item 2
Write eight thousand and 2 hundredths in standard form.

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.

MA.5.NSO.1.3

Benchmarks

MA.5.NSO.1.3 Compose and decompose multi-digit numbers with decimals to the thousandths in multiple ways using the values of the digits in each place. Demonstrate the compositions or decompositions using objects, drawings and expressions or equations.

Example: The number 20.107 can be expressed as 2 tens + 1 tenth + 7 thousandths or as 20 ones + 107 thousandths.

Related Benchmarks/Horizontal Alignment
- MA.5.NSO.2.4/2.5
- MA.5.AR.2.1/2.2/2.3
- MA.5.M.2.1

Terms from the K-12 Glossary

Vertical Alignment

Previous Benchmarks
- MA.4.FR.2.1

Next Benchmarks
- MA.6.NSO.3.2
**Purpose and Instructional Strategies**

The purpose of this benchmark is for students to use place value relationships to compose and decompose multi-digit numbers with decimals. While students have composed and decomposed whole numbers in Grade 3 (MA.3.NSO.1.2) and fractions in Grade 4 (MA.4.FR.2.1), naming multi-digit decimals in flexible ways in Grade 5 helps students with decimal comparisons and operations (addition, subtraction, multiplication and division). Flexible representations of multi-digit numbers with decimals also reinforces the understanding of how the value of digits change if they move one or more places left or right (MA.5.NSO.1.1). Composing and decomposing numbers also helps build the foundation for further work with the distributive property in Grade 6 (MA.6.NSO.3.2).

- **Instruction** may include multiple representations using base ten models (MTR.2.1).

  During instruction, teachers should emphasize that the value of a base ten block (or another concrete model) is flexible (e.g., one flat could be 1 ten, one, tenth, hundredth, and so forth). Using base ten models flexibly helps students think about how numbers can be composed and decomposed in different ways. For example, the image below shows 2.1. This representation shows that 2.1 can also be composed as 21 tenths or 210 hundredths. Thinking about 2.1 as 210 hundredths may help subtracting 2.1 – 0.04 easier for students because they can think about the expression as 210 hundredths minus 4 hundredths, or 206 hundredths.

  ![Base Ten Blocks](image)

- Representing multi-digit numbers with decimals flexibly can help students reason through multiplication and division as well. For example, students may prefer to multiply 1.2 x 4 as 12 tenths x 4 to use more familiar numbers. (MTR.2.1, MTR.5.1)

- Students should name their representations in different forms (e.g., word, expanded) during classroom discussion. While students are representing multi-digit numbers with decimals in different ways, teachers should invite all answers and have students compare them. (MTR.4.1)

**Common Misconceptions or Errors**

- Students may assume that the value of base ten blocks are fixed based on their previous experiences with whole numbers (e.g., units are ones, rods are tens, flats are hundreds). During instruction, teachers should name a base ten block for each example so students can relate the other blocks. (For example, “Show 2.4. Allow 1 rod to represent 1 tenth.”)

**Instructional Tasks**

*Instructional Task 1*

Using base ten blocks, show 1.36 in two different ways. Allow one flat to represent 1 whole.

*Instructional Task 2*

How many tenths are equivalent to 13.2? How do you know?
**Instructional Items**

**Instructional Item 1**
Select all the ways to name 14.09.

- a. 1,409 hundredths
- b. 1 ten + 409 hundredths
- c. 1 ten + 4 ones + 9 tenths
- d. 14 tenths + 9 hundredths
- e. 1,409 tenths

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*

**MA.5.NSO.1.4**

**Benchmark**

**MA.5.NSO.1.4** Plot, order and compare multi-digit numbers with decimals up to the thousandths.

*Example:* The numbers 4.891, 4.918 and 4.198 can be arranged in ascending order as 4.198, 4.891 and 4.918.

*Example:* 0.15 < 0.2 because fifteen hundredths is less than twenty hundredths, which is the same as two tenths.

Benchmark Clarifications:
*Clarification 1:* When comparing numbers, instruction includes using an appropriately scaled number line and using place values of digits.
*Clarification 2:* Scaled number lines must be provided and can be a representation of any range of numbers.
*Clarification 3:* Within this benchmark, the expectation is to use symbols (<, > or =).

**Related Benchmarks/Horizontal Alignment**

- MA.5.NSO2.4/2.5
- MA.5.AR.2.1/2.2/2.3

**Terms from the K-12 Glossary**

***Previous Benchmarks***
- MA.4.NSO.1.3
- MA.4.NSO.1.5

***Next Benchmarks***
- MA.6.NSO.1.1
Purpose and Instructional Strategies
The purpose of this benchmark is for students to use place value understanding to plot, order and compare multi-digit numbers with decimals to the thousandths. In Grade 4 (MA.4.NSO.1.5), decimals were plotted to the hundredths, and in Grade 6 (MA.6.NSO.1.1) rational numbers, including negative numbers, will be plotted.

- During instruction, students should apply understanding of flexible representations from MA.5.NSO.1.3 to help them reason while plotting, ordering and comparing.
- During instruction, teachers should show students how to represent these decimals on scaled number lines. Students should use place value understanding to make comparisons.
- Instruction should expect students to justify their arguments when plotting, comparing and ordering.

Common Misconceptions or Errors
- Students may be confused when comparing numbers that have the same digits (but different values). For example, when comparing 2.459 and 13.24, a student may not consider the magnitude of the numbers and only look at their digits. That student may claim that 2.459 is greater than 13.24 because the digit 2 is greater than the digit 1 (though they are actually comparing 2 and 10).

Instructional Tasks

Instructional Task 1
Part A. Plot the numbers 1.519, 1.9, 1.409 and 1.59 on the number line below.
Part B. Choose two values from the list and compare them using >, < or =.
Part C. Choose a number between 1.519 and 1.59 and plot it on the number line.
Part D. Use evidence from your number line to justify which number is greatest.

Instructional Items

Instructional Item 1
Select all the statements that are true.
   a. 13.049 < 13.49
   b. 13.049 < 13.05
   c. 2.999 > 28.99
   d. 1.28 < 1.31
   e. 5.800 = 5.8

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.
**MA.5.NSO.1.5**

**Benchmark**

**MA.5.NSO.1.5** Round multi-digit numbers with decimals to the thousandths to the nearest hundredth, tenth or whole number.

*Example:* The number 18.507 rounded to the nearest tenth is 18.5 and to the nearest hundredth is 18.51.

**Related Benchmarks/Horizontal Alignment**

- MA.5.NSO.2.3/2.4
- MA.5.AR.2.1/2.2/2.3

**Terms from the K-12 Glossary**

**Vertical Alignment**

**Previous Benchmarks**
- MA.4.NSO.1.4

**Next Benchmarks**
- MA.6.NSO.2.3
- MA.8.NSO.1.4

**Purpose and Instructional Strategies**

The purpose of this benchmark is for students to think about the magnitude of multi-digit numbers with decimals to round them to the nearest hundredth, tenth or whole number. In Grade 5, the expectations for rounding are to the nearest hundredth and to digits other than the leading digit, e.g., round 29.834 to the nearest hundredth. Students have experience rounding whole numbers to any place in Grade 4 (MA.4.NSO.1.4). Rounding skills continue to be important in later grades as students solve real-world problems with fractions and decimals (MA.6.NSO.2.3) and work with scientific notation (MA.8.NSO.1.4).

- Instruction should develop some efficient rules for rounding fluently by building from the basic strategy of - “Is 29.834 closer to 20 or 30?” Number lines are effective tools for this type of thinking and help students relate the placement of numbers to benchmarks for rounding. (MTR.3.1, MTR.5.1)
- The expectation is that students have a deep understanding of place value and number sense in order to develop and use an algorithm or procedure for rounding. Additionally, students should explain and reason about their answers when they round and have numerous experiences using a number line and a hundred chart as tools to support their work with rounding.

**Common Misconceptions or Errors**

- Students may confuse benchmarks by which numbers can round. For example, when rounding 29.834 to the nearest tenth, they may confuse that the benchmarks are 29.8 and 29.9. The reliance on mnemonics, songs or rhymes during instruction can often confuse students further because it may replace their motivation to think about the benchmark numbers.
**Instructional Tasks**

**Instructional Task 1**
Round 29.834 to the nearest whole number. Identify between which two whole numbers 29.834 lies on a number line.

**Instructional Task 2**
Round 29.834 to the nearest tenth. Identify between which two tenths 29.834 lies on a number line.

**Instructional Task 3**
Round 29.834 to the nearest hundredth. Identify between which two hundredths 29.834 lies on a number line.

**Instructional Items**

**Instructional Item 1**
Which of the following are true about the number 104.029?
- a. 104.029 rounded to the nearest whole number is 4.
- b. 104.029 rounded to the nearest whole number is 104.
- c. 104.029 rounded to the nearest tenth is 104.2.
- d. 104.029 rounded to the nearest hundredth is 104.02.
- e. 104.029 rounded to the nearest hundredth is 104.03.

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.

**MA.5.NSO.2 Add, subtract, multiply and divide multi-digit numbers.**

**MA.5.NSO.2.1**

**Benchmark**

**MA.5.NSO.2.1** Multiply multi-digit whole numbers including using a standard algorithm with procedural fluency.

**Related Benchmarks/Horizontal Alignment**
- MA.5.FR.2.2
- MA.5.AR.1.1
- MA.5.M.1.1
- MA.5.GR.3.1/3.2/3.3

**Terms from the K-12 Glossary**
- Equation
- Expression
- Whole Number

**Vertical Alignment**

**Previous Benchmarks**
- MA.4.NSO.2.1/2.2

**Next Benchmarks**
- MA.6.NSO.2.1
Purpose and Instructional Strategies

The purpose of this benchmark is for students to demonstrate procedural fluency while multiplying multi-digit whole numbers. To demonstrate procedural fluency, students may choose the standard algorithm that works best for them and demonstrates their procedural fluency. A standard algorithm is a method that is efficient and accurate (MTR.3.1). In Grade 4, students had experience multiplying two-digit by three-digit numbers using a method of their choice with procedural reliability (MA.4.NSO.2.2) and multiplying two-digit by two-digit numbers using a standard algorithm (MA.4.NSO.2.3). In Grade 6, students will multiply and divide multi-digit numbers including decimals with fluency (MA.6.NSO.2.1).

- There is no limit on the number of digits for multiplication in Grade 5.
- When students use a standard algorithm, they should be able to justify why it works conceptually. Teachers can expect students to demonstrate how their algorithm works, for example, by comparing it to another method for multiplication. (MTR.6.1)
- Along with using a standard algorithm, students should estimate reasonable solutions before solving. Estimation helps students anticipate possible answers and evaluate whether their solutions make sense after solving.
- This benchmark supports students as they solve multi-step real-world problems involving combinations of operations with whole numbers (MA.5.AR.1.1).

Common Misconceptions or Errors

- Students can make computational errors while using standard algorithms when they cannot reason why their algorithms work. In addition, they can struggle to determine where or why that computational mistake occurred because they did not estimate reasonable values for intermediate outcomes as well as for the final outcome. During instruction, teachers should expect students to justify their work while using their chosen algorithms and engage in error analysis activities to connect their understanding to the algorithm.

Instructional Tasks

Instructional Task 1

Maggie has three dogs. She buys a box containing 175 bags of dog food. Each bag weighs 64 ounces.

Part A. What is the total weight of the bags of dog food in ounces?

Part B. Maggie has a storage cart to transport the box that holds up to 750 pounds. Will the storage cart be able to hold the box? Explain.

Instructional Items

Instructional Item 1

What is the product of 1,834 × 23?

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*
MA.5.NSO.2.2

**Benchmark**

**MA.5.NSO.2.1** Divide multi-digit whole numbers, up to five digits by two digits, including using a standard algorithm with procedural fluency. Represent remainders as fractions.

*Example:* The quotient $27 \div 7$ gives 3 with remainder 6 which can be expressed as $3 \frac{6}{7}$.

**Benchmark Clarifications:**
*Clarification 1:* Within this benchmark, the expectation is not to use simplest form for fractions.

**Related Benchmarks/Horizontal Alignment**
- MA.5.FR.2.4
- MA.5.AR.1.1/1.3
- MA.5.M.1.1
- MA.5.GR.3.3

**Terms from the K-12 Glossary**
- Equation
- Expression
- Whole Number

**Vertical Alignment**

**Previous Benchmarks**
- MA.4.NSO.2.4

**Next Benchmarks**
- MA.6.NSO.2.1
Purpose and Instructional Strategies

The purpose of this benchmark is for students to demonstrate procedural fluency while dividing multi-digit whole numbers with up to 5-digit dividends and 2-digit divisors. To demonstrate procedural fluency, students may choose the standard algorithm that works best for them and demonstrates their procedural fluency. A standard algorithm is a method that is efficient and accurate (MTR.3.1). In Grade 4, students had experience dividing four-digit by one-digit numbers using a method of their choice with procedural reliability (MA.4.NSO.2.4). In Grade 6, students will multiply and divide multi-digit numbers including decimals with fluency (MA.6.NSO.2.1).

- When students use a standard algorithm, they should be able to justify why it works conceptually. Teachers can expect students to demonstrate how their algorithm works, for example, by comparing it to another method for division. (MTR.6.1)
- In this benchmark, students are to represent remainders as fractions. In the benchmark example, the quotient of $27 \div 7$ is represented as $3\frac{6}{7}$. Students should gain understanding that this quotient means that there are 3 full groups of 7 in 27, and the remainder of 6 represents $\frac{6}{7}$ of another group. Students are not expected to have mastery of converting between forms (fraction, decimal, percentage) until grade 6 but students should start to gain familiarity that fractions and decimals are numbers and can be equivalent (i.e., a remainder of $\frac{1}{2}$ is the same as 0.5). Writing remainders as fractions or decimals is acceptable. Similarly, students should be able to understand that a remainder of zero means that whole groups have been filled without any of the dividend remaining. (MTR.5.1, MTR.7.1)
- Along with using a standard algorithm, students should estimate reasonable solutions before solving. Estimation helps students anticipate possible answers and evaluate whether their solutions make sense after solving.
- This benchmark supports students as they solve multi-step real-world problems involving combinations of operations with whole numbers (MA.5.AR.1.1). In a real-world problem, students should interpret remainders depending on its context.

