Grade 4 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>focal point for instruction within lesson or task</th>
</tr>
</thead>
<tbody>
<tr>
<td>This section includes the benchmark as identified in the <a href="#">B.E.S.T. Standards for Mathematics</a>. 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></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connecting Benchmarks/Horizontal Alignment</th>
<th>Terms from the K-12 Glossary</th>
</tr>
</thead>
<tbody>
<tr>
<td>in other standards within the grade level or 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>
</tr>
<tr>
<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>
<td></td>
</tr>
</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

*demontstrate 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

*demontstrate 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 B1G-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>
</tr>
</thead>
</table>
| MA.K12.MTR.4.1  
Engage in discussions that reflect on the mathematical thinking of self and others. | ● Student effectively justifies their reasoning for their methods.  
● Student can identify errors within their own work and create possible explanations.  
● When working in small groups, student recognizes errors of their peers and offers suggestions.  
● Student communicates mathematical vocabulary efficiently to others. | ● Teacher purposefully groups students together to provide opportunities for discussion.  
● Teacher chooses sequential representation of methods to help students explain their reasoning. |
| MA.K12.MTR.5.1  
Use patterns and structure to help understand and connect mathematical concepts. | ● Student determines what information is needed and logically follows a plan to solve problems piece by piece.  
● Student is able to make connections from previous knowledge. | ● Teacher allows for students to engage with information to connect current understanding to new methods.  
● Teacher provides opportunities for students to discuss and develop generalizations about a mathematical concept.  
● Teacher provides opportunities for students to develop their own steps in solving a problem. |
| MA.K12.MTR.6.1  
Assess the reasonableness of solutions. | ● Student provides explanation of results.  
● Student continually checks their calculations.  
● Student estimates a solution before performing calculations. | ● Teacher encourages students to check and revise solutions and provide explanations for results.  
● Teacher allows opportunities for students to verify their solutions by providing justifications to self and others. |
| MA.K12.MTR.7.1  
Apply mathematics to real-world contexts. | ● Student relates their real-world experience to the context provided by the teacher during instruction.  
● Student performs investigations to determine if a scenario can represent a real-world context. | ● Teacher provides real-world context in mathematical problems to support students in making connections using models and investigations. |
Grade 4 Areas of Emphasis

In grade 4, instructional time will emphasize four areas:

(1) extending understanding of multi-digit multiplication and division;
(2) developing the relationship between fractions and decimals and beginning operations with both;
(3) classifying and measuring angles; and
(4) developing an understanding for interpreting data to include mode, median and range.

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>Understand Multiplication and Division</th>
<th>Develop Relationship between Fractions and Decimals</th>
<th>Classify and Measure Angles</th>
<th>Interpret Data (Mean, Median, Mode)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA.4.NSO.1.1</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA.4.NSO.1.2</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA.4.NSO.1.3</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA.4.NSO.1.4</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA.4.NSO.1.5</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA.4.NSO.2.1</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA.4.NSO.2.2</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA.4.NSO.2.3</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA.4.NSO.2.4</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA.4.NSO.2.5</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA.4.NSO.2.6</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MA.4.NSO.2.7</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>MA.4.FR.1.1</td>
<td>MA.4.FR.1.2</td>
<td>MA.4.FR.1.3</td>
<td>MA.4.FR.1.4</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------</td>
<td>-------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Fractions</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Algebraic Reasoning</td>
<td>MA.4.AR.1.1</td>
<td>X</td>
<td>MA.4.AR.1.2</td>
<td>MA.4.AR.1.3</td>
</tr>
<tr>
<td>Geometric Reasoning</td>
<td>X</td>
<td>X</td>
<td>MA.4.GR.1.1</td>
<td>X</td>
</tr>
<tr>
<td>Data Analysis &amp; Probability</td>
<td>MA.4.DP.1.1</td>
<td>X</td>
<td>MA.4.DP.1.2</td>
<td>MA.4.DP.1.3</td>
</tr>
</tbody>
</table>
Number Sense and Operations

MA.4.NSO.1 Understand place value for multi-digit numbers.

**MA.4.NSO.1.1**

**Benchmark**

Express how the value of a digit in a multi-digit whole number changes if the digit moves one place to the left or right.

**Related Benchmarks/Horizontal Alignment**
- MA.4.NSO.2.5

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

**Vertical Alignment**

**Previous Benchmarks**
- MA.3.NSO.2.3

**Next Benchmarks**
- MA.5.NSO.1.1

**Purpose and Instructional Strategies**

The purpose of this benchmark is to extend students’ understanding of place value to build a foundation for multiplying and dividing by 10. Students should work with the idea that the tens place is ten times as much as the ones place, and the ones place is 1/10 the size of the tens place. Work in this benchmark builds from student understanding of what happens when they multiply by a multiple of 10 (MA.3.NSO.2.3). Students use these patterns as they generalize place value relationships with decimals in Grade 5 (K12.MTR.5.1).

- Throughout instruction, teachers should have students practice this concept using place value charts, base-ten blocks and/or digit cards to manipulate and investigate place value relationships.

**Common Misconceptions or Errors**

- Students do not understand that when the digit moves to the left that it has increased a place value which is the same thing as multiplying by 10 and when the digit moves to the right that it has decreased a place value, which is the same thing as dividing by 10. It is important to have math discourse throughout instruction about why this is happening.
**Instructional Tasks**

**Instructional Task 1**
Paul and his family traveled 528 miles for their summer vacation. Wayne and his family traveled 387 miles for their summer vacation. How much greater is the digit eight in 387 than the digit eight in 528? Have students explain their answer and discuss what role, if any, the other digits play.

**Instructional Items**

**Instructional Item 1**
The clues below describe the 4 digits of a mystery number that contains the digits 3,4,7,8.
- The value of the 8 is 10 times the value of the 8 in 3,518.
- The value of the 7 is 100 times the value of the 7 in 1,273.
- The value of the 4 is 100 times the value of the 4 in 7,284.
- The missing place value is the 3.

What is the number?

a. 7,483  
b. 8,743  
c. 7,834  
d. 4,738

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

**MA.4.NSO.1.2**

**Benchmark**

**MA.4.NSO.1.2**
Read and write multi-digit whole numbers from 0 to 1,000,000 using standard form, expanded form and word form.