Common Misconceptions or Errors

- Students can make computational errors while using standard algorithms when they cannot reason why their algorithms work. In addition, they can struggle to determine where or why that computational mistake occurred because they did not estimate reasonable values for intermediate outcomes as well as for the final outcome. During instruction, teachers should expect students to justify their work while using their chosen algorithms and engage in error analysis activities to connect their understanding to the algorithm.
Instructional Tasks

Instructional Task 1
The Magnolia Outreach organization is donating 6,924 pounds of rice to families in need. They pour all the rice into 15-pound containers.

Part A. How many containers will they fill if they use all the rice?
Part B. Will Magnolia Outreach be able to fill all the containers completely? If not, will the partially filled container be more or less than half-full? Explain how you know.

Instructional Items

Instructional Item 1
What is the quotient of 498 ÷ 72?

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.

MA.5.NSO.2.3

Benchmark

MA.5.NSO.2.3 Add and subtract multi-digit numbers with decimals to the thousandths, including using a standard algorithm with procedural fluency.

Related Benchmarks/Horizontal Alignment
- MA.5.NSO.1.5
- MA.5.AR.2.1/2.2/2.3
- MA.5.M.2.1
- MA.5.GR.2.1

Terms from the K-12 Glossary
- Equation
- Expression

Vertical Alignment

Previous Benchmarks
- MA.4.NSO.2.6/2.7

Next Benchmarks
- MA.6.NSO.2.3

Purpose and Instructional Strategies

The purpose of this benchmark is for students to add and subtract multi-digit numbers with decimals to the thousandths with procedural fluency. In Grade 4 (MA.4.NSO.2.7), students explored the addition and subtraction of multi-digit numbers with decimals to hundredths using money and manipulatives. In Grade 6, students add and subtract positive fractions with procedural fluency.

- To demonstrate procedural fluency, students may choose the standard algorithm that works best for them and demonstrates their procedural fluency. A standard algorithm is a method that is efficient and accurate. (MTR.3.1)
- When students use a standard algorithm, they should be able to justify why it works conceptually. Teachers can expect students to demonstrate how their algorithm works, for example, by comparing it to another method for addition and subtraction. (MTR.6.1)
- Along with using a standard algorithm, students should estimate reasonable solutions before solving. Estimation helps students anticipate possible answers and evaluate whether their solutions make sense after solving.
Common Misconceptions or Errors

- Students can make computational errors while using standard algorithms when they cannot reason why their algorithms work. In addition, they can struggle to determine where or why that computational mistake occurred because they did not estimate reasonable values for intermediate outcomes as well as for the final outcome. During instruction, teachers should expect students to justify their work while using their chosen algorithms and engage in error analysis activities to connect their understanding to the algorithm.

Instructional Tasks

Instructional Task 1
Use a standard algorithm to find the difference of eight hundred two and forty-six thousandths and three hundred and nine tenths. Explain how you use your algorithm to subtract.

Instructional Items

Instructional Item 1
Find the sum and difference of 8.72 and 3.032.

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.

MA.5.NSO.2.4

Benchmark

MA.5.NSO.2.4 Explore the multiplication and division of multi-digit numbers with decimals to the hundredths using estimation, rounding and place value.

Example: The quotient of 23 and 0.42 can be estimated as a little bigger than 46 because 0.42 is less than one-half and 23 times 2 is 46.

Benchmark Clarifications:
Clarification 1: Estimating quotients builds the foundation for division using a standard algorithm.
Clarification 2: Instruction includes the use of models based on place value and the properties of operations.

Related Benchmarks/Horizontal Alignment

- MA.5.NSO.1.1/1.2/1.3/1.4/1.5
- MA.5.FR.2.3
- MA.5.AR.2.2/2.3
- MA.5.M.1.1
- MA.5.M.2.1
- MA.5.GR.2.1

Terms from the K-12 Glossary

- Equation
- Expression

Vertical Alignment

Previous Benchmarks
- MA.4.NSO.2.7

Next Benchmarks
- MA.6.NSO.2.1
Purpose and Instructional Strategies

The purpose of this benchmark is for students to explore multiplication division of multi-digit numbers with decimals using estimation, rounding, place value, and exploring the relationship between multiplication and division. This benchmark connects to the work students did in Grade 4 with addition and subtraction of decimals (MA.4.NSO.2.7). Students achieve procedural fluency with multiplying and dividing multi-digit numbers with decimals in Grade 6 (MA.6.NSO.2.1)

- Instruction of this benchmark will focus on number sense to help students develop procedural reliability while multiplying and dividing multi-digit numbers with decimals.
- During instruction, students should explore how the products and quotients of whole numbers relate to decimals. For example, if students know the product of 8 x 7 and the quotient of 56 ÷ 4, then they can reason through 0.08 x 7 or 5.6 ÷ 0.4 through place value relationships. Classroom discussions should allow for students to explore these patterns and use them to estimate products and quotients.
- Teachers should connect what students know about place value and fractions. For example, because students know that multiplying a number by one-fourth will result in a product that is smaller, multiplying a number by 0.25 (its decimal equivalence) will also result in a smaller product. In division, dividing a number by one-fourth and 0.25 will result in a larger quotient. Continued work in this benchmark will help students to generalize patterns in multiplication and division of whole numbers and fractions (K12.MTR.5.1).
- Models that help students explore the multiplication and division of multi-digit numbers with decimals include base ten representations (e.g., blocks) and place value mats.

Common Misconceptions or Errors

- Students may not understand the reasoning behind the placement of the decimal point in the product. Modeling and exploring the relationships between place value will help students gain understanding.
- Students can confuse that multiplication always results in a larger product, and that division always results in a smaller quotient. Through classroom discussion, estimation and modeling, classroom work should address this misconception.

Instructional Tasks

Instructional Task 1

What is the same about the products of these expressions? What is different? Explain.

\[14 \times 5\]  \[0.14 \times 0.05\]

Instructional Task 2

What is the same about the quotients of these expressions? What is different? Explain.

\[50 \div 25\]  \[50 \div 0.25\]

Instructional Task 3

How can you use \(2 \times 12 = 24\) to help you find the product of \(2 \times 1.2\)? Explain.
**Instructional Items**

*Instructional Item 1*

Raul reasons that the product of $82 \times 0.56$ will be greater than 41 and less than 82. Explain whether or not his conclusion is reasonable.

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.*

**MA.5.NSO.2.5**

**Benchmark**

**MA.5.NSO.2.5** Multiply and divide a multi-digit number with decimals to the tenths by one-tenth and one-hundredth with procedural reliability.

*Example:* The number 12.3 divided by 0.01 can be thought of as $? \times 0.01 = 12.3$ to determine the quotient is 1,230.

**Benchmark Clarifications:**
*Clarification 1:* Instruction focuses on the place value of the digit when multiplying or dividing.

**Related Benchmarks/Horizontal Alignment**

- MA.5.NSO.1.1/1.2/1.3/1.4
- MA.5.FR.2.3
- MA.5.AR.2.2/2.3
- MA.5.M.1.1
- MA.5.M.2.1
- MA.5.GR.2.1

**Terms from the K-12 Glossary**

- Equation
- Expression

**Vertical Alignment**

**Previous Benchmarks**

- MA.4.NSO.2.6

**Next Benchmarks**

- MA.6.NSO.2.1
Purpose and Instructional Strategies

The purpose of this benchmark is for students to multiply multi-digit numbers with decimals to the tenths by .1 and by .01 with procedural reliability. Procedural reliability refers to the ability for students to develop an accurate, reliable method that aligns with a student’s understanding and learning style. Fluency of multiplying and dividing multi-digit whole numbers with decimals is not expected until Grade 6 (MA.6.NSO.2.1).

- When multiplying and dividing, students should continue to use the number sense strategies built in MA.5.NSO.2.4 (estimation, rounding, exploring place value relationships). Using these strategies will help students predict reasonable solutions and determine whether their solutions make sense after solving.

- During instruction, students should see the relationship between multiplying and dividing multi-digit numbers with decimals to multiplying and dividing by whole numbers. Students extend their understanding to generalize patterns that exist when multiplying or dividing by 10 or 100 (MTR.5.1).

- Instruction may include the language that the “digits shift” relative to the position of the decimal point as long as there is an accompanying explanation. An instructional strategy that helps students see this is by putting digits on sticky notes or cards and showing how the values shift (or the decimal point moves) when multiplying by a power of ten. For example, a teacher could show one card with a 3 and another with a 5, and place them on the left and right of a decimal point on a blank place value chart. The teacher could then ask students to multiply by ten and shift both digits one place left to show the equation $3.5 \times 10 = 35$. They could ask students to multiply by $\frac{1}{10}$ and show that $3.5 \times \frac{1}{10} = 0.35$. Instruction may also include using the language “moving the decimal point” as long as there is an explanation about what happens to a number when multiplying and dividing by 0.1 and 0.01. Moving the decimal point does not change its meaning; it always indicates the transition from the ones to the tenths place. From either point of view, when the change is made it is important to emphasize the digits have new place values. (MTR.2.1, MTR.4.1,MTR.5.1)

![Diagram of place value chart]

Common Misconceptions or Errors

- Students can confuse that multiplication always results in a larger product, and that division always results in a smaller quotient. Through classroom discussion, estimation and modeling, classroom work should address this misconception.
## Instructional Tasks

### Instructional Task 1

Part A. What is $\frac{1}{10}$ times 15?
Part B. How many dimes are in $1.50$?
Part C. Write an expression to represent how many dimes are in $1.50$.

## Instructional Items

### Instructional Item 1

Which compares the products of $7.8 \times 0.1$ and $7.8 \times 10$ correctly?

- a. The product of $7.8 \times 0.1$ is 100 times less than the product of $7.8 \times 10$.
- b. The product of $7.8 \times 0.1$ is 10 times less than the product of $7.8 \times 10$.
- c. The product of $7.8 \times 0.1$ is 100 times more than the product of $7.8 \times 10$.
- d. The product of $7.8 \times 0.1$ is 10 times more than the product of $7.8 \times 10$.

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.*
Fractions

**MA.5.FR.1** Interpret a fraction as an answer to a division problem.

**MA.5.FR.1.1**

**Benchmark**

**MA.5.FR.1.1** Given a mathematical or real-world problem, represent the division of two whole numbers as a fraction.

*Example:* At Shawn’s birthday party, a two-gallon container of lemonade is shared equally among 20 friends. Each friend will have \( \frac{2}{20} \) of a gallon of lemonade which is equivalent to one-tenth of a gallon which is a little more than 12 ounces.

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes making a connection between fractions and division by understanding that fractions can also represent division of a numerator by a denominator.

*Clarification 2:* Within this benchmark, the expectation is not to simplify or use lowest terms.

*Clarification 3:* Fractions can include fractions greater than one.

**Related Benchmarks/Horizontal Alignment**

- MA.5.NSO.2.2
- MA.5.AR.1.1
- MA.5.GR.3.3
- MA.5.DP.1.2

**Terms from the K-12 Glossary**

**Vertical Alignment**

**Previous Benchmarks**

- MA.4.NSO.2.4

**Next Benchmarks**

- MA.6.NSO.2.2
Purpose and Instructional Strategies

The purpose of this benchmark is for students to understand that a division expression can be written as a fraction by explaining their thinking when working with fractions in various contexts. This builds on the understanding developed in Grade 4 that remainders are fractions (MA.4.NSO.2.4), and prepares students for the division of fractions in Grade 6 (MA.6.NSO.2.2).

- When students read \( \frac{5}{8} \) as “five-eighths,” they should be taught that \( \frac{5}{8} \) can also be interpreted as “5 divided by 8,” where 5 represents the numerator and 8 represents the denominator of the fraction \( \frac{5}{8} = 5 \div 8 \) and refers to 5 wholes divided into 8 equal parts.
- Teachers can activate students’ prior knowledge of fractions as division by using fractions that represent whole numbers (e.g., \( \frac{24}{6} \)). Familiar division expressions help build students’ understanding of the relationship between fractions and division (MTR.5.1).
- During instruction, provide examples accompanied by area and number line models.
- During instruction for solving mathematical or real-world problems involving division of whole numbers and interpreting the quotient in the context of the problem, students will be able to represent the division of two whole numbers as a mixed number, where the remainder is the fractional part’s numerator and the size of a group is its denominator (for example, \( 17 \div 3 = 5 \frac{2}{3} \) which is the number of size 3 groups you can make from 17 objects including the fractional group). Students should demonstrate their understanding by explaining or illustrating solutions using visual fraction models or equations.

Common Misconceptions or Errors

- Students can believe that the fraction bar represents subtraction in lieu of understanding that the fraction bar represents division.
- Students can have the misconception that division always result in a smaller number.
- Students can presume that dividends must always be greater than divisors and, thus, reorder when representing a division expression as a fraction. Show students examples of fractions with greater numerators and greater denominators to create a division equation.

Instructional Tasks

**Instructional Task 1**
Create a real-world division problem that results in an answer equivalent to \( \frac{3}{10} \).

**Instructional Task 2**
Write a mixed number that is equivalent to \( 10 \div 3 \).

**Instructional Task 3**
Monica has a ribbon that is 8 feet long. She wants to make 12 bows for her friends. How long will each piece of the ribbon be? Express your answer in both feet and inches.