*Example:* The number two hundred seventy-five thousand eight hundred two written in standard form is 275,802 and in expanded form is 200,000 + 70,000 + 5,000 + 800 + 2 or $(2 \times 100,000) + (7 \times 10,000) + (5 \times 1,000) + (8 \times 100) + (2 \times 1)$.

**Related Benchmarks/Horizontal Alignment**

- MA.4.NSO.2.5

**Terms from the K-12 Glossary**

- Whole Number

**Vertical Alignment**

**Previous Benchmarks**
- MA.3.NSO.1.1
- MA.3.NSO.1.2

**Next Benchmarks**
- MA.5.NSO1.2
**Purpose and Instructional Strategies**

The purpose of this benchmark is for students to read numbers appropriately and to write numbers in all forms and have flexibility with the different forms. This benchmark builds on the work in Grade 3 of reading and writing numbers in multiple ways to 10,000 (MA.3.NSO.1.1).

- Students should also have opportunities to explore the idea that 285 could also be 28 tens plus 5 ones or 1 hundred, 18 tens and 5 ones.
- Decomposing numbers flexibly helps students reason through multiplication and division strategies. Multiple representations of the number (K12.MTR.2.1) allow for opportunities to apply the commutative and associative properties. This will allow students to explain their thinking and show their work using place-value strategies and algorithms, in addition to verifying that their answer is reasonable.

**Common Misconceptions or Errors**

- Students may have misconceptions when translating word form to standard form. Numbers like one thousand often do not cause a problem; however, a number like three thousand four can cause problems for students. Many students will understand the 3000 and the 4 but then instead of placing the 4 in the ones place, students will write the numbers as they hear them, 30004, not understanding that this number represents more than 3004.

**Instructional Tasks**

*Instructional Task 1*

Write each number in standard form and in expanded form.

a. *Eight hundred two thousand five hundred fifty*  
b. *Twenty thousand three*  
c. *One thousand four hundred fifty six*  
d. *Seven hundred nineteen thousand two hundred forty eight*  
e. *Three thousand eighty one*

**Instructional Items**

*Instructional Item 1*

Select all the ways to rename the number 2,340.

a. 234 tens  
b. 2,340 ones  
c. 234 thousands  
d. *2 hundreds and 34 ones*  
e. 2 thousands and 34 tens  
f. 2 thousands and 34 ones  
g. 2 thousands and 34 hundreds

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*
MA.4.NSO.1.3

**Benchmark**

**MA.4.NSO.1.3** Plot, order and compare multi-digit whole numbers up to 1,000,000.

*Example:* The numbers 75,421; 74,241 and 74,521 can be arranged in ascending order as 74,241; 74,521 and 75,421.

**Benchmark Clarifications:**

*Clarification 1:* When comparing numbers, instruction includes using an appropriately scaled number line and using place values of the hundred thousands, ten thousands, thousands, hundreds, tens and ones 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.4.NSO.2.5

**Terms from the K-12 Glossary**

- Whole Number

**Vertical Alignment**

**Previous Benchmarks**
- MA.3.NSO.1.3

**Next Benchmarks**
- MA.5.NSO.1.4

**Purpose and Instructional Strategies**

The purpose of this benchmark extends up to 1,000,000 the work from Grade 3 of plotting, ordering and comparing numbers using place value up to 10,000.

- Place value strategies should be used to compare numbers. For example, in comparing 65,570 and 65,192, a student might say both numbers have the same value of 10,000s and the same value of 1000s; however, the value in the 100s place is different so that is where the comparison of the two numbers would be determined.

- Students need opportunities to compare numbers in various situations to build procedural fluency and to compare numbers with the same number of digits, numbers that have the same number in the leading digit position, and numbers that have different numbers of digits and different leading digits (e.g., compare the four numbers) (K12.MTR.5.1).

- As stated in MA.3.NSO.1.3, it is important for teachers to define the meaning of the ≠ symbol through instruction. It is recommended that students use = and ≠ symbols first. Once students have determined that numbers are not equal, then they can determine “how” they are not equal, with the understanding now the number is either < or >. If students cannot determine if amounts are ≠ or = then they will struggle with < or >. This will build understanding of statements of inequality and help students determine differences between inequalities and equations.
Common Misconceptions or Errors

- Students often assume that the first digit of a multi-digit number indicates the size of a number. The assumption is made that 864 is greater than 2001 because students are focusing on the leading digit instead of the place values of the number.

Instructional Tasks

Instructional Task 1

Students will create numbers that meet specific criteria through this performative task. Provide students with cards numbered 0 through 9. Ask students to select 4 to 6 cards, then using all the cards make the largest number possible with all cards, the smallest number possible, the closest number to 6000, a number that is greater than 6000, or a number that is less than 6000, etc. Then discussions with the students about the numbers will solidify their understanding.

Instructional Items

Instructional Item 1

Which number correctly completes this inequality?

\[ \underline{\phantom{0000}} \underline{\phantom{0000}} \underline{\phantom{0000}} \underline{\phantom{0000}} \underline{\phantom{0000}} < 44,038 \]

a. 40,000 + 600 + 30 + 7
b. 40,000 + 5,000 + 30 + 7
c. Forty – four thousand, nine hundred fifty
d. Forty – four thousand, one hundred twelve

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

MA.4.NSO.1.4

Benchmark

MA.4.NSO.1.4 Round whole numbers from 0 to 10,000 to the nearest 10, 100 or 1,000.

Example: The number 6,325 is rounded to 6,300 when rounded to the nearest 100.
Example: The number 2,550 is rounded to 3,000 when rounded to the nearest 1,000.

Related Benchmarks/Horizontal Alignment

- MA.4.NSO.2.5

Terms from the K-12 Glossary

- Whole Number

Vertical Alignment

Previous Benchmarks

- MA.3.NSO.1.4

Next Benchmarks

- MA.5.NSO.1.5
**Purpose and Instructional Strategies**

The purpose of this benchmark is for students to use place value understanding to explain and reason about rounding. Students should have numerous experiences using a number line and a one hundred chart as tools to support their work with rounding. This benchmark continues instruction of rounding from Grade 3, where students rounded numbers from 0 to 1,000 to the nearest 10 or 100 (MA.3.NSO.1.4).