**Instructional Task 4**
Albert baked 18 fudge brownies for his video game club members. He wants to share the brownies with the 5 club members. How many brownies will each club member get?
### Instructional Items

**Instructional Item 1**
Which expression is equivalent to $\frac{7}{12}$?
- a. $7 - 12$
- b. $7 ÷ 12$
- c. $12 - 7$
- d. $12 ÷ 7$

**Instructional Item 2**
Amanda has 12 pepperoni slices that need to be distributed equally among 5 mini pizzas. How many pepperoni slices will go on each mini pizza?
- a. $\frac{5}{12}$
- b. $2\frac{2}{5}$
- c. 7
- d. 60

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.

### MA.5.FR.2 Perform operations with fractions.

**MA.5.FR.2.1**

### Benchmark

**MA.5.FR.2.1** Add and subtract fractions with unlike denominators, including mixed numbers and fractions greater than 1, with procedural reliability.

*Example:* The sum of $\frac{1}{12}$ and $\frac{1}{24}$ can be determined as $\frac{1}{8}$, $\frac{3}{24}$, $\frac{6}{48}$ or $\frac{36}{288}$ by using different common denominators or equivalent fractions.

**Benchmark Clarifications:**
*Clarification 1:* Instruction includes the use of estimation, manipulatives, drawings or the properties of operations.
*Clarification 2:* Instruction builds on the understanding from previous grades of factors up to 12 and their multiples.

### Related Benchmarks/Horizontal Alignment
- MA.5.NSO.2.3
- MA.5.AR.1.2
- MA.5.GR.2.1

### Terms from the K-12 Glossary

### Vertical Alignment

**Previous Benchmarks**
- MA.4.FR.1.3
- MA.4.FR.2.1/2.2

**Next Benchmarks**
- MA.6.NSO.2.3
Purpose and Instructional Strategies

The purpose of this benchmark is for students to understand that when adding or subtracting fractions with unlike denominators, equivalent fractions are generated to rewrite the fractions with like denominators, with which students have experience from Grade 4 (MA.4.FR.2.2). Procedural fluency will be achieved in Grade 6 (MA.6.NSO.2.3).

- During instruction, have students begin with expressions with two fractions that require the rewriting of one of the fractions (where one denominator is a multiple of the other, like $\frac{1}{2} + \frac{3}{6}$ or $\frac{3}{4} + \frac{5}{8}$) and progress to expressions where both fractions must be rewritten (where denominators are not multiples of one another, like $\frac{4}{5} + \frac{2}{3}$ or $\frac{1}{2} + 9 \frac{2}{3}$), so that students can explore how both fractions need like denominators to make addition and subtraction easier. Once students have stronger conceptual understanding, expressions requiring adding or subtracting 3 or more numbers should be included in instruction.
- It is important for students to practice problems that include various fraction models as students may find that a circular model might not be the best model when adding or subtracting fractions because of the difficulty in partitioning the pieces so they are equal (MTR.2.1).
- When students use an algorithm to add or subtract fraction expressions, encourage students’ use of flexible strategies. For example, students can use a partial sums strategy when adding $1 \frac{2}{3} + 4 \frac{4}{5}$ by adding the whole numbers $1 + 4$ together first before adding the fractional parts and regrouping when necessary.
- Mental computations and estimation strategies should be used to determine the reasonableness of solutions. For example, when adding $1 \frac{2}{3} + 4 \frac{4}{5}$, students could reason that the sum will be greater than 6 because the sum of the whole numbers is 5 and the sum of the fractional parts in the mixed numbers will be greater than 1. Keep in mind that estimation is about getting reasonable solutions and not about getting exact solutions, therefore allow for flexible estimation strategies and expect students to justify them.
- Instruction includes students using equivalent fractions to simplify answers.

Common Misconceptions or Errors

- Students can carry misconceptions from Grade 4 about adding and subtracting fractions and understanding why the denominator remains the same. Emphasize the use of area and number line models, and present expressions in numeral-word form to help understand that the denominator is the unit. For example, “5 eighths + 9 eighths is equal to how many eighths?”
- Students often try to use different models when adding, subtracting or comparing fractions. For example, they may use a circle for thirds and a rectangle for fourths, when comparing fractions with thirds and fourths.
- Remind students that the representations need to be from the same whole models with the same shape and same size. In a real-world problem, this often looks like same units. For example, “Trey has $1 \frac{3}{4}$ cups of water and Rachel has $2 \frac{5}{6}$ cups of water. How many cups of water do they have?”
**Instructional Tasks**

**Instructional Task 1**
Write an expression for the visual model below. Then find the sum.

![Visual Model](image)

**Instructional Task 2**
Use a visual fraction model to find the value of the expression $\frac{3}{5} + \frac{4}{15}$.

**Instructional Task 3**
Find the value of the expression $3\frac{5}{6} + \frac{3}{8}$.

**Instructional Task 4**
Find the differences $\frac{5}{7} - \frac{2}{3}$ and $2\frac{1}{4} - \frac{4}{6}$.

**Instructional Items**

**Instructional Item 1**
Find the sum $\frac{5}{8} + \frac{7}{16}$.

a. $1\frac{2}{16}$
b. $\frac{12}{16}$
c. $1\frac{1}{16}$
d. $\frac{12}{24}$

**Instructional Item 2**
Find the difference $2\frac{1}{4} - \frac{3}{8}$.

a. $1\frac{2}{4}$
b. $1\frac{5}{8}$
c. $1\frac{7}{8}$
d. $2\frac{2}{8}$

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.*
MA.5.FR.2.2

Benchmark

Extend previous understanding of multiplication to multiply a fraction by a fraction, including mixed numbers and fractions greater than 1, with procedural reliability.

Benchmark Clarifications:
Clarification 1: Instruction includes the use of manipulatives, drawings or the properties of operations.
Clarification 2: Denominators limited to whole numbers up to 20.

Related Benchmarks/Horizontal Alignment

- MA.5.NSO.2.1/2.4
- MA.5.AR.1.2
- MA.5.GR.2.1

Terms from the K-12 Glossary

Vertical Alignment

Previous Benchmarks
- MA.4.FR.2.4

Next Benchmarks
- MA.6.NSO.2.2

Purpose and Instructional Strategies

- The purpose of this benchmark is for students to learn strategies to multiply two fractions. This continues the work from Grade 4 where students multiplied a whole number times a fraction and a fraction times a whole number (MA.4.FR.2.4). Procedural fluency will be achieved in Grade 6 (MA.6.NSO.2.2).
- During instruction, students are expected to multiply fractions including proper fractions, improper fractions (fractions greater than 1), and mixed numbers efficiently and accurately.
- Visual fraction models (area models, tape diagrams, number lines) should be used and created by students during their work with this benchmark (MTR.2.1). Visual fraction models should show how a fraction is partitioned into parts that are the same as the product of the denominators.

When exploring an algorithm to multiply fractions \( \frac{a}{b} \times \frac{c}{d} = \frac{axc}{bxd} \), make connections to an accompanying area model. This will help students understand the algorithm conceptually and use it more accurately.

Instruction includes students using equivalent fractions to simplify answers; however, putting answers in simplest form is not a priority.
Common Misconceptions or Errors

- Students may believe that multiplication always results in a larger number. Using models when multiplying with fractions will enable students to generalize about multiplication algorithms that are based on conceptual understanding (MTR.5.1).
- Students can have difficulty with word problems when determining which operation to use, and the stress of working with fractions makes this happen more often.
  - For example, “Mark has $\frac{3}{4}$ yards of rope and he gives a third of the rope to a friend. How much rope does Mark have left?” expects students to first find $\frac{1}{3}$ of $\frac{3}{4}$, or multiply $\frac{1}{3} \times \frac{3}{4}$, and then to find the difference to find how much Mark has left.
  - On the other hand, “Mark has $\frac{3}{4}$ yards of rope and gives $\frac{1}{3}$ yard of rope to a friend. How much rope does Mark have left?” only requires finding the difference $\frac{3}{4} - \frac{1}{3}$.

Instructional Tasks

Instructional Task 1

Part A. Maritza has $4 \frac{1}{2}$ cups of cream cheese. She uses $\frac{3}{4}$ of the cream cheese for a banana pudding recipe. After she uses it for the recipe, how much cream cheese will Maritza have left?

Part B. To find out how much cream cheese she used, Maritza multiplied $4 \frac{1}{2} \times \frac{3}{4}$ as

$$
\left(4 \times \frac{3}{4}\right) + \left(\frac{1}{2} \times \frac{3}{4}\right).
$$

Will this method work? Why or why not?

Part C. What additional step is required to find how much cream cheese she has left?

Instructional Items

Instructional Item 1

What is the product of $\frac{1}{5} \times 6 \frac{2}{2}$?

a. $\frac{6}{10}$
b. $\frac{12}{5}$
c. $6 \frac{7}{10}$
d. $1 \frac{3}{10}$

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.*
MA.5.FR.2.3

**Benchmark**

When multiplying a given number by a fraction less than 1 or a fraction greater than 1, predict and explain the relative size of the product to the given number without calculating.

**Benchmark Clarifications:**

*Clarification 1:* Instruction focuses on the connection to decimals, estimation and assessing the reasonableness of an answer.

**Related Benchmarks/Horizontal Alignment**

- MA.5.NSO.2.4/2.5
- MA.5.GR.2.1

**Vertical Alignment**

**Previous Benchmarks**

- MA.4.FR.2.4

**Next Benchmarks**

- MA.6.NSO.2.2/2.3

**Purpose and Instructional Strategies**

The purpose of this benchmark is for students to examine how numbers change when multiplying by fractions (MTR.2.1). Students already had experience with this idea when they multiplied a fraction by a whole number in Grade 4 (MA.4.FR.2.4). Work from this benchmark will help prepare students to multiply and divide fractions and decimals with procedural fluency in Grade 6 (MA.6.NSO.2.2).

- It is important for students to have experiences examining:
  - when multiplying by a fraction greater than 1, the number increases;
  - when multiplying by a fraction equal to 1, the number stays the same; and
  - when multiplying by a fraction less than 1, the number decreases.

- Throughout instruction, encourage students to use models or drawings to assist them with a visual of the relative size. Models to consider when multiplying fractions to assist with finding relative size without calculating include, but are not limited to, area models (rectangles), linear models (fraction strips/bars and number lines) and set models (counters). Include examples with equivalent fractions and decimals (K.12.MTR.2.1).

- Have students explain how they used the model or drawing to arrive at the solution and justify reasonableness of their answers (K12.MTR.4.1).

**Common Misconceptions or Errors**

- Students may believe that multiplication always results in a larger number. This is why it is imperative to include models during instruction when multiplying fractions so students can see and experience the results and begin to make generalizations that are based on their understanding. Ultimately, allowing students to begin to understand that multiplying by a fraction less than one will result in a lesser product, but when multiplying by a fraction greater than one will result in a greater product.
### Instructional Tasks

**Instructional Task 1**

Derrick is playing a computer game where he must multiply a number by a factor that increases the number’s size each time. Select all of the factors that he could multiply by to continue to increase the size of his number? Explain your thinking.

- a. $\frac{3}{4}$
- b. $\frac{4}{3}$
- c. $1 \frac{1}{9}$
- d. 1.01
- e. $\frac{5}{2}$
- f. $\frac{8}{9}$
- g. $\frac{99}{100}$
- h. $\frac{2}{2}$

### Instructional Items

**Instructional Item 1**

Which of the following expressions will have a product greater than 4?

- a. $4 \times \frac{8}{8}$
- b. $\frac{3}{4} \times 4$
- c. $4 \times \frac{99}{100}$
- d. $\frac{101}{100} \times 4$

**Instructional Item 2**

Fill in the blank. The product of the expression $\frac{63}{65} \times 20$ will be ______________ 20.

- a. less than
- b. equal to
- c. greater than
- d. half of

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*
**MA.5.FR.2.4**

**Benchmark**

Extend previous understanding of division to explore the division of a unit fraction by a whole number and a whole number by a unit fraction.

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes the use of manipulatives, drawings or the properties of operations.

*Clarification 2:* Refer to Situations Involving Operations with Numbers (Appendix A).

**Related Benchmarks/Horizontal Alignment**

- MA.5.NSO.2.2
- MA.5.AR.1.3

**Vertical Alignment**

**Previous Benchmarks**
- MA.4.FR.2.4

**Next Benchmarks**
- MA.6.NSO.2.2
- MA.6.NSO.2.3

**Purpose and Instructional Strategies**

The purpose of this benchmark is for students to experience division with whole number divisors and unit fraction dividends (fractions with a numerator of 1) and with unit fraction divisors and whole number dividends. This work prepares for division of fractions in Grade 6 (MA.6.NSO.2.2) in the same way that in Grade 4 (MA.4.FR.2.4) students were prepared for multiplication of fractions.

- Instruction should include the use of manipulatives, area models, number lines, and emphasizing the properties of operations (e.g., through fact families) for students to see the relationship between multiplication and division (K12.MTR.2.1).
- Throughout instruction, students should have practice with both types of division: a unit fraction that is divided by a non-zero whole number and a whole number that is divided by a unit fraction.
- Students should be exposed to all situation types for division (refer to: Situations Involving Operations with Numbers (Appendix A)).
- The expectation of this benchmark is not for students to use an algorithm (e.g., multiplicative inverse) to divide by a fraction.
- Instruction includes students using equivalent fractions to simplify answers; however, putting answers in simplest form is not a priority.

**Common Misconceptions or Errors**

- Students may believe that division always results in a smaller number, which is true when dividing a fraction by a whole number, but not when dividing a whole number by a fraction. Using models will help students develop the understanding needed for computation with fractions.
**Instructional Tasks**

*Instructional Task 1*

Part A. Emily has 2 feet of ribbon to make friendship bracelets. Use models and equations to answer the questions below.

a. How many friendship bracelets can she make if each bracelet uses 2 feet of ribbon?
b. How many friendship bracelets can she make if each bracelet uses 1 foot of ribbon?
c. How many friendship bracelets can she make if each bracelet uses 1 half foot of ribbon?
d. How many friendship bracelets can she make if each bracelet uses 1 third foot of ribbon?
e. How many friendship bracelets can she make if each bracelet uses 1 fifth foot of ribbon?

Part B. Do you see any patterns in the models and equations you have written? Explain.

**Instructional Items**

*Instructional Item 1*

What is the quotient of $\frac{1}{3} \div 5$?

a. $\frac{1}{15}$
b. 15
c. $\frac{5}{3}$
d. $\frac{3}{5}$

*Instructional Item 2*

How many fourths are in 8 wholes?

a. 4
b. 8
c. 16
d. 32

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.*
Algebraic Reasoning

MA.5.AR.1 Solve problems involving the four operations with whole numbers and fractions.

MA.5.AR.1.1

Benchmark

Solve multi-step real-world problems involving any combination of the four operations with whole numbers, including problems in which remainders must be interpreted within the context.

Benchmark Clarifications:
Clarification 1: Depending on the context, the solution of a division problem with a remainder may be the whole number part of the quotient, the whole number part of the quotient with the remainder, the whole number part of the quotient plus 1, or the remainder.

Related Benchmarks/Horizontal Alignment

- MA.5.NSO.2.1/2.2
- MA.5.FR.1.1
- MA.5.GR.3.3
- MA.5.GR.4.2
- MA.5.DP.1.2

Terms from the K-12 Glossary

- Dividend
- Divisor
- Equation

Vertical Alignment

Previous Benchmarks

- MA.3.AR.1.2
- MA.4.AR.1.1

Next Benchmarks

- MA.6.NSO.2.3
**Purpose and Instructional Strategies**

The purpose of this benchmark is for students to solve multistep word problems with whole numbers and whole-number answers involving any combination of the four operations. Work in this benchmark continues instruction from Grade 4 where students interpreted remainders in division situations (MA.4.AR.1.1) (MTR.7.1), and prepares for solving multi-step word problems involving fractions and decimals in Grade 6 (MA.6.NSO.2.3).

- To allow for an effective transition into algebraic concepts in Grade 6 (MA.6.AR.1.1), it is important for students to have opportunities to connect mathematical statements and number sentences or equations.
- During instruction, teachers should allow students an opportunity to practice with word problems that require multiplication or division which can be solved by using drawings and equations, especially as the students are making sense of the context within the problem (MTR.5.1).
- Teachers should have students practice with representing an unknown number in a word problem with a variable by scaffolding from the use of only an unknown box.
- Offer word problems to students with the numbers covered up or replaced with symbols or icons and ensure to ask students to write the equation or the number sentence to show the problem type situation (MTR.6.1).
- Interpreting number pairs on a coordinate graph can provide students opportunities to solve multi-step real-world problems with the four operations (MA.5.GR.4.2).

**Common Misconceptions or Errors**

- Students may apply a procedure that results in remainders that are expressed as \( r \) for ALL situations, even for those in which the result does not make sense. For example, when a student is asked to solve the following problem: “There are 34 students in a class bowling tournament. They plan to have 3 students in each bowling lane. How many bowling lanes will they need so that everyone can participate?” the student response is “11 \( r \) 1 bowling lanes,” without any further understanding of how many bowling lanes are needed and how the students may be divided among the last 1 or 2 lanes. To assist students with this misconception, pose the question…“What does the quotient mean?”

**Instructional Tasks**

*Instructional Task 1*

There are 128 girls in the Girl Scouts Troop 1653 and 154 girls in the Girl Scouts Troop 1764. Both Troops are going on a camping trip. Each bus can hold 36 girls. How many buses are needed to get all the girls to the camping site?

**Instructional Items**

*Instructional Item 1*

A shoe store orders 17 cases each containing 142 pairs of sneakers and 12 cases each containing 89 pairs of sandals. How many more pairs of sneakers did the store order?

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*
**MA.5.AR.1.2**

**Benchmark**

Solve real-world problems involving the addition, subtraction or multiplication of fractions, including mixed numbers and fractions greater than 1.

*Example:* Shanice had a sleepover, and her mom is making French toast in the morning. If her mom had $2\frac{1}{4}$ loaves of bread and used $1\frac{1}{2}$ loaves for the French toast, how much bread does she have left?

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes the use of visual models and equations to represent the problem.

**Related Benchmarks/Horizontal Alignment**

- MA.5.FR.2.1/2.2
- MA.5.M.1.1
- MA.5.GR.2.1
- MA.5.DP.1.1

**Terms from the K-12 Glossary**

**Vertical Alignment**

**Previous Benchmarks**

- MA.4.AR.1.2/1.3

**Next Benchmarks**

- MA.6.NSO.2.3

**Purpose and Instructional Strategies**

The purpose of this benchmark is to continue the work from Grade 4 (MA.4.AR.1.2/1.3) where students began solving real-world with fractions, and prepares them for Grade 6 (MA.6.NSO.2.3) where they will solve real-world fraction problems using all four operations with fractions. (MTR.7.1).

- Students need to develop an understanding that when adding or subtracting fractions, the fractions must refer to the same whole.
- During instruction, teachers should provide opportunities for students to practice solving problems using models or drawings to add, subtract or multiply with fractions. Begin with students modeling with whole numbers, have them explain how they used the model or drawing to arrive at the solution, then scaffold using the same methodology using fraction models.
- Models to consider when solving fraction problems should include, but are not limited to, area models (rectangles), linear models (fraction strips/bars and number lines) and set models (counters) (MTR.2.1).
- Please note that it is not expected for students to always find least common multiples or make fractions greater than 1 into mixed numbers, but it is expected that students know and understand equivalent fractions, including naming fractions greater than 1 as mixed numbers to add, subtract or multiply.
- It is important that teachers have students rename the fractions with a common denominator when solving addition and subtraction fraction problems in lieu of the “butterfly” method (or other shortcut/mnemonic) to ensure students build a complete conceptual understanding of what makes solving addition and subtraction of fractions problems true.
Common Misconceptions or Errors

- When solving real-world problems, students can often confuse contexts that require subtraction and multiplication of fractions. For example, “Mark has \( \frac{3}{4} \) yards of rope and he gives half of the rope to a friend. How much rope does Mark have left?” expects students to find \( \frac{1}{2} \) of \( \frac{3}{4} \), or multiply \( \frac{1}{2} \times \frac{3}{4} \) to find the product that represents how much is given to the friend. On the other hand, “Mark has \( \frac{3}{4} \) yards of rope and gives \( \frac{1}{2} \) yard of rope to a friend. How much rope does Mark have left?” expects students to take \( \frac{1}{2} \) yard from \( \frac{3}{4} \) yard, or subtract \( \frac{3}{4} - \frac{1}{2} \) to find the difference. Encourage students to look for the units in the problem (e.g., \( \frac{1}{2} \) yard versus \( \frac{1}{2} \) of the whole rope) to determine the appropriate operation.

- Students may believe that multiplication always results in a larger number. Using models when multiplying with fractions will enable students to generalize about multiplication algorithms that are based on conceptual understanding (MTR.5.1).

- Students can have difficulty with word problems when determining which operation to use, and the stress of working with fractions makes this happen more often.
  
  - For example, “Mark has \( \frac{3}{4} \) yards of rope and he gives a third of the rope to a friend. How much rope does Mark have left?” expects students to first find \( \frac{1}{3} \) of \( \frac{3}{4} \) or multiply \( \frac{1}{3} \times \frac{3}{4} \), and then to find the difference to find how much Mark has left. On the other hand, “Mark has \( \frac{3}{4} \) yards of rope and gives \( \frac{1}{3} \) yard of rope to a friend. How much rope does Mark have left?” only requires finding the difference \( \frac{3}{4} - \frac{1}{3} \).

Instructional Tasks

Instructional Task 1
Rachel wants to bake her two favorite brownie recipes. One recipe needs \( 1\frac{1}{2} \) cups of flour and the other recipe needs \( \frac{3}{4} \) cups of flour. How much flour does Rachel need to bake her two favorite brownie recipes?

Instructional Task 2
Shawn finished a 100 meter race in \( \frac{3}{8} \) of one minute. The winner of the race finished in \( \frac{1}{3} \) of Shawn’s time. How long did it take for the winner of the race to finish?

Instructional Items

Instructional Item 1
Monica has 2\( \frac{3}{4} \) cups of berries. She uses \( \frac{5}{8} \) cups of berries to make a smoothie. She then uses \( \frac{1}{2} \) cup for a fruit salad. After she makes her smoothie and fruit salad, how much of the berries will Monica have left?

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*
**MA.5.AR.1.3**

### Benchmark

**MA.5.AR.1.3** Solve real-world problems involving division of a unit fraction by a whole number and a whole number by a unit fraction.

*Example:* Shanice had a sleepover and her mom is making French toast in the morning. If her mom had \(2 \frac{1}{4}\) loaves of bread and used \(1 \frac{1}{2}\) loaves for the French toast, how much bread does she have left?

**Benchmark Clarifications:**
*Clarification 1:* Instruction includes the use of visual models and equations to represent the problem.

### Related Benchmarks/Horizontal Alignment

- MA.5.NSO.2.2
- MA.5.FR.2.4

### Vertical Alignment

**Previous Benchmarks**
- MA.4.AR.1.3

**Next Benchmarks**
- MA.6.NSO.2.3

### Purpose and Instructional Strategies

The purpose of this benchmark is to connect division of fraction concepts to real-world scenarios (K12.MTR.7.1). This work builds on the multiplication of fractions by whole numbers in Grade 4 (MA.4.AR.1.3), and prepares them for Grade 6 (MA.6.NSO.2.3) where they will solve real-world fraction problems using all four operations with fractions (MTR.7.1).

- During instruction, it is important for students to have opportunities to extend their understanding of the meaning of fractions, how many unit fractions are in a whole, and their understanding of division of fractions as involving equal groups or shares and the number of objects in each.
- Students should use visual fraction models and reasoning to solve word problems involving division of fractions. For example, to assist students with solving the problem, “The elephant eats 4 lbs of peanuts a day. His trainer gives him \(\frac{1}{5}\) of a pound at a time. How many times a day does the elephant eat peanuts?” use the following diagram to show how \(4 \div \frac{1}{5}\) can be visualized to assist students with solving.

```
1 lb. of peanuts

\[\begin{array}{c}
\frac{1}{5} \text{ lb.}
\end{array}\]
```

- The expectation of this benchmark is not for students to use an algorithm (e.g., multiplicative inverse) to divide fractions.
- Instruction includes students using equivalent fractions to simplify answers; however, putting answers in simplest form is not a priority.
Common Misconceptions or Errors

- Students may believe that division always results in a smaller number, which is true when dividing a fraction by a whole number, but not when dividing a whole number by a fraction. Using models will help students develop the understanding needed for computation with fractions.

Instructional Tasks

Instructional Task 1

Sonya has \( \frac{1}{2} \) gallon of chocolate chip ice cream. She wants to share her ice cream with 6 friends. How much ice cream will each friend get?

Instructional Items

Instructional Item 1

Betty has 12 sheets of tissue paper to add to her holiday gift bags. Each gift bag needs \( \frac{1}{3} \) sheet of tissue paper. How many holiday gift bags can Betty fill?

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.

MA.5.AR.2 Demonstrate an understanding of equality, the order of operations and equivalent numerical expressions.

MA.5.AR.2.1

Benchmark

MA.5.AR.2.1 Translate written real-world and mathematical descriptions into numerical expressions and numerical expressions into written mathematical descriptions.

Example: The expression \( 4.5 + (3 \times 2) \) in word form is four and five tenths plus the quantity 3 times 2.

Benchmark Clarifications:

Clarification 1: Expressions are limited to any combination of the arithmetic operations, including parentheses, with whole numbers, decimals and fractions.

Clarification 2: Within this benchmark, the expectation is not to include exponents or nested grouping symbols.

Related Benchmarks/Horizontal Alignment

- MA.5.NSO.1.1/1.2/1.3/1.4/1.5
- MA.5.NSO.2.3
- MA.5.AR.3.1
- MA.5.M.1.1

Terms from the K-12 Glossary

- Expression

Vertical Alignment

Previous Benchmarks

- MA.4.AR.2.2

Next Benchmarks

- MA.6.AR.1.1
Purpose and Instructional Strategies
The purpose of this benchmark is for students to translate between numerical and written mathematical expressions. This builds from previous work where students wrote equations with unknowns in any position of the equation in Grade 4 (MA.4.AR.2.2). Algebraic expressions are a major theme in Grade 6 starting with MA.6.AR.1.1.

- During instruction, teachers should model how to translate numerical expressions into words using correct vocabulary. This includes naming fractions and decimals correctly. Students should use diverse vocabulary to describe expressions. For example, in the expression $4.5 + (3 \times 2)$ could be read in multiple ways to show its operations. Students should explore them and find connections between their meanings (MTR.3.1, MTR.4.1, MTR.5.1).
  - 4 and five tenths plus the quantity 3 times 2
  - 4 and 5 tenths plus the product of 3 and 2
  - The sum of 4 and 5 tenths and the quantity 3 times 2
  - The sum of 4 and 5 tenths and the product of 3 and 2

- The expectation of this benchmark is to not use exponents or nested grouping symbols. Nested grouping symbols refer to grouping symbols within one another in an expression, like in $3 + [5.2 + (4 \times 2)]$.
- Instruction of this benchmark helps students understand the order of operations, the expectation of MA.5.AR.2.2.

Common Misconceptions or Errors
- Students can misrepresent decimal and fraction numbers in words. This benchmark helps students practice naming numbers according to place value.
- Some students can confuse the difference between what is expected in the expressions $5(9 + 3)$ and $5 + (9 + 3)$. Students need practice naming the former as multiplication (e.g., $5$ times the sum of 9 and 3) and understanding that in that expression, both 5 and 9 + 3 are factors.

Instructional Tasks

Instructional Task 1
Nadia sees the numerical expression $6.5 + \frac{1}{2} (4 - 2)$. She translates the expression as, “6 and five tenths plus 1 half times 4, minus 2.”

Part B: Evaluate the expression.