- In Grade 4, rounding is not a new concept and students need to build on the skills of rounding to the nearest 10 or 100 (MA.3.NSO.1.4) to include larger numbers and place value. What is new for Grade 4 is rounding to the nearest 1,000 and to digits other than the leading digit (e.g., round 23,960 to the nearest hundred). This requires more complex thinking than rounding to the nearest ten thousand because the digit in the hundreds place represents 900 and when rounded it becomes 1,000, not just zero. Students should also begin to develop some efficient rules for rounding fluently by building from the basic strategy of - “Is 37 closer to 30 or 40?” Number lines are effective tools for this type of thinking. Students need to generalize the rule for much larger numbers and rounding to values that are not the leading digit.

- Rounding numbers is a skill that helps students estimate reasonable solutions when using the four operations. Instruction of rounding skills should be taught within the context of estimating while using the four operations. Rounding numbers in an expression should be done before performing operations to estimate reasonable sums or differences. Rounding sums, differences, products and quotients should not be done after students have already performed operations.

- Instruction should not focus on tricks for rounding that do not focus on place value understanding or the use of number lines.

**Common Misconceptions or Errors**

- Teaching only rote procedures for rounding may lead to misconceptions about the magnitudes of numbers. Students may need to have a strong foundation of place value concepts before students may find success with rounding.

**Instructional Tasks**

*Instructional Task 1*

What is the smallest number that rounds to 4,000 to the nearest ten?  
What is the smallest number that rounds to 4,000 to the nearest hundred?

**Instructional Items**

*Instructional Item 1*

What is 495,686 rounded to the nearest ten thousand?

a. 400,000  
b. 490,000  
c. 495,150  
d. 500,000

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*
MA.4.NSO.1.5

Benchmark

MA.4.NSO.1.5  Plot, order and compare decimals up to the hundredths.

Example: The numbers 3.2; 3.24 and 3.12 can be arranged in ascending order as 3.12; 3.2 and 3.24.

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

Related Benchmarks/Horizontal Alignment

- MA.4.NSO.2.6/2.7
- MA.4.FR.1.2/1.4
- MA.4.DP.1.1/1.3

Terms from the K-12 Glossary

Vertical Alignment

Previous Benchmarks
- MA.3.NSO.1.3

Next Benchmarks
- MA.5.NSO.1.4

Purpose and Instructional Strategies

The purpose of this benchmark is for students to plot, order and compare decimals using place value. Grade 4 contains the first work with decimals. During instruction make connections to decimal fractions (e.g., \( \frac{1}{10}, \frac{1}{100} \)) (MA.4.FR.1.2).

- For instruction, teachers should show students how to represent these decimals on scaled number lines. Students should use place value understanding to make comparisons.
- Students learn that the names for decimals match their fraction equivalents (e.g., 2 tenths = 0.2 = \( \frac{2}{10} \)).
- Students build area models (e.g., a 10 x 10 grid) and other models to compare decimals.

Common Misconceptions or Errors

- Students treat decimals as whole numbers when making comparison of two decimals. They think the longer the number, the greater the value. For example, they think that 0.04 is greater than 0.4.
### Instructional Tasks

#### Instructional Task 1

Use relational symbols to fill in the blanks to compare the numbers.

1. \( 3 \text{ tenths} + 5 \text{ hundredths} \_\_ 3 \text{ tenths} + 11 \text{ hundredths} \)
2. \( 4 \text{ hundredths} + 5 \text{ tenths} \_\_ 1 \text{ tenth} + 33 \text{ hundredths} \)
3. \( 4 \text{ hundredths} + 1 \text{ tenth} \_\_ 1 \text{ tenth} + 4 \text{ hundredths} \)
4. \( 5 \text{ hundredths} + 1 \text{ tenth} \_\_ 15 \text{ hundredths} + 0 \text{ tenths} \)
5. \( 5 \text{ hundredths} + 1 \text{ tenth} \_\_ 0 \text{ tenths} + 15 \text{ hundredths} \)

### Instructional Items

#### Instructional Item 1

Select all the values that would make the comparison \( 0.6 > __ \) a true statement.

- a. 0.06
- b. 0.70
- c. 0.8
- d. 0.5
- e. 0.4

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

**MA.4.NSO.2** Build an understanding of operations with multi-digit numbers including decimals.

**MA.4.NSO.2.1**

### Benchmark

**MA.4.NSO.2.1** Recall multiplication facts with factors up to 12 and related division facts with automaticity.

### Related Benchmarks/Horizontal Alignment

- MA.4.FR.2.4
- MA.4.AR.2.1

### Terms from the K-12 Glossary

- Associative Property of Multiplication
- Commutative Property of Multiplication
- Distributive Property
- Factor

### Vertical Alignment

#### Previous Benchmarks

- MA.3.NSO.2.2/2.4

#### Next Benchmarks

- MA.5.NSO.2.1/2.2
Purpose and Instructional Strategies

The purpose of this benchmark is for students to be able to state (recall) their multiplication and division facts in an effortless manner. This work builds on prior multiplication and related division fact strategy work from Grade 3 (MA.3.NSO.2.4). Students also understand that multiplication is commutative and that the Distributive Property can be used to break more complex facts into easier ones.

- To help reach automaticity of multiplication and related division facts, the related concepts should be considered to be foundational. These concepts may be addressed during the exploration or procedural reliability stage (MA.3.NSO.2.4) of the benchmark progression.
  - Multiplication by zeroes and ones
  - Doubles (2s facts)
  - Double and Double Again (4s)
  - Doubling three times (8s)
  - Tens facts (relating to place value, 5 x 10 is 5 tens or 50)
  - Five facts (half of tens or connect to the analog clock)
  - Skip counting (counting groups of __ and knowing how many groups have been counted)
  - Square numbers (the physical and visual representation of these facts makes a square - ex: 3 x 3)
  - Nines (10 groups less 1 group; e.g., 9 x 3 is 10 groups of 3 minus 1 group of 3 so 30 – 3 = 27)
  - Decomposing into known facts (6 x 7 is a double - 6 x 6 - plus one more group of 6)
  - Elevens (10 groups and 1 group more; e.g., 11 x 5 is 10 groups of 5 plus 1 group of 5 so 50 + 5 = 55)
  - Decomposing using the Distributive property (12 x 6 = (10 x 6) + (2 x 6) = (60) + (12) = 72)

- Throughout K-5 instruction, it is not recommended to use timed fact fluency assessments to learn and practice facts.