Instructional Task 2
Translate the written mathematical description below into a numerical expression:

**Divide the difference of 20 and 5 by the sum of 4 and 1.**
Instructional Items

Instructional Item 1
Translate the numerical expression below into a written mathematical description.
\[ 2(53.8 + 4 - 22.9) \]

Instructional Item 2
Translate the written mathematical description into a numerical expression.
“one half the difference of 6 and 8 hundredths and 2”

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.

MA.5.AR.2.2

Benchmark

MA.5.AR.2.2 Evaluate multi-step numerical expressions using order of operations.

Example: Patti says the expression \( 12 \div 2 \times 3 \) is equivalent to 18 because she works each operation from left to right. Gladys says the expression \( 12 \div 2 \times 3 \) is equivalent to 2 because first multiplies \( 2 \times 3 \) then divides 6 into 12. David says that Patti is correctly using order of operations and suggests that if parentheses were added, it would give more clarity.

Benchmark Clarifications:
Clarification 1: Multi-step expressions are limited to any combination of arithmetic operations, including parentheses, with whole numbers, decimals and fractions.
Clarification 2: Within this benchmark, the expectation is not to include exponents or nested grouping symbols.
Clarification 3: Decimals are limited to hundredths. Expressions cannot include division of a fraction by a fraction.

Related Benchmarks/Horizontal Alignment

- MA.5.NSO.1.1/1.2/1.3/1.4/1.5
- MA.5.NSO.2.3/2.4/2.5
- MA.5FR.1.1
- MA.5.FR.2.1

Terms from the K-12 Glossary

- Expression
- Order of Operations

Vertical Alignment

Previous Benchmarks
- MA.4.AR.2.1/2.2

Next Benchmarks
- MA.6.NSO.2.3
- MA.6.AR.1.3
Purpose and Instructional Strategies

The purpose of this benchmark is for students to use the order of operations to evaluate numerical expressions. In Grade 4, students had experience with numerical expressions involving all four operations (MA.4.AR.2.1/2.2), but the focus was not on order of operations. In Grade 6, students will be evaluating algebraic expressions using substitution and these expressions can include negative numbers (MA.6.AR.1.3).

- Begin instruction by exposing students to expressions that have two operations without any grouping symbols, before introducing expressions with multiple operations. Use the same digits, with the operations in a different order, and have students evaluate the expressions, then discuss why the value of the expression is different. For example, have students evaluate $6 \times 3 + 7$ and $6 + 3 \times 7$.
- In Grade 5, students should learn to first work to simplify within any parentheses, if present in the expression. Within the parentheses, the order of operations is followed. Next, while reading left to right, perform any multiplication and division in the order in which it appears. Finally, while reading from left to right, perform addition and subtraction in the order in which it appears.
- During instruction, students should be expected to explain how they used the order of operations to evaluate expressions and share with others. To address misconceptions around the order of operations, instruction should include reasoning and error analysis tasks for students to complete (MTR.3.1, MTR.4.1, MTR.5.1).

Common Misconceptions or Errors

- When students learn mnemonics like PEMDAS to perform the order of operations, they can confuse that multiplication must always be performed before division, and likewise addition before subtraction. Students should have experiences solving expressions with multiple instances of procedural operations and their inverse, such as addition and subtraction, so they learn how to solve them left to right.

Instructional Tasks

Instructional Task 1

The two equations below are very similar. Are both equations true? Why or why not?

Equation One: $4 \times 6 + 3 \times 2 + 4 = 34$

Equation Two: $4 \times (6 + 3 \times 2 + 4) = 64$

Instructional Task 2

Part A. Insert one set of parentheses around two numbers in the expression below. Then evaluate the expression.

$40 \div 5 \times 2 + 6$

Part B. Now insert one set of parentheses around a different pair of numbers. Then evaluate this expression.

$40 \div 5 \times 2 + 6$
**Instructional Items**

*Instructional Item 1*
What is the value of the numerical expression below:

\[(2.45 + 3.05) \div (7.15 - 2.15)\]

*Instructional Item 2*
A numerical expression is evaluated as shown.

\[\frac{1}{2} \times (3 \times 5 + 1) - 2\]

In which step does the first mistake appear

a. Step 1: \[\frac{1}{2} \times (15 + 1) - 2\]
b. Step 2: \[\frac{1}{2} \times 14\]
c. Step 3: \[\frac{14}{2}\]
d. Step 4: 7

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.

**MA.5.AR.2.3**

**Benchmark**

**MA.5.AR.2.3** Determine and explain whether an equation involving any of the four operations is true or false.

*Example:* The equation \(2.5 + (6 \times 2) = 16 - 1.5\) can be determined to be true because the expression on both sides of the equal sign are equivalent to 14.5.

**Benchmark Clarifications:**

*Clarification 1:* Problem types include equations that include parenthesis but not nested parentheses.

*Clarification 2:* Instruction focuses on the connection between properties of equality and order of operations.

**Related Benchmarks/Horizontal Alignment**

- **MA.5.NSO.1.1/1.2/1.3/1.4/1.5**
- **MA.5.NSO.2.1/2.3/2.5**

**Terms from the K-12 Glossary**

- **Equal Sign**
- **Equation**
- **Expression**

**Vertical Alignment**

**Previous Benchmarks**

- **MA.4.AR.2.1**

**Next Benchmarks**

- **MA.6.AR.2.1**
Purpose and Instructional Strategies

The purpose of this benchmark is to determine if students can connect their understanding of using the four operations reliably or fluently (MTR.3.1) to the concept of the meaning of the equal sign. Students have evaluated whether equations are true or false since Grade 2. In Grade 5, additional expectations include non-whole numbers and parentheses. In Grade 6, students extend this work to involve negative numbers and inequalities (MA.6.AR.2.1).

- Students will use their understanding of order of operations (MA.5.AR.2.2) to simplify expressions on each side of an equation (MTR.5.1).
- Students will determine if the expression on the left of equal sign is equivalent to the expression to the right of the equal sign. If these expressions are equivalent, then the equation is true.
- Students may use comparative relational thinking, instead of solving, in order to determine if the equation is true or false (MTR.2.1, MTR.3.1, MTR.5.1).

Common Misconceptions or Errors

- Some students may not understand that the equal sign is a relational symbol showing expressions on both sides that are the same. While justifying whether equations are true or false, students should explain what makes the equation true.

Instructional Tasks

Instructional Task 1
Using the numbers below, create an equation that is true.

\[(\_ \times \_ ) - \_\_ = \_ \_ - \_\_\]

12, 6.2, 5\(\frac{1}{5}\), 4, 3.5

Instructional Items

Instructional Item 1
Which best explains the equation below?

\[13.8 - 6 + 3 = 4 \times 1.2\]

a. This equation is true because both sides of the equation are equal to 4.8.
b. This equation is true because both sides of the equation are equal to 10.8.
c. This equation is false because both sides of the equation are equal to 4.8.
d. This equation is false because both sides of the equation are unequal.

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*
MA.5.AR.2.4

**Benchmark**

Given a mathematical or real-world context, write an equation involving any of the four operations to determine the unknown whole number with the unknown in any position.

*Example:* The equation $250 - (5 \times s) = 15$ can be used to represent that 5 sheets of paper are given to $s$ students from a pack of paper containing 250 sheets with 15 sheets left over.

**Benchmark Clarifications:**

*Clarification 1:* Instruction extends the development of algebraic thinking where the unknown letter is recognized as a variable.

*Clarification 2:* Problems include the unknown and different operations on either side of the equal sign.

**Related Benchmarks/Horizontal Alignment**

- **Terms from the K-12 Glossary**
  - Equal Sign
  - Equation
  - Expression
  - Whole Number

- MA.5.NSO.2.1/2.2
- MA.5.AR.1.1
- MA.5.AR.3.1

**Vertical Alignment**

**Previous Benchmarks**

- MA.4.AR.2.2

**Next Benchmarks**

- MA.6.AR.1.4
- MA.6.AR.2.2/2.3/2.4
Purpose and Instructional Strategies

The purpose of this benchmark is for students to write equations that determine unknown whole numbers from mathematical and real-world contexts. In Grade 4, students wrote equations from mathematical and real-world contexts to determine unknown whole numbers (represented by letter symbols) (MA.4.AR.2.2). The extension in Grade 5 is that factors are not limited to within 12 and equations may use parentheses, implying students may have to use the order of operations to solve. In Grade 6, students extend this work to include integers and positive fractions and decimals (MA.6.AR.2.2/3/4).

- Instruction should focus on helping students translate mathematical and real-world contexts to equations. Instructional emphasis should be placed on students’ comprehension of the contexts to then translate to equations more easily. An instructional strategy that helps students translate from context to symbolic equations is to first present contexts with some or all their numerical information omitted. In a mathematical context, this may look like showing a data display with some numerical information covered. In a real-world context, this may look like a word problem with quantities covered. This allows students to comprehend what the problem trying to find and allows students to think deeper about what operations will be required to do so. It can also help students estimate reasonable solution ranges. Once students can predict an equation (or equations) to solve the problem, then the teacher can reveal all numerical information and allow students to solve (MTR.5.1).
- In each context, students may provide many examples of equations that can be used to solve. During instruction, teachers should have students compare their equations and evaluate whether they can be used to solve (MTR.4.1).
- During instruction, students should justify how their equations match the mathematical and real-world contexts through checking solutions. Students should substitute their solution for their letter symbol and use the order of operations to check that it makes the equation true.

Common Misconceptions or Errors

- When students have trouble comprehending contexts, they tend to just grab numbers from a given context and begin computing without justifying their arguments. Emphasis of instruction should be on the comprehension of problems through classroom discussion, sharing strategies, estimating reasonable solutions, and justifying equations and solutions.

Instructional Tasks

Instructional Task 1

To celebrate reaching their monthly reading goal, Dr. Ocasio’s class has a cookie party. Dr. Ocasio buys a box of 96 cookies. She plans to give the same number to each of the 21 students in her class. She wants 12 cookies remaining to bring home for her children. What is the greatest number of cookies each of Dr. Ocasio’s students can receive?

Part A. Write an equation that can be used to solve. Use a letter to represent the unknown number.

Part B. What is the greatest number of cookies each of Dr. Ocasio’s students can receive?

Part C. Prove that your answer is correct by showing how your equation is true.
Instructional Items

Instructional Item 1

Which of the equations can be used to solve the problem below?
To celebrate reaching their monthly reading goal, Dr. Ocasio’s class has a cookie party. Dr. Ocasio buys a box of 96 cookies. She plans to give the same number to each of the 21 students in her class. She wants 12 remaining to bring home for her children. What is the greatest number of cookies each of Dr. Ocasio’s students can receive?

a. $96 - 21 - 12 = c$

b. $96 - (21 \times c) = 12$

c. $12 + c = 96 - 21$

d. $21 \times c + 12 = 96$

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.

MA.5.AR.3 Analyze patterns and relationships between inputs and outputs.

MA.5.AR.3.1

Benchmark

MA.5.AR.3.1 Given a numerical pattern, identify and write a rule that can describe the pattern as an expression.

Example: The given pattern 6, 8, 10, 12 ... can be describe using the expression $4 + 2x$, where $x = 1, 2, 3, 4 ...$; the expression $6 + 2x$, where $x = 0, 1, 2, 3 ...$ or the expression $2x$, where $x = 3, 4, 5, 6 ...$

Benchmark Clarifications:
Clarification 1: Rules are limited to one or two operations using whole numbers.

Related Benchmarks/Horizontal Alignment

• MA.5.AR.2.1/2.4

Terms from the K-12 Glossary

• Coefficient

Vertical Alignment

Previous Benchmarks

• MA.4.AR.3.2

Next Benchmarks

• MA.6.AR.3.3
Purpose and Instructional Strategies

The purpose of this benchmark is for students to identify and write an expression that shows the rule for a given pattern. Students have been identifying and generating patterns since Grade 3. In Grade 5, the expectation extends to students writing a rule as an expression that may have 1 or 2 operations. In Grade 6, the focus is on patterns involving ratios (MA.6.AR.3.3).

- The rules for given patterns are limited to one or two operations using whole numbers.
- Vocabulary (e.g., coefficient, terms, variables) should be interwoven into instruction of this benchmark. These terms are introduced in Grade 5, but not expected to be mastered until Grade 6.
- Students should understand that determining a rule for patterns helps them determine the value of future terms in the pattern (MTR.2.1, MTR.5.1).
- During instruction, teachers can have students compare their rules and justify them using properties of operations. For example, have students determine why the rule for the pattern in the benchmark example could be 6 + 2x or 2x + 6 (MTR.5.1, MTR.6.1).
- Instruction of this benchmark should be paired with MA.5. AR.3.2. The combination of determining rules and completing tables is important for students to begin understanding ratios and functions in the middle grades (MTR.5.1).
- Instruction includes recognizing patterns that arise from geometrical figures with different lengths and their perimeter or area.
  - For example, a pattern can arise from the following sequence of rectangles: 1 unit by 1 unit, 1 unit by 2 units, 1 unit by 3 units, 1 unit by 4 units. Students can describe the pattern of the perimeter or of the area.

Common Misconceptions or Errors

- A common mistake that students make is to determine a rule based on the change in only the first two terms. During instruction, teachers should emphasize that a rule must work for the change in any two terms in a pattern.

Instructional Tasks

Instructional Task 1

The first four terms of a pattern are below.

\[9, 13, 17, 21, \ldots\]

Part A. Write a mathematical description for a rule that matches these terms.

Part B. Write an expression that describes your rule.

Part C. Use your answer from Part B to determine the value of the 16th term.

Instructional Items

Instructional Item 1

Write an expression that can be a rule for the terms shown below.

\[2, 7, 12, 17, \ldots\]

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*
**MA.5.AR.3.2**

### Benchmark

**MA.5.AR.3.2**  
Given a rule for a numerical pattern, use a two-column table to record the inputs and outputs.

*Example:* The expression $6 + 2x$, where $x$ represents any whole number, can be represented in a two-column table as shown below.

<table>
<thead>
<tr>
<th>Input ($x$)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>12</td>
</tr>
</tbody>
</table>

**Benchmark Clarifications:**

*Clarification 1:* Instruction builds a foundation for proportional and linear relationships in later grades.  
*Clarification 2:* Rules are limited to one or two operations using whole numbers.

### Related Benchmarks/Horizontal Alignment

- MA.5.GR.4.2

### Terms from the K-12 Glossary


### Vertical Alignment

#### Previous Benchmarks

- MA.4.AR.3.2

#### Next Benchmarks

- MA.6.AR.3.3

### Purpose and Instructional Strategies

The purpose of this benchmark is to relate patterns to a two-column table for students to record inputs and outputs. It is related to MA.5.AR.3.1 where students determine rules from given patterns. This is the first grade in which students record inputs and outputs two-column tables, and this work helps build the foundation for proportional relationships (MA.6.AR.3.3) in middle school and functional relationships starting in Grade 8.

- Instruction of this benchmark should be paired with MA.5.AR.3.1. Organizing patterns into input and output tables lays the foundation for students to explore proportional and linear relationships in later grades (MTR.5.1).
- During instruction, teachers can relate the idea of “inputs” and “outputs” on a two-column table to a machine. The input is the term number, and the output is the corresponding term’s value. Students are to find what the machine does to determine the output.
- Instruction should make connections between representing the information in a two-column table and as ordered pairs on a coordinate plane (MA.5.GR.4.2).

### Common Misconceptions or Errors

- A common mistake that students make is to determine a rule based on the change in only the first two terms (in a pattern or on a two-column table). During instruction, teachers should emphasize that a rule must work for the change in any two terms in a pattern.
**Instructional Tasks**

*Instructional Task 1*

The Math Machine makes two-column tables when the user tells it a rule. Jacob tells the Math Machine to create a table using the rule “10 + 2x.” Unfortunately, the machine is malfunctioning and only some of the table is correct.

Part A: Identify which values are incorrect and complete the table correctly.

<table>
<thead>
<tr>
<th>Input (x)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>12</td>
<td>12</td>
<td>22</td>
<td>32</td>
</tr>
</tbody>
</table>

Part B: Extend your table to show the outputs for x = 10, 11 and 12.

**Instructional Items**

*Instructional Item 1*

What is the missing value in the two-column table below?

<table>
<thead>
<tr>
<th>Input (x)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>?</td>
<td>37</td>
<td>34</td>
<td>31</td>
</tr>
</tbody>
</table>

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*
Measurement

MA.5.M.1 Convert measurement units to solve multi-step problems.

MA.5.M.1.1

Benchmark

MA.5.M.1.1 Solve multi-step real-world problems that involve converting measurement units to equivalent measurements within a single system of measurement.

Example: There are 60 minutes in 1 hour, 24 hours in 1 day and 7 days in 1 week. So, there are $60 \times 24 \times 7$ minutes in one week which is equivalent to 10,080 minutes.

Benchmark Clarifications:
Clarification 1: Within the benchmark, the expectation is not to memorize the conversions.
Clarification 2: Conversions include length, time, volume and capacity represented as whole numbers, fractions and decimals.

Related Benchmarks/Horizontal Alignment

- MA.5.NSO.1.1
- MA.5.NSO.2.1/2.4/2.5
- MA.5.AR.1.2
- MA.5.AR.2.1
- MA.5.M.2.1
- MA.5.GR.1.1
- MA.5.GR.2.1
- MA.5.GR.3.3

Terms from the K-12 Glossary

Vertical Alignment

Previous Benchmarks
- MA.4.M.1.2

Next Benchmarks
- MA.6.AR.3.5
Purpose and Instructional Strategies

The purpose of this benchmark is for students to be able to understand the relationship between units of measure through problem solving. This benchmark builds on 4th grade concepts of converting measurement units (MA.4.M.1.2), and becomes a part of a larger context of ratios and rates in Grade 6 (MA.6.AR.3.5).

- Instruction should allow students to convert measurements flexibly. For example, when finding the number of inches in 2 yards, students may start with inches, feet or yards when calculating. Classroom discussion should compare those conversions to explore their similarities and differences (MTR.2.1, MTR.4.1).
- For students to have a better understanding of the relationships between units, it is important for teachers to allow students to have practice with tools during instruction. This will show students how the number of units relates to the size of the unit. For example, for students to discover converting inches to yards, teachers can have them use 12-inch rulers and yardsticks. This will allow students to see that three of the 12-inch rulers are equivalent to one yardstick (3 × 12 inches = 36 inches; 36 inches = 1 yard), so that students understand that there are 12 inches in 1 foot and 3 feet in 1 yard. Using this knowledge, students will be able to determine whether to multiply or divide when making conversions (MTR.2.1).
- When moving into real-world problem solving, it is important to begin with problems that allow for renaming the units to represent the solution before using problems that require renaming to find the solution (MTR.7.1).

Common Misconceptions or Errors

- Students confuse renaming units of measurement with the renaming that they do with whole numbers and place value. For example, when subtracting 6 inches from 3 feet, they get 2 feet 4 inches because they think of subtracting 6 inches from 30 inches. Students need to pay attention to the unit of measurement which dictates the renaming (inches in this example) and the number to use (12 inches in a foot instead of 10 inches in a foot).

Instructional Tasks

Instructional Task 1

Zevah is helping her mom plan her sister’s surprise birthday party.

Part A. The recipe to make one bowl of punch is shown below. How many cups of punch will they be able to serve at the party if they only make one bowl of punch and there is no punch leftover in the bowl?

<table>
<thead>
<tr>
<th>Liquid</th>
<th>Fluid Ounces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pineapple Juice</td>
<td>32 oz</td>
</tr>
<tr>
<td>Fruit Punch</td>
<td>64 oz</td>
</tr>
<tr>
<td>Ginger Ale</td>
<td>76 oz</td>
</tr>
</tbody>
</table>

Part B. At the party, Zevah wants each balloon to have a string that is 250 centimeters long. The string she wants to buy comes in rolls of 30 meters. How many rolls of string does Zevah need to buy if she plans to have 36 balloons at the party?
**Instructional Items**

**Instructional Item 1**
Michael is measuring fabric for the costumes of a school play. He needs 11.5 meters of fabric. He has 280 centimeters of fabric. How many more centimeters of fabric does he need?

**Instructional Item 2**
A recipe requires 24 ounces of milk. Edwin has only a $\frac{1}{2}$ cup measuring cup. How many measuring cups of milk will Edwin need?
   a. 6 
   b. 12 
   c. 18 
   d. 24

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.*

**MA.5.M.2 Solve problems involving money.**

**MA.5.M.2.1**

**Benchmark**

MA.5.M.2.1 Solve multi-step real-world problems involving money using decimal notation.

*Example:* Don is at the store and wants to buy soda. Which option would be cheaper: buying one 24-ounce can of soda for $1.39 or buying two 12-ounce cans of soda for 69¢ each?

**Related Benchmarks/Horizontal Alignment**

- MA.5.NSO.1.1/1.2/1.3
- MA.5.NSO.2.3/2.4/2.5
- MA.5.AR.2.1/2.4
- MA.5.M.1.1

**Terms from the K-12 Glossary**

**Vertical Alignment**

**Previous Benchmarks**
- MA.4.M.2.2

**Next Benchmarks**
- MA.6.NSO.2.3
**Purpose and Instructional Strategies**

The purpose of this standard is for students to apply understanding of multi-step real-world problems, measurement conversions, and decimal operations to solve problems involving money (MTR.7.1). This benchmark connects to previous work in Grade 4 where students added and subtracted money in real world situations (MA.4.M.2.2). Money contexts continue to be important throughout the later grades.

- During instruction, teachers should provide strategies for helping students comprehend what is happening in the problem and what needs to be found before students complete numerical calculations. Students should be encouraged to estimate a solution and model a problem using manipulatives, pictures and/or equations before computing (K12.MTR.2.1).

**Common Misconceptions or Errors**

- Students can misinterpret multi-step word problems and only complete one of the steps. Encourage students to estimate reasonable solutions and justify models to solve before computing.

**Instructional Tasks**

*Instructional Task 1*

Jordan was saving his money to buy a remote control motorcycle. He saved $37.81 from his allowance and received two checks worth $10.00 each for his birthday. Jordan also has a half dollar coin collection with 30 coins in it. If the motorcycle costs $72.29, does Jordan have enough money to buy the motorcycle?

**Instructional Items**

*Instructional Item 1*

Pecans and almonds each cost $6.80 per pound. Kendall buys 1.5 pounds of pecans and 2.5 pounds of almonds. What is the total cost of Kendall’s purchase?

*Instructional Item 2*

A table below shows the costs of items at a candy store.

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chocolate bar</td>
<td>$2.99 each</td>
</tr>
<tr>
<td>Candy rope</td>
<td>$0.45 per ounce</td>
</tr>
<tr>
<td>Peanut butter cups</td>
<td>$1.50 each</td>
</tr>
<tr>
<td>Bubble gum</td>
<td>$0.29 per ounce</td>
</tr>
</tbody>
</table>

Wayne has $10 to spend. Select all the purchases that Wayne has enough money to make.

- 3 chocolate bars
- 25 ounces of candy rope
- 2 chocolate bars and 3 peanut butter cups
- 3 peanut butter cups and 5 ounces of bubble gum
- 24 ounces of bubble gum and 2 ounces of candy rope

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*
Geometric Reasoning

**MA.5.GR.1** Classify two-dimensional figures and three-dimensional figures based on defining attributes.

**MA.5.GR.1.1 Benchmark**

Classify triangles or quadrilaterals into different categories based on shared defining attributes. Explain why a triangle or quadrilateral would or would not belong to a category.

**Benchmark Clarifications:**
*Clarification 1:* Triangles include scalene, isosceles, equilateral, acute, obtuse and right; quadrilaterals include parallelograms, rhombi, rectangles, squares and trapezoids.

**Related Benchmarks/Horizontal Alignment**
- There are no direct connections outside of this standard; however, teachers are encouraged to find possible indirect connections.

**Terms from the K-12 Glossary**
- Acute Triangle
- Equilateral Triangle
- Isosceles Triangle
- Obtuse Triangle
- Parallelogram
- Quadrilateral
- Rectangle
- Rhombus
- Right Triangle
- Scalene Triangle
- Square
- Trapezoid
- Triangle

**Vertical Alignment**

**Previous Benchmarks**
- MA.4.GR.1.1

**Next Benchmarks**
- MA.912.GR.3.2
**Purpose and Instructional Strategies**

The purpose of this benchmark is for students to understand that shapes can be classified by their attributes and these attributes may place them in multiple categories. In Grade 3, students identified and drew quadrilaterals based on their attributes (MA.3.GR.1.2). In Grade 4, students explored angle classifications and measures in two-dimensional figures (MA.4.GR.1.1). This past work built the understanding required for students to classify triangles and quadrilaterals in Grade 5. Classification of geometric figures will return in high school geometry (MA.912.GR.3.2) using another Grade 5 concept, the coordinate plane.

- The work in Grade 5 will help students to understand that triangles can be defined by two different attributes that students can actually measure: the length of their sides (3 congruent sides, 2 congruent sides, or 0 congruent sides) or by the size of their angle measures (3 acute angles, 2 acute angles and a right angle, or 2 acute angles and an obtuse angle).

- During instruction, it is important for students to have practice with classifying figures in multiple ways so they can better understand the relationship between attributes of the geometric figures. In addition, students should practice this concept by using graphic organizers such as, flow charts, T-charts and Venn diagrams (MTR.2.1).

- This benchmark requires a strong understanding and use of geometry vocabulary. Allow students to use math discourse throughout instruction to compare the attributes of geometric figures. For example, pose questions such as, “Why is a square always a rhombus?” and “Why is a rhombus not always a square?” Lesson activities should require students to justify their thinking when making mathematical arguments about geometric figures (MTR.4.1).

**Common Misconceptions or Errors**

- Students may think that when describing and classifying geometric shapes and placing them in subcategories, the last subcategory is the only classification that can be used.

- Students may think that a geometric figure can only be classified in one way. For example, a square (a shape with 4 congruent sides and 4 congruent angles) can also be a parallelogram because it contains 2 pairs of sides that are congruent and parallel.
**Instructional Tasks**

*Instructional Task 1*

Part A. Roll a number cube twice and write a statement based on the key below.

**Number Cube Key**
- 1 – Equilateral
- 2 – Acute
- 3 – Right
- 4 – Obtuse
- 5 – Isosceles
- 6 – Scalene

Part B. Write a statement that reads, “A(n) _________ (roll 1) triangle is _____________ (always, sometimes or never) a(n) _________ triangle (roll 2).” Complete your statement by determining whether the category of triangle from roll 1 is always, sometimes, or never the category of triangle from roll 2. Complete this process three more times for a total of four statements.

Part C. Choose one of the statements that you said is sometimes true. Give an example of when the statement is true and when the statement is not true using picture models or words. If none of your statements are sometimes true, then create one to give an example.

**Instructional Items**

*Instructional Item 1*

Choose all the shapes that can always be classified as parallelograms.
- a. Trapezoid
- b. Rectangle
- c. Rhombus
- d. Square
- e. Equilateral Triangle

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.*

**Benchmark**

*MA.5.GR.1.2*

Identify and classify three-dimensional figures into categories based on their defining attributes. Figures are limited to right pyramids, right prisms, right circular cylinders, right circular cones and spheres.

**Benchmark Clarifications:**

*Clarification 1:* Defining attributes include the number and shape of faces, number and shape of bases, whether or not there is an apex, curved or straight edges and curved surfaces or flat faces.
### Related Benchmarks/Horizontal Alignment
- There are no direct connections outside of this standard; however, teachers are encouraged to find possible indirect connections.