Common Misconceptions or Errors

- Many students have difficulty with multiplication and related division facts when teachers rely solely on memorization of facts. It is important that strategy work and conceptual understanding is the foundation of instruction for multiplication and division facts.

Instructional Tasks

Instructional Task 1

Explain how the 2s facts, 4s facts, and 8s facts for multiplication are related.
Instructional Items

**Instructional Item 1**
Select all the true equations.

- a. 11 = 132 ÷ 11
- b. 7 × 12 = 84
- c. 56 = 7 × 7
- d. 49 ÷ 7 = 7
- e. 6 × 11 = 66

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

**MA.4.NSO.2.2**

**Benchmark**

**MA.4.NSO.2.2** Multiply two whole numbers, up to three digits by up to two digits, with procedural reliability.

**Benchmark Clarifications:**
*Clarification 1:* Instruction focuses on helping a student choose a method they can use reliably.
*Clarification 2:* Instruction includes the use of models or equations based on place value and the distributive property.

**Related Benchmarks/Horizontal Alignment**

- MA.4.AR.1.1
- MA.4.M.1.2
- MA.4.M.2.1
- MA.4.GR.2.1/2.2

**Terms from the K-12 Glossary**

- Distributive Property
- Expression
- Equation
- Factor

**Vertical Alignment**

**Previous Benchmarks**
- MA.3.NSO.2.2/2.3/2.4

**Next Benchmarks**
- MA.5.NSO.2.1
**Purpose and Instructional Strategies**

The purpose of this benchmark is for students to choose a reliable method for multiplying 3 digit numbers by 2 digit numbers. It builds on the understanding developed in Grade 3 (MA.3.NSO.2.2/2.3/2.4), builds on automaticity (MA.4.NSO.2.1) and prepares for procedural fluency (MA.4.NSO.2.3 and MA.5.NSO.2.1).

- For instruction, students may use a variety of strategies when multiplying whole numbers and use words and diagrams to explain their thinking (K12.MTR.2.1). Strategies can include using base-ten blocks, area models, partitioning, compensation strategies and a standard algorithm.
- Using place value strategies enables students to develop procedural reliability with multiplication and transfer that understanding to division. Procedural reliability expects students to utilize skills from the exploration stage to develop an accurate, reliable method that aligns with their understanding and learning style.
- The area model shows students how they can use place value strategies and the distributive property to find products with multi-digit factors.

![Area Model](image)

### Common Misconceptions or Errors

- Students that are taught a standard algorithm without any conceptual understanding will often make mistakes. For students to understand a standard algorithm or any other method, they need to be able to explain the process of the method they chose and why it works. This explanation may include pictures, properties of multiplication, decomposition, etc.

### Instructional Tasks

**Instructional Task 1**

Paul orders tomatoes for The Produce Shop. Each box has 24 tomatoes in it. If Paul orders 32 boxes of tomatoes, how many tomatoes will The Produce Shop have to sell? Use a strategy of your choice to find the number of tomatoes The Produce Shop has to sell. Explain your thinking and why your method works.

### Instructional Items

**Instructional Item 1**

The product of 57 and 92 is _____.

a. 627  
b. 4,644  
c. 5,234  
d. 5,244

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.*
**MA.4.NSO.2.3**

**Benchmark**

Multiply two whole numbers, each up to two digits, including using a standard algorithm with procedural fluency.

**Related Benchmarks/Horizontal Alignment**
- MA.4.AR.1.1
- MA.4.M.1.2
- MA.4.M.2.1
- MA.4.GR.2.1/2.2

**Terms from the K-12 Glossary**
- Expression
- Equation
- Factor

**Vertical Alignment**

<table>
<thead>
<tr>
<th>Previous Benchmarks</th>
<th>Next Benchmarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA.3.NSO.2.2/2.3/2.4</td>
<td>MA.5.NSO.2.1</td>
</tr>
</tbody>
</table>

**Purpose and Instructional Strategies**

The purpose of this benchmark is for students to become procedurally fluent in using a standard algorithm. Work with standard algorithms began in the procedural reliability stage when students explored a variety of methods and learned to use at least one of those methods accurately and reliably.

- It is important to challenge students to explain the steps they follow when using a standard algorithm (i.e. regrouping, proper recording and placement of digits by place value).

**Common Misconceptions or Errors**

- Students that are taught a standard algorithm without any conceptual understanding will often make mistakes. For students to understand a standard algorithm or any other method, they need to be able to explain the process of the method they chose and why it works. This explanation may include pictures, properties of multiplication, decomposition, etc.

- Some students may struggle with this benchmark if they do not have a strong command of basic addition and multiplication facts.

**Instructional Tasks**

*Instructional Task 1*

Using the digits 1, 2, 3 and 4, arrange them to create two 2-digit numbers that when multiplied, will yield the greatest product.
**Instructional Items**

*Instructional Item 1*

Select the expressions that have a product of 480.

a. $10 \times 48$
b. $16 \times 30$
c. $24 \times 24$
d. $32 \times 15$
e. $40 \times 80$

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

**MA.4.NSO.2.4**

**Benchmark**

Divide a whole number up to four digits by a one-digit whole number with procedural reliability. Represent remainders as fractional parts of the divisor.

**Benchmark Clarifications:**

*Clarification 1:* Instruction focuses on helping a student choose a method they can use reliably.

*Clarification 2:* Instruction includes the use of models based on place value, properties of operations or the relationship between multiplication and division.

**Related Benchmarks/Horizontal Alignment**

- MA.4.AR.1.1
- MA.4.M.1.2
- MA.4.M.2.1
- MA.4.GR.2.1/2.2

**Terms from the K-12 Glossary**

- Dividend
- Divisor
- Expression
- Equation
- Quotient

**Vertical Alignment**

**Previous Benchmarks**

- MA.3.NSO.2.4

**Next Benchmarks**

- MA.5.NSO.2.2
**Purpose and Instructional Strategies**

The purpose of this benchmark is for students to choose a reliable method for dividing 4 digit numbers by 1 digit numbers. It builds on the understanding developed during exploration (MA.3.NSO.2.2) and on automaticity (MA.4.NSO.2.1), and prepares for procedural fluency (MA.5.NSO.2.2).

- This benchmark connects to previous work with division within 144. Before achieving procedural reliability it may be useful for students to engage in additional exploratory work dividing multi-digit numbers by single-digit numbers. Students should use multiple methods (K12.MTR.2.1) such as area models or models of base-ten blocks to connect understanding to a method they will use with procedural reliability and ultimately leading to a standard algorithm.
- When students are using their preferred method they should be able to explain their thinking, connecting it to place value understanding and the relationship between division and repeated subtraction.

**Base-Ten Blocks**

\[
526 \div 2 = 263
\]

Dividend = Total

<table>
<thead>
<tr>
<th>Base-Ten Blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>526 ÷ 2 = 263</td>
</tr>
</tbody>
</table>

**Long Division Algorithm**

\[
348 \div 4 = 87
\]

**Area Model**

\[
60 + 20 + 7 = 87
\]

**Partial Quotient Division**

\[
248 \div 4 = 62
\]

**Common Misconceptions or Errors**

- Many students are taught an algorithm for division and then tend to look at the digits within the number as single digits instead of thinking about the place value of each digit or thinking about the number as a whole. When asked if their solution is reasonable, students do not understand what is reasonable because they are unable to estimate since they do not see the number in its entirety, but rather, as individual digits. Students must have a solid understanding about place value and the properties of operations to make sense of division.

- Some students may not understand that the remainder represents a fraction with the divisor as the denominator. For example, \(7 \div 3 = 2r1\) means that \(7 \div 3 = 2\frac{1}{3}\). Students should have experience with equal sharing division problems that involve remainders (MA.4.AR.1.1).
**Instructional Tasks**

**Instructional Task 1**
Using only the number tiles 2, 3, 4, 5, 6 or 7, fill in the blanks in the division situation to find a quotient as close to 100 as possible.

**Instructional Task 2**
Sam and Sally were given $117 after they helped deliver groceries for a month. In order to split the money equally, Sam divides 117 by 2 and gets 58 with a remainder of 1. Explain how they should use this result to determine their equal shares in dollars and cents.

**Instructional Items**

**Instructional Item 1**
What is 1,545 divided by 5?

**Instructional Item 2**
What is 311 divided by 7? (Express the remainder as a fraction)

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

**MA.4.NSO.2.5**

**Benchmark**

MA.4.NSO.2.5 Explore the multiplication and division of multi-digit whole numbers using estimation, rounding and place value.

*Example:* The product of 215 and 460 can be estimated as being between 80,000 and 125,000 because it is bigger than \(200 \times 400\) but smaller than \(250 \times 500\).

*Example:* The quotient of 1,380 and 27 can be estimated as 50 because 27 is close to 30 and 1,380 is close to 1,500. 1,500 divided by 30 is the same as 150 tens divided by 3 tens which is 5 tens, or 50.

**Benchmark Clarifications:**

*Clarification 1:* Instruction focuses on previous understanding of multiplication with multiples of 10 and 100, and seeing division as a missing factor problem.

*Clarification 2:* Estimating quotients builds the foundation for division using a standard algorithm.

*Clarification 3:* When estimating the division of whole numbers, dividends are limited to up to four digits and divisors are limited to up to two digits.
Related Benchmarks/Horizontal Alignment
- MA.4.NSO.1.1/1.2/1.3/1.4
- MA.4.AR.1.1
- MA.4.M.1.2
- MA.4.M.2.1
- MA.4.GR.2.1/2.2

Terms from the K-12 Glossary
- Expression
- Equation
- Factor

Vertical Alignment

Previous Benchmarks
- MA.3.NSO.1.4
- MA.3.NSO.2.2

Next Benchmarks
- MA.5.NSO.2.4

Purpose and Instructional Strategies
The purpose of this benchmark is to give students authentic opportunities to estimate in multiplication and division. This work builds on students rounding to the nearest 10 or 100 without preforming operations (MA.3.NSO.1.4).
- When students find exact solutions of multiplication and division problems, they should use mental math and computation strategies to estimate to determine if their solution is reasonable (K12.MTR.6.1).
- Estimation is often about getting useful answers that need not be exact.
- Students need to be able to explain their reasoning.

Common Misconceptions or Errors
- Some students may not understand how an approximate answer can be useful.
- Students may obsess over whether they got the same estimate as someone else. This can be resolved when the teacher explains that both estimates are useful and acceptable.

Instructional Tasks

Instructional Task 1
Mrs. Diaz bought 50 packages of crayons to give to her art class. Each package contains 8 individual crayons. She wants to give an equal numbers of crayons to each of the 22 students in the class.

Part A. One student estimated that each student in Mrs. Diaz’ class would get 10 crayons. Do you think this is a good estimate? Why or why not?
Part B. Use estimation to determine about how many crayons each student will get. Write your answer below and explain your reasoning.
### Instructional Items

#### Instructional Item 1

Marianela bought 33 packages of pink erasers and 25 packages of glow-in-the-dark erasers for the school store. Packages of pink erasers cost $12 each and packages of glow-in-the-dark erasers cost $19 each. Marianela says she spent about $850, is her answer reasonable? Explain.

- a. Yes, because $(30 \times $10) + (25 \times $20) = $800.$
- b. Yes, because $(30 \times 25) + ($10 \times $20) = $950.$
- c. No, because $(30 \times 30) + ($10 \times $20) = $1,100.$
- d. No, because $(30 + 30) \times ($10 \times $20) = $1,200.$

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

### MA.4.NSO.2.6

#### Benchmark

**MA.4.NSO.2.6** Identify the number that is one-tenth more, one-tenth less, one-hundredth more and one-hundredth less than a given number.

*Example:* One-hundredth less than 1.10 is 1.09.  
*Example:* One-tenth more than 2.31 is 2.41.

#### Related Benchmarks/Horizontal Alignment

- MA.4.NSO.1.5
- MA.4.FR1.1/1.2
- MA.4.M.1.2
- MA.4.M.2.2

#### Terms from the K-12 Glossary

- Equation
- Expression

#### Vertical Alignment

**Previous Benchmarks**

- MA.2.NSO.2.2

**Next Benchmarks**

- MA.5.NSO.2.3
- MA.5.NSO.2.4
**Purpose and Instructional Strategies**

The purpose of this benchmark is for students to develop an understanding of place value with tenths and hundredths in addition and subtraction.