### Terms from the K-12 Glossary
- Cone
- Cylinders
- Edge
- Prisms
- Pyramids
- Sphere
- Vertex

### Vertical Alignment

#### Previous Benchmarks
- MA.4.GR.1.1

#### Next Benchmarks
- MA.6.GR.2.4

### Purpose and Instructional Strategies
The purpose of this benchmark is to begin formal categorization of three-dimensional figures based on attributes of their faces, edges and vertices. Three-dimensional figures were identified informally in Kindergarten and Grade 1. The work in Grade 5 prepares students for more detailed work with three-dimensional figures, including finding volumes and surface areas using formulas and nets (MA.6.GR.2.4).

- Instruction includes having students use language they have already learned and apply it to a larger variety of figures including prisms and pyramids with any number of sides.
- During instruction teachers should explain that a cone has one flat face, a cylinder has two flat faces and a sphere does not have any flat faces, but each of these figures has a curved surface.

### Common Misconceptions or Errors
- Students may believe that the orientation of a figure changes the three-dimensional shape.

### Instructional Tasks

#### Instructional Task 1
Categorize the three-dimensional figures below into the table.

<table>
<thead>
<tr>
<th>Contains circular faces</th>
<th>Contains rectangular faces</th>
<th>May contain a rectangular face</th>
<th>Contains no faces</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Right pyramids
- Spheres
- Right circular cylinders
- Right prisms
- Right circular cones
Instructional Items

Instructional Item 1
Select all the shapes that contain an apex.
   a. Right pyramids
   b. Spheres
   c. Right circular cylinders
   d. Right prisms
   e. Right circular cones

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.

MA.5.GR.2 Find the perimeter and area of rectangles with fractional or decimal side lengths.

MA.5.GR.2.1

Benchmark

MA.5.GR.2.1 Find the perimeter and area of a rectangle with fractional or decimal side lengths using visual models and formulas.

Benchmark Clarifications:
Clarification 1: Instruction includes finding the area of a rectangle with fractional side lengths by tiling it with squares having unit fraction side lengths and showing that the area is the same as would be found by multiplying the side lengths.
Clarification 2: Responses include the appropriate units in word form.

Related Benchmarks/Horizontal Alignment
- MA.5.NSO.2.3/2.4/2.5
- MA.5.FR.2.1/2.2/2.3
- MA.5.AR1.2
- MA.5.M.1.1

Terms from the K-12 Glossary
- Area Model
- Perimeter

Vertical Alignment

Previous Benchmarks
- MA.3.GR.2.3
- MA.4.GR.2.1

Next Benchmarks
- MA.6.GR.1.3
Purpose and Instructional Strategies

The purpose of this benchmark is for students to understand how to work with fractional and decimal sums and products when calculating perimeter and area. This benchmark connects to previous work where students found areas and perimeters with whole number side lengths in Grade 4 (MA.4.GR.2.1) and prepares for future work of finding area and perimeter on a coordinate plane in Grade 6 (MA.6.GR.1.3).

- During instruction, teachers should encourage students to use models or drawings to assist them with finding the perimeter and area of a rectangle and have them explain how they used the model or drawing to arrive at the solution getting them to understand that multiplying fractional side lengths to find the area is the same as tiling a rectangle with unit squares of the appropriate unit fraction side lengths (MTR.5.1).
- This benchmark provides a natural real-world context and also a visual model for the multiplication of fractions and decimals. When finding the area, teachers can begin with students modeling multiplication with whole numbers and progress into the fractional and decimal parts, such as area models using rectangles or squares, fraction strips/bars and sets of counters. For example, ask questions such as, “What does $2 \times 3$ mean?” Then, follow with questions for multiplication with fractions, such as, “What does $\frac{3}{4} \times 1\frac{1}{3}$ mean?” “What does $\frac{3}{4} \times 7$ mean?” “What does $7 \times \frac{3}{4}$ mean?” (MTR.2.1, MTR.3.1, MTR.5.1).

Common Misconceptions or Errors

- Students may believe that multiplication always results in a larger number. Working with area provides them with concrete situations where this is not true. For example a city block that is $\frac{1}{10}$ mile by $\frac{1}{10}$ mile has an area of $\frac{1}{100}$ of a square mile.
- Students have difficulty connecting visual models to the symbolic representation using equations. Use concrete visuals to represent problems.

Instructional Tasks

**Instructional Task 1**
Margaret draws a rectangle with a length of 5.2 inches. The width of her rectangle is one-half its length.

Part A. Draw Margaret’s rectangle and show its dimensions.
Part B. What is the perimeter of her rectangle in inches?
Part C. What is the area of her rectangle in square inches?

Instructional Items

**Instructional Item 1**
What is the area of the square below?

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*
MA.5.GR.3 Solve problems involving the volume of right rectangular prisms.

MA.5.GR.3.1

Benchmark
Explore volume as an attribute of three-dimensional figures by packing them with unit cubes without gaps. Find the volume of a right rectangular prism with whole-number side lengths by counting unit cubes.

Benchmark Clarifications:
Clarification 1: Instruction emphasizes the conceptual understanding that volume is an attribute that can be measured for a three-dimensional figure. The measurement unit for volume is the volume of a unit cube, which is a cube with edge length of 1 unit.

Related Benchmarks/Horizontal Alignment
- MA.5.NSO.2.1

Terms from the K-12 Glossary

Vertical Alignment
Previous Benchmarks
- MA.3.GR.2.1

Next Benchmarks
- MA.6.GR.2.3

Purpose and Instructional Strategies
This benchmark introduces volume to students. Their prior experiences with volume were restricted to liquid volume (also called capacity). The concept of volume should be extended from the understanding of area starting in Grade 3 (MA.3.GR.2.1), with the idea that a layer (such as the bottom of cube) can be built up by adding more layers of unit cubes. In Grade 6, (MA.6.GR.2.3) students solve volume problems involving rectangular prisms with fraction and decimal side lengths.

- As students develop their understanding of volume, they recognize that a 1-unit by 1-unit by 1-unit cube is the standard unit for measuring volume. This cube has a length of 1 unit, a width of 1 unit and a height of 1 unit and is called a cubic unit. This cubic unit is written with an exponent of 3 (e.g., in³, m³). Students connect this notation to their understanding of powers of 10 in our place value system (K12.MTR.5.1).

Example:

Common Misconceptions or Errors
- Students may incorrectly fill figures to find volume with cubes. Students need to ensure there is no empty space included and that unit cubes are equally-sized and packed tightly in without overlaps.
**Instructional Tasks**

*Instructional Task 1*

Molly is putting her cube-shaped blocks into their storage container after she finishes playing with her sister. The storage container is shaped like a right rectangular prism and she has a total of 120 blocks. The bottom layer of her storage container holds exactly 6 rows of 4 blocks each with no gaps or overlaps. The storage container holds exactly 6 layers of blocks with no gaps or overlaps.

Part A. Will all of Molly’s blocks fit in the storage container? Explain how you know using drawings and equations.

Part B. If there is enough room, determine how many more blocks Molly could fit in the storage container. If there is not enough room, determine how many blocks will not fit be able to fit in the storage container.

**Instructional Items**

*Instructional Item 1*

What is the volume of the right rectangular prism?

---

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.*

**MA.5.GR.3.2**

**Benchmark**

Find the volume of a right rectangular prism with whole-number side lengths using a visual model and a formula.

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes finding the volume of right rectangular prisms by packing the figure with unit cubes, using a visual model or applying a multiplication formula.

*Clarification 2:* Right rectangular prisms cannot exceed two-digit edge lengths and responses include the appropriate units in word form.

**Related Benchmarks/Horizontal Alignment**

- MA.5.NSO.2.1

**Terms from the K-12 Glossary**

- Rectangular Prism

**Vertical Alignment**

*Previous Benchmarks*

- MA.3.GR.2.2

*Next Benchmarks*

- MA.6.GR.2.3
Purpose and Instructional Strategies

The purpose of this benchmark is for students to make connections between packing a right rectangular prism with unit cubes to determine its volume and developing and applying a multiplication formula to calculate it more efficiently. Students have developed experience with area since Grade 3 (MA.3.GR.2.2). For volume, side lengths are limited to whole numbers in Grade 5, and problems extend to fraction and decimal side lengths in Grade 6 (MA.6.GR.2.3).

- Instruction should make connections between the exploration expected of MA.5.GR.3.1 and what is happening mathematically when calculating volume (MTR.2.1).
- Instruction should begin by connecting the measurement of a right rectangular prism to the calculation of a rectangle’s area. The bottom layer of the prism is packed with a number of rows with a number of cubes in each, like area of a rectangle is calculated with unit squares. From there, the third dimension (height) of the prism is calculated by the number of layers stacked atop one another.
- Having students explore how volume is calculated helps students see the patterns and develop a multiplication formula that will help them make sense of the two most common volume formulas, \( V = B \times h \) (where \( B \) represents the area of the rectangular prism’s base) and \( V = l \times w \times h \). If students understand conceptually what the formulas mean, they are more likely to use them effectively and efficiently (MTR.5.1).
- When students use a multiplication formula, it is important for them to see that it is a matter of choice which dimensions of rectangular prisms are named length, width and height. This will help students understand that when calculating the volume of a rectangular prism, the three dimensions are multiplied together and that the order of factors does not matter (commutative property of multiplication).

Common Misconceptions or Errors

- Students may confuse the difference between \( b \) in the area formula \( A = b \times h \) and \( B \) in the volume formula \( V = B \times h \). When building understanding of the volume formula for right rectangular prisms, teachers and students should include a visual model to justify their calculations.
- Students may make computational errors when calculating volume. Encourage them to estimate reasonable solutions before calculating and justify their solutions after. Instruction can also encourage students to find efficient ways to use the formula. For example, when calculating the volume of a rectangular prism using the formula \( V = 45 \times 12 \times 2 \), students may find calculating easier if they multiply \( 45 \times 2 \) (90) first, instead of \( 45 \times 12 \). During class discussions, teachers should encourage students to share their strategies so they can build efficiency.

Instructional Tasks

**Instructional Task 1**

The Great Graham Cracker Company is looking for a new package design for next year’s boxes. The boxes must be a right rectangular prism and measure 144 cubic centimeters.

Part A. What are three package designs the company could use? Draw models and write equations to show their volumes.

Part B. Dr. Cruz, the company’s founder, wants the height of the package to be exactly 8 centimeters. What are two package designs that the company can use? Draw models and write equations to show their volumes.
**Instructional Items**

**Instructional Item 1**
Which of the following equations can be used to calculate the volume of the rectangular prism below?

![Rectangular Prism Diagram]

a. \( V = 96 \times 15 \)
b. \( V = 15 \times 8 \times 12 \)
c. \( V = 15 \times 20 \)
d. \( V = 27 \times 8 \)
e. \( V = 23 \times 12 \)

**Instructional Item 2**
A bedroom shaped like a rectangular prism is 15 feet wide, 32 feet long and measures 10 feet from the floor to the ceiling. What is the volume of the room?

a. 57 cubic ft.
b. 150 cubic ft.
c. 4,500 cubic ft.
d. 4,800 cubic ft.

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.*

**MA.5.GR.3.3**

**Benchmark**

Solve real-world problems involving the volume of right rectangular prisms, including problems with an unknown edge length, with whole-number edge lengths using a visual model or a formula. Write an equation with a variable for the unknown to represent the problem.

*Example:* A hydroponic box, which is a rectangular prism, is used to grow a garden in wastewater rather than soil. It has a base of 2 feet by 3 feet. If the volume of the box is 12 cubic feet, what would be the depth of the box?

**Benchmark Clarifications:**

- **Clarification 1:** Instruction progresses from right rectangular prisms to composite figures composed of right rectangular prisms.
- **Clarification 2:** When finding the volume of composite figures composed of right rectangular prisms, recognize volume as additive by adding the volume of non-overlapping parts.
- **Clarification 3:** Responses include the appropriate units in word form.
Related Benchmarks/Horizontal Alignment

- MA.5.NSO2.1/2.2
- MA.5.FR.1.1
- MA.5.AR.1.1
- MA.5.M.1.1

Terms from the K-12 Glossary

- Composite Figure
- Rectangular Prism

Vertical Alignment

Previous Benchmarks

- MA.4.GR.2.1

Next Benchmarks

- MA.6.GR.2.3

Purpose and Instructional Strategies

The purpose of this benchmark is to solve real-world problems involving right rectangular prisms using a visual model or a formula. The real-world problems can require students to find an unknown side length or find the volume of a composite figure (MTR.7.1), if the figure can be decomposed into smaller right rectangular prisms. Students are expected to write an equation with a variable for the unknown to represent the problem. Similar expectations for area were developed in Grade 4 (MA.4.GR.2.1) and this work will be extended to include fraction and decimal side lengths in Grade 6 (MA.6.GR.2.3).

- Instruction of this benchmark can be combined with MA.5.GR.3.2 as students develop and apply understanding of calculating volume of right rectangular prisms using visual models and formulas (MTR.2.1).
- While finding volume, teachers should have students communicate and justify their decisions while solving problems (MTR.4.1).
- Instruction may include problems with the unknown side length being a fraction (MA.5.FR.1.1). For example, if a box has a base of 5in x 3in, and a volume of 20in$^3$, what is the length of its missing side?
- During instruction teachers should allow students the flexibility to use different equations for the same problem. For example, to find the height of a rectangular prism with volume 120 and base dimensions 3 and 10, students can use any of the follow equations: $120 = 3 \times 10 \times h$ or $120 = 30h$ or $120 \div 30 = h$.