- This benchmark extends upon students’ thinking about 1 more/less from whole numbers to decimals. Students should continue using place value understanding to reason how adding and subtracting 1 tenth and 1 hundredth changes a number’s value.
- Teachers should use familiar manipulatives to help connect students’ exploration of decimals to whole numbers. These materials include base-ten blocks, tenths and hundredths charts (modeled after hundred charts students used in primary), and place value mats. During instruction, teachers model correct vocabulary consistently to describe decimals and expect the same from students (e.g., the number 1.09 is be read as “one and 9 hundredths”).
- In this initial exploration of decimal addition and subtraction, the expectation is to develop understanding using manipulatives, visual models, discussions, estimation and drawings, with the focus being on adding and subtracting 1 tenth and 1 hundredth. This prepares students for the broader exploration of adding and subtracting decimals in MA.4.NSO.2.7.

**Common Misconceptions or Errors**

- When using base-ten blocks, it is important to first identify the value of each block. Students may have preconceptions about relating units to ones, rods to tens, and flats to hundreds, which can be confusing when their values shift from whole numbers to decimals. Teachers should share the relationship between the blocks (each larger block is ten times larger the next smaller block) so that students understand they can be used flexibly.
- Students can struggle to understand that one-hundredth is smaller than one-tenth because of one hundred is larger than one ten. During instruction, emphasize that one-hundredth is smaller because it would require 100 hundredths to equal 1 whole and only 10 tenths to equal 1 whole.

**Instructional Tasks**

*Instructional Task 1*

Kathy says that 1 tenth more than 3.9 is 4. Mickey says that 1 tenth more than 3.9 is 3.91. Who is correct? Explain how you know.

**Instructional Items**

*Instructional Item 1*

What is one tenth more than 3.8?
What is one tenth less than 7?
What is one hundredth more than 15.29?
What is one hundredth less than 7?

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*
**MA.4.NSO.2.7**

<table>
<thead>
<tr>
<th>Benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MA.4.NSO.2.7</strong> Explore the addition and subtraction of multi-digit numbers with decimals to the hundredths.</td>
</tr>
</tbody>
</table>

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes the connection to money and the use of manipulatives and models based on place value.

**Related Benchmarks/Horizontal Alignment**

<table>
<thead>
<tr>
<th>Related Benchmarks/Horizontal Alignment</th>
<th>Terms from the K-12 Glossary</th>
</tr>
</thead>
<tbody>
<tr>
<td>• MA.4.NSO.1.5</td>
<td>• Equation</td>
</tr>
<tr>
<td>• MA.4.FR.1.1/1.2</td>
<td>• Expression</td>
</tr>
<tr>
<td>• MA.4.FR.2.3</td>
<td></td>
</tr>
<tr>
<td>• MA.4.M.2.2</td>
<td></td>
</tr>
<tr>
<td>• MA.4.DP.1.3</td>
<td></td>
</tr>
</tbody>
</table>

**Vertical Alignment**

**Previous Benchmarks**

<table>
<thead>
<tr>
<th>Previous Benchmarks</th>
<th>Next Benchmarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>• MA.2.NSO.2.2</td>
<td>• MA.5.NSO.2.3</td>
</tr>
</tbody>
</table>

**Purpose and Instructional Strategies**

The purpose of this benchmark is for students to explore addition and subtraction of decimals to the hundredths using manipulatives, visual models, discussions, estimation and drawing.

- Instruction should focus on strategies based on place value. Through the connection to money students can build on previous content knowledge about money to adding and subtracting decimals based on place value. Examples of manipulatives that support understanding when adding and subtracting decimals are base-ten blocks, place value chips, money (dollars and coins) and place value mats.

**Common Misconceptions or Errors**

- A common error that students make is to not add or subtract like place values, especially in an example such as 30.1 + 2.74. Instruction should relate decimals to methods used for whole numbers. When adding whole numbers, ones were added to ones, tens to tens, hundreds to hundreds, and so forth. When adding decimal numbers, like place values are combined, too. Like place values are subtracted, just as with whole numbers.

**Instructional Tasks**

**Instructional Task 1**

Tony’s lunchbox weighs 2.5 pounds. He took out his apple that weighs 0.65 pounds. How much does his lunchbox weigh now?
Instructional Items

Instructional Item 1

Match each expression on the left with the equivalent decimal.

<table>
<thead>
<tr>
<th>Expression</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.65 + 5.23</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>15.74 – 2.3</td>
<td>E</td>
<td>F</td>
<td>G</td>
<td>H</td>
</tr>
<tr>
<td>6.16 + 7.03</td>
<td>I</td>
<td>J</td>
<td>K</td>
<td>L</td>
</tr>
<tr>
<td>23.11 – 9.2</td>
<td>M</td>
<td>N</td>
<td>O</td>
<td>P</td>
</tr>
</tbody>
</table>

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

**MA.4.FR.1** Develop an understanding of the relationship between different fractions and the relationship between fractions and decimals.

**MA.4.FR.1.1**

**Benchmark**

MA.4.FR.1.1 Model and express a fraction, including mixed numbers and fractions greater than one, with the denominator 10 as an equivalent fraction with the denominator 100.

**Benchmark Clarifications:**

*Clarification 1:* Instruction emphasizes conceptual understanding through the use of manipulatives, visual models, number lines or equations.

**Related Benchmarks/Horizontal Alignment**

- MA.4.NSO.2.6/2.7
- MA.4.FR.2.3

**Terms from the K-12 Glossary**

**Vertical Alignment**

**Previous Benchmarks**

- MA.3.FR.2.2

**Next Benchmarks**

- MA.5.FR.2.1

**Purpose and Instructional Strategies**

The purpose of this benchmark is to have students begin connecting fractions with decimals. This benchmark will connect fractions and decimals by writing equivalent fractions with denominators of 10 or 100 (decimal fractions). Decimal fractions are defined as fractions with denominators of a power of ten.

- For students to have a concrete foundation for future work with decimals (MA.4.NSO.1.5, MA.4.FR.1.2, MA.4.FR.1.3), plan experiences that allow students to use 10 x 10 grids, base-ten blocks, and other place value models (K12.MTR.2.1) to explore the relationship between fractions with denominators of 10 and denominators of 100.
- This work lays the foundation for performing decimal addition and subtraction in MA.4.NSO.2.7.

**Common Misconceptions or Errors**

- Students often confuse decimals such as .6 and .06. Students need to have conceptual understanding of the visual representations for tenths and hundredths. Students should use models and explain their reasoning to develop their understanding about the connections between fractions and decimals.
Instructional Tasks

Instructional Task 1
Shade the models to complete the equivalent fractions.

Instructional Items

Instructional Item 1
An equation is shown. What number completes the equivalent fraction?

\[
\frac{6}{10} = \frac{?}{100}
\]

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

MA.4.FR.1.2

Benchmark

MA.4.FR.1.2 Use decimal notation to represent fractions with denominators of 10 or 100, including mixed numbers and fractions greater than 1, and use fractional notation with denominators of 10 or 100 to represent decimals.

Benchmark Clarifications:
Clarification 1: Instruction emphasizes conceptual understanding through the use of manipulatives visual models, number lines or equations.
Clarification 2: Instruction includes the understanding that a decimal and fraction that are equivalent represent the same point on the number line and that fractions with denominators of 10 or powers of 10 may be called decimal fractions.
Purpose and Instructional Strategies

The purpose of this benchmark is to connect fractions to decimals. Students extend their understanding of fraction equivalence (MA.3.FR.2.2) to include decimal fractions with denominators of 10 or 100. The connection will continued in Grade 6 (MA.6.NSO.3.5) and completed in Grade 7 (MA.7.NSO.1.2).

- Instruction should help students understand that decimals are another way to write fractions. The place value system developed for whole numbers extends to fractional parts represented as decimals. The concept of one whole used in fractions is extended to models of decimals. It is important that students make connections between fractions and decimals in models.
- Instruction should provide visual fraction models of tenths and hundredths, number lines, and equations so that students can express a fraction with a denominator of 10 as an equivalent fraction with a denominator of 100.
- Students reinforce understanding that the names for decimals match their fraction equivalents (e.g., seven tenths, 7 tenths, 0.7, \(\frac{7}{10}\), seventy hundredths, 70 hundredths, 0.70 and \(\frac{70}{100}\) are all equivalent).

\[
\frac{7}{10} = .7 \quad \text{and} \quad \frac{30}{100} = .30
\]

- This benchmark is a connection point to the metric system and will be explored in MA.4.M.1.2.
Common Misconceptions or Errors

- Students often confuse decimals such as 6 tenths and 6 hundredths. Students should use models and explain their reasoning to develop their understanding about the connections between fractions and decimals.
- Some students may not understand that fractions and decimals are different presentations of the same thing. Number lines and other visual models will help students gain a better understanding of this concept.

Instructional Tasks

**Instructional Task 1**
Read the following numbers and use the benchmark fractions to place them on the number line.

- a. 0.8
- b. 0.32
- c. 0.6
- d. 0.17

![Number Line]

Instructional Items

**Instructional Item 1**
A value is shown.

\[
\frac{2}{100} \quad \frac{5}{100}
\]

What is the value in decimal form?

- a. 0.25
- b. 2.05
- c. 2.5
- d. 25.100

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*
**MA.4.FR.1.3**

**Benchmark**

Identify and generate equivalent fractions, including fractions greater than one.

**MA.4.FR.1.3** Describe how the numerator and denominator are affected when the equivalent fraction is created.

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes the use of manipulatives, visual models, number lines or equations.

*Clarification 2:* Instruction includes recognizing how the numerator and denominator are affected when equivalent fractions are generated.

**Related Benchmarks/Horizontal Alignment**

- MA.4.FR.2.1/2.3
- MA.4.M.1.1/1.2
- MA.4.DP.1.1/1.2

**Terms from the K-12 Glossary**

**Vertical Alignment**

**Previous Benchmarks**
- MA.3.FR.2.2

**Next Benchmarks**
- MA.5.FR.2.1

**Purpose and Instructional Strategies**

The purpose of this benchmark is for students to begin generating equivalent fractions. This work builds on identifying equivalent fractions in Grade 3 (MA.3.FR.2.2) and builds the foundation for adding and subtracting fractions with unlike denominators in Grade 5 (MA.5.FR.2.1).

- For instruction, students should use multiple models to develop understanding of equivalent fractions (K12.MTR.2.1). Students should use area models, set models, number lines and equations to determine and generate equivalent fractions.
- Instruction should focus on reasoning about how the numerator and denominators are affected when equivalent fractions are generated.
- Reasoning about the size of a fraction using benchmark fractions helps solidify students’ understanding about the size of the fraction.
- This work should also be done with fractions equal to and greater than one.
**Common Misconceptions or Errors**

- Students think that when generating equivalent fractions, they need to multiply or divide only the numerator or only the denominator, such as changing $\frac{3}{4}$ to $\frac{3}{8}$.

**Instructional Tasks**

*Instructional Task 1*

Divide the number line below into enough equal sections so that you can locate and label the point $\frac{2}{5}$. Divide the same number line with a different color so that you can locate and label the point $\frac{4}{10}$. Discuss what you have learned.

**Instructional Items**

*Instructional Item 1*

Olivia modeled a fraction by shading parts of the rectangle as shown.

![Rectangle](image)

Ethan draws a rectangle with the same size to model a fraction equivalent to Olivia’s. Which rectangle could Ethan have drawn?

a.  

b.  

c.  

d.  

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.*
**MA.4.FR.1.4**

**Benchmark**

Plot, order and compare fractions, including mixed numbers and fractions greater than one, with different numerators and different denominators.

*Example:* $\frac{2}{3} > \frac{1}{4}$ because $\frac{2}{3}$ is greater than $\frac{1}{2}$ and $\frac{1}{2}$ is greater than $\frac{1}{4}$.

**Benchmark Clarifications:**

*Clarification 1:* When comparing fractions, instruction includes using an appropriately scaled number line and using reasoning about their size.

*Clarification 2:* Instruction includes using benchmark quantities, such as $0, \frac{1}{4}, \frac{1}{2}, \frac{3}{4}$ and 1, to compare fractions.

*Clarification 3:* Denominators are limited to 2, 3, 4, 5, 6, 8, 10, 12, 16 and 100.

*Clarification 4:* Within this benchmark, the expectation is to use symbols ($<$, $>$ or $=$).