Common Misconceptions or Errors

- Students may confuse the difference between $b$ in the area formula $A = b \times h$ and $B$ in the volume formula $V = B \times h$. When building understanding of the volume formula for right rectangular prisms, teachers and students should include a visual model to use to justify their calculations.
- Students may make computational errors when calculating volume. Encourage them to estimate reasonable solutions before calculating and justify their solutions after. Instruction can also encourage students to find efficient ways to use the formula. For example, when calculating the volume of a rectangular prism using the formula, $V = 45 \times 12 \times 2$, students may find calculating easier if they first multiply 45 x 2 (90), instead of 45 x 12. During class discussions, teachers should encourage students to share their strategies so they can build efficiency.
**Instructional Tasks**

*Instructional Task 1*

The Great Graham Cracker Company places packages of their graham crackers into a larger box for shipping to area grocery stores. Each package of graham crackers is a right rectangular prism that measures 18 cubic inches. The base of each package of graham crackers measures 2 inches by 3 inches. Packages are placed upright into the shipping box.

Part A. If the larger shipping box is a cube with edges that are each 30 inches, how many layers of graham cracker packages can the shipping box hold? Show your thinking using a visual model and equation(s).

Part B. Will the packages reach the top of the shipping box? If not, what will be the length of the gap from the top of the package to the top of the shipping box?

Part C. How many graham cracker packages will fit in the shipping box?

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**Instructional Items**

*Instructional Item 1*

Select all of the following that could be the dimensions of the base of a rectangular box with height of 16in and volume of 128in³.

a. 2in x 4in  
b. 3in x 3in  
c. 1in x 8in  
d. 4in x 2in  
e. 56in x 56in

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.

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MA.5.GR.4 Plot points and represent problems on the coordinate plane.

MA.5.GR.4.1

**Benchmark**

MA.5.GR.4.1 Identify the origin and axes in the coordinate system. Plot and label ordered pairs in the first quadrant of the coordinate plane.

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes the connection between two-column tables and coordinates on a coordinate plane.

*Clarification 2:* Instruction focuses on the connection of the number line to the x- and y-axis.

*Clarification 3:* Coordinate planes include axes scaled by whole numbers. Ordered pairs contain only whole numbers.

**Related Benchmarks/Horizontal Alignment**

- MA.5.AR.3.2
- MA.5.DP.1.1

**Terms from the K-12 Glossary**

- Coordinate Plane (first quadrant)
- Origin
- x-axis
- y-axis
Purpose and Instructional Strategies

The purpose of this benchmark is for students to extend their thinking from Grade 4 (MA.4.NSO.1.3) about horizontal and vertical number lines to plot and label whole number ordered pairs on a coordinate plane. In addition, students will make a connection between a two-column table and the ordered pairs represented on the coordinate plane. In Grade 6 (MA.6.GR.1.1), students plot rational number pairs in all four quadrants of the coordinate plane.

- During instruction, teachers should relate the coordinate plane as the intersection of two axes – a horizontal number line called the \( x \)–axis and a vertical number line called the \( y \)–axis. The number lines that form the axes are perpendicular and meet at the origin, labeled by the ordered pair (0, 0) (K12.MTR.5.1).
- When students learn to plot ordered pairs represented in a two-column table, they should understand that the ordered pair \((x, y)\) represents how far to travel from the origin along the \( x \)– and \( y \)–axes. For example, students should understand that in the ordered pair \((2, 4)\), the point travels along the \( x \)–axis 2 whole units to the right, and then vertically (parallel to the \( y \)–axis) 4 units up (K12.MTR.5.1).

Common Misconceptions or Errors

- Students can confuse the \( x \)– and \( y \)–values in an ordered pair and move vertically along the \( y \)–axis before moving horizontally along the \( x \)–axis. For example, they may mean to plot and label the ordered pair \((2, 4)\), but plot and label \((4, 2)\) instead. To assist students with this misconception, have students practice with creating directions for their student peers to follow to allow them to gain a better understanding of the direction and distance on the coordinate plane.
- Some students may not understand what an \( x \)– or \( y \)–coordinate value of 0 represents. During instruction, students should justify why ordered pairs with a 0 will plot on the \( x \)–axis or \( y \)–axis.
**Instructional Tasks**

*Instructional Task 1*

Part A. A point has coordinates (3, 5). If you were to graph this point on a coordinate plane, what does the 3 tell you to do?

Part B. Consider the same point with coordinates (3, 5). What does the 5 tell you to do?

Part C. The point above has coordinates (3, 5). Which of these is the $x$ - coordinate? Which of these is the $y$ - coordinate?

**Instructional Items**

*Instructional Item 1*

What ordered pair represents the origin of a coordinate plane?

a. (0, 0)  
b. (1, 0)  
c. (0, 1)  
d. (1, 1)

*Instructional Item 2*

A point has coordinates (1, 6). If you were to plot this point on a coordinate plane, what does the 1 tell you to do?

a. From the origin, move along the $x$ - axis 1 unit up.  
b. From the origin, move along the $y$ - axis 1 unit up.  
c. From the origin, move along the $x$ - axis 1 unit right.  
d. From the origin, move along the $y$ - axis 1 unit right.

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*
**MA.5.GR.4.2**

### Benchmark

**MA.5.GR.4.2** Represent mathematical and real-world problems by plotting points in the first quadrant of the coordinate plane and interpret coordinate values of points in the context of the situation.

*Example:* For Kevin’s science fair project, he is growing plants with different soils. He plotted the point (5, 7) for one of his plants to indicate that the plant grew 7 inches by the end of week 5.

**Benchmark Clarifications:**

*Clarification 1:* Coordinate planes include axes scaled by whole numbers. Ordered pairs contain only whole numbers.

### Related Benchmarks/Horizontal Alignment

- MA.5.AR.1.1
- MA.5.AR.3.2
- MA.5.DP.1.1

### Terms from the K-12 Glossary

- Coordinate Plane (first quadrant)
- Origin
- $x$–axis
- $y$–axis

### Vertical Alignment

**Previous Benchmarks**

- MA.4.NSO.1.3

**Next Benchmarks**

- MA.6.GR.1.1/1.2/1.3

### Purpose and Instructional Strategies

The purpose of this benchmark is for students to interpret coordinate values plotted in mathematical and real-world contexts. Students have been plotting and interpreting numbers on a number line since Kindergarten. Students’ first experience with interpreting points plotted on a coordinate plane is in Grade 5, which leads to the foundational understanding needed throughout middle school.

- An example of interpreting coordinate values of points in a mathematical context could be identifying points of a rectangle plotted on the coordinate plane.
- An example of interpreting coordinate values of points in a real-world context could look like the example in the benchmark description. In this real-world example, students would interpret that each axis represents a variable describing a situation. The $x$–axis represents number of weeks and the $y$–axis represents plants’ heights in inches.
- During instruction, teachers should provide plenty of opportunities for students to both plot and interpret ordered pairs on a coordinate plane. Teachers should connect the expectations of this benchmark with MA.5.GR.4.1 by having students represent the points plotted on two-column tables as well (MTR.4.1, MTR.7.1).
- In real-world contexts teachers should allow students the flexibility to decide which variable is represented by $x$ and which is represented by $y$. Students may be encouraged to explain their preference.
- During instruction, students should be given the flexibility to decide how to scale their graphs for a given real-world context. Students may be encouraged to explain their preference.
Common Misconceptions or Errors

- Students can confuse the $x -$ and $y -$ values in an ordered pair and move vertically along the $y -$axis before moving horizontally along the $x -$axis. For example, they may mean to plot and label the ordered pair $(2, 4)$, but plot and label $(4, 2)$ instead.
- Some students may not understand what an $x -$ or $y -$ coordinate value of 0 represents. During instruction, students should justify why ordered pairs with a 0 will plot on the $x -$axis or $y -$axis.

Instructional Tasks

Instructional Task 1

Lukas can make four bracelets per hour and he will work for five hours. Make a two-column table where the first column contains the numbers 1, 2, 3, 4, 5 indicating the number of hours worked, and the second column shows how many total bracelets he has made in that many hours.

Plot points on the coordinate plane to represent your table, where the $x -$ coordinate represents the number of hours worked and the $y -$ coordinate represents the number of bracelets made.
Instructional Items

Instructional Item 1

The map below shows the location of several places in a town.

The fire department is 2 blocks north of the library. What ordered pair represents the location of the fire department?

- e. (4, 2)
- f. (2, 4)
- g. (4, 8)
- h. (8, 4)

Instructional Item 2

Deanna is plotting a square on the coordinate plane below.

What ordered pair would represent the fourth vertex?

- a. (6, 2)
- b. (2, 6)
- c. (2, 0)
- d. (0, 2)

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.*
Data Analysis & Probability

**MA.5.DP.1** Collect, represent and interpret data and find the mean, mode, median or range of a data set.

**MA.5.DP.1.1**

**Benchmark**

Collect and represent numerical data, including fractional and decimal values, using tables, line graphs or line plots.

*Example:* Gloria is keeping track of her money every week. She starts with $10.00, after one week she has $7.50, after two weeks she has $12.00 and after three weeks she has $6.25. Represent the amount of money she has using a line graph.

**Benchmark Clarifications:**
*Clarification 1:* Within this benchmark, the expectation is for an estimation of fractional and decimal heights on line graphs.
*Clarification 2:* Decimal values are limited to hundredths. Denominators are limited to 1, 2, 3 and 4. Fractions can be greater than one.

**Related Benchmarks/Horizontal Alignment**

- MA.5.NSO.1.4
- MA.5.AR.1.2
- MA.5.GR.4.1/4.2

**Terms from the K-12 Glossary**

- Line Graphs
- Line Plots

**Vertical Alignment**

**Previous Benchmarks**
- MA.4.DP.1.1

**Next Benchmarks**
- MA.6.DP.1.5

**Purpose and Instructional Strategies**

The purpose of this benchmark is to collect and display authentic numerical data in tables, line graphs or line plots, including fractional and decimal values. Students have represented whole number and fractional values using tables, stem-and-leaf plots and line plots in Grade 4 (MA.4.DP.1.1). In Grade 6, this work will extend to box plots and histograms (MA.6.DP.1.5).

- Instruction with line graphs should develop the understanding that values in this graph often represent data that changes over time.
- Instruction should include identifying the meaning of the points presented on the $x$ – axis and $y$ – axis with both axes being labeled correctly.

**Common Misconceptions or Errors**

- For line plots, students may misread a number line and have difficulty because they use whole-number names when counting fractional parts on a number line instead of the fraction name.
**Instructional Tasks**

*Instructional Task 1*

Claire studied the amount of water in different glasses. The data she collected is below. Use her data to create a line plot to show the amount of water in the glasses.

- a. $\frac{1}{2}$
- b. $\frac{1}{4}$
- c. $\frac{1}{8}$
- d. $\frac{1}{4}$
- e. $\frac{1}{4}$
- f. $\frac{5}{8}$
- g. $\frac{3}{8}$
- h. $\frac{5}{8}$
- i. $\frac{1}{8}$
- j. $\frac{1}{8}$

**Instructional Items**

*Instructional Item 1*

A line graph is shown.

![Mass of Newborn Kitten](image)

Part A. What is the approximate change in the kitten’s mass, in grams, between Days 3 and 4?

Part B. What is the approximate change in the kitten’s mass, in grams, between Days 2 and 5?

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.*
### Benchmark

**MA.5.DP.1.2** Interpret numerical data, with whole-number values, represented with tables or line plots by determining the mean, mode, median or range.

**Example:** Rain was collected and measured daily to the nearest inch for the past week. The recorded amounts are 1, 0, 3, 1, 0, 0 and 1. The range is 3 inches, the modes are 0 and 1 inches, and the mean value can be determined as \( \frac{1+0+3+1+0+0+1}{7} \), which is equivalent to \( \frac{6}{7} \) of an inch. This mean would be the same if it rained \( \frac{6}{7} \) of an inch each day.

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes interpreting the mean in real-world problems as a leveling out, a balance point or an equal share.

### Related Benchmarks/Horizontal Alignment

<table>
<thead>
<tr>
<th>Terms from the K-12 Glossary</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Line Plots</td>
</tr>
<tr>
<td>- Mean</td>
</tr>
<tr>
<td>- Median</td>
</tr>
<tr>
<td>- Mode</td>
</tr>
<tr>
<td>- Range</td>
</tr>
</tbody>
</table>

### Vertical Alignment

**Previous Benchmarks**
- MA.4.DP.1.2

**Next Benchmarks**
- MA.6.DP.1.2/1.6

### Purpose and Instructional Strategies

The purpose of this benchmark is to interpret numerical data by using the mean, mode, median and range. This work builds on the previous understanding of mode, median, and range in Grade 4 (MA.4.DP.1.2). In Grade 6, a focus will be on comparing the advantages and disadvantages of the mean and median.

- When finding median and mode, it is important for students to organize their data, putting it in order from least to greatest.
- With the data organized, students can determine:
  - range by subtracting the least value from the greatest value in the set.
  - mode by finding the value that occurs most often.
  - median by finding the value in middle of the set.
  - mean by finding the average of the set of numbers.

### Common Misconceptions or Errors

- Students may confuse the mean and median of a data set. During instruction, teachers should provide students with examples where the median and mean of a data set are not close in value.
### Instructional Tasks

**Instructional Task 1**

Bobbie is a fifth grader who competes in the 100-meter hurdles. In her 8 track meets during the season, she recorded the following times to the nearest second.

<table>
<thead>
<tr>
<th>Track Meet</th>
<th>100-meter hurdle Time (seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>31</td>
</tr>
<tr>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>6</td>
<td>36</td>
</tr>
<tr>
<td>7</td>
<td>17</td>
</tr>
<tr>
<td>8</td>
<td>18</td>
</tr>
</tbody>
</table>

Part A. What is the mean time, in seconds, of Bobbie’s 100-meter hurdles?

Part B. What is the median time, in seconds, of Bobbie’s 100-meter hurdles?

Part C. What is the mode time, in seconds, of Bobbie’s 100-meter hurdles?

Part D. If you were Bobbie, which of these results would you report to your friend?

### Instructional Items

**Instructional Item 1**

There was a pie-eating contest at the county fair. The line plot below shows the number of pies each of the 10 contestants ate. Use the line plot to determine the mean, mode, median and range of the data.

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*