**Related Benchmarks/Horizontal Alignment**

- MA.4.M.1.1
- MA.4.DP.1.1/1.2

**Terms from the K-12 Glossary**

- MA.4.M.1.1
- MA.4.DP.1.1/1.2

**Vertical Alignment**

**Previous Benchmarks**

- MA.3.FR.2.1

**Next Benchmarks**

- MA.5.NSO.1.4

**Purpose and Instructional Strategies**

The purpose of this benchmark is to understand the relative size of fractions. Students will plot fractions on the appropriate scaled number line, compare fractions using relational symbols, and order fractions from greatest to least or least to greatest. Work builds on conceptual understanding of the size of fractions from Grade 3 (MA.3.FR.2.1) where students learned to compare fractions with common numerators or common denominators.

- Instruction may include helping students extend understanding by generating equivalent fractions with common numerators or common denominators to compare and order fractions.

- Instruction may include number lines, which will make a connection to using inch rulers to measure to the nearest $\frac{1}{16}$ of one inch.

- Instruction may include using benchmark fractions and estimates to reason about the size of fractions when comparing them. Students can compare $\frac{3}{5}$ to $\frac{1}{2}$ by recognizing that $3$ (in the numerator) is more than half of $5$ (the denominator) so they can reason that $\frac{3}{5} > \frac{1}{2}$.
Common Misconceptions or Errors

- The student may mistake the fraction with the larger numerator and denominator as the larger fraction. The student may not pay attention to the relationship between numerator and denominator when estimating.

- The student incorrectly judges that a mixed number like $1 \frac{3}{4}$ is always greater than an improper fraction like $\frac{17}{4}$ because of the whole number in front.

Instructional Tasks

Instructional Task 1

Use benchmark fractions and the number line below to compare the fractions $\frac{12}{5}$ and $2 \frac{7}{8}$.

In the space below the number line, record the results of the comparison using the $<$, $>$ or $=$ symbol.

Instructional Items

Instructional Item 1

Four soccer players started a game with the exact same amount of water in their water bottles. The table shows how much water each soccer player has left at the end of the game. Who has the least amount of water remaining?

<table>
<thead>
<tr>
<th>Player</th>
<th>Fraction of Water Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jackie</td>
<td>$\frac{2}{6}$</td>
</tr>
<tr>
<td>Laura</td>
<td>$\frac{1}{3}$</td>
</tr>
<tr>
<td>Terri</td>
<td>$\frac{4}{9}$</td>
</tr>
<tr>
<td>Amanda</td>
<td>$\frac{2}{10}$</td>
</tr>
</tbody>
</table>

a. Jackie
b. Laura
c. Terri
d. Amanda

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*
MA.4.FR.2 Build a foundation of addition, subtraction and multiplication operations with fractions.

**MA.4.FR.2.1**

**Benchmark**

Decompose a fraction, including mixed numbers and fractions greater than one, into a sum of fractions with the same denominator in multiple ways. Demonstrate each decomposition with objects, drawings and equations.

*Example:* $\frac{9}{8}$ can be decomposed as $\frac{8}{8} + \frac{1}{8}$ or as $\frac{3}{8} + \frac{3}{8} + \frac{3}{8}$.

**Benchmark Clarifications:**

*Clarification 1:* Denominators are limited to 2, 3, 4, 5, 6, 8, 10, 12, 16 and 100.

**Related Benchmarks/Horizontal Alignment**

- MA.4.FR.1.3
- MA.4.AR.1.2

**Terms from the K-12 Glossary**

- Expression

**Vertical Alignment**

**Previous Benchmarks**

- MA.3.FR.1.1/1.2

**Next Benchmarks**

- MA.5.FR.2.1

**Purpose and Instructional Strategies**

The purpose of this benchmark is to build students’ understanding from Grade 3 that each fraction is composed as the sum of its unit fractions. Decomposing fractions becomes the foundation for students to make sense of adding and subtracting fractions, much like decomposing whole numbers provided the foundation for adding and subtracting whole numbers in the primary grades.

- During instruction, students should show multiple ways to decompose a fraction into equivalent addition expressions with the support of models (e.g., objects, drawings and equations).

**Common Misconceptions or Errors**

- Students may have difficulty decomposing mixed numbers and fractions greater than one because of misunderstanding of flexible fraction representations (e.g., $\frac{4}{4}$ is equivalent to 1). It is helpful when students’ expressions are accompanied by a model that justifies them.
### Instructional Tasks

**Instructional Task 1**

Part A. Use a visual fraction model to show one way to decompose $\frac{5}{9}$. Make sure to label each fraction part in the model, and write an equation to show how you decomposed $\frac{5}{9}$.

Part B. Show how you could decompose $\frac{5}{9}$ in a different way using a visual fraction model. Again, make sure to label each fraction part in the model, and write an equation to show how you decomposed $\frac{5}{9}$.

### Instructional Items

**Instructional Item 1**

Which sums show ways to express $\frac{8}{3}$?

a. $\frac{1}{3} + \frac{1}{3} + \frac{1}{3}$

b. $\frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$

c. $\frac{3}{3} + \frac{3}{3} + \frac{1}{3}$

d. $\frac{3}{3} + \frac{3}{3} + \frac{1}{3} + \frac{1}{3}$

e. $\frac{3}{3} + \frac{3}{3} + \frac{3}{3}$

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

### MA.4.FR.2.2

**Benchmark**

MA.4.FR.2.2 Add and subtract fractions with like denominators, including mixed numbers and fractions greater than one, with procedural reliability.

*Example:* The difference $\frac{9}{5} - \frac{4}{5}$ can be expressed as 9 fifths minus 4 fifths which is 5 fifths, or one.

**Benchmark Clarifications:**

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

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

*Clarification 3:* Denominators are limited to 2, 3, 4, 5, 6, 8, 10, 12, 16 and 100.

### Related Benchmarks/Horizontal Alignment

- MA.4.AR.1.2

### Terms from the K-12 Glossary

- Equation
- Expression
**Vertical Alignment**

<table>
<thead>
<tr>
<th>Previous Benchmarks</th>
<th>Next Benchmarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>• MA.3.FR.1.1</td>
<td>• MA.5.FR.2.1</td>
</tr>
<tr>
<td>• MA.3.FR.1.2</td>
<td></td>
</tr>
</tbody>
</table>

**Purpose and Instructional Strategies**

The purpose of this benchmark is for students to build upon their decomposition of fractions to develop an accurate, reliable method for adding and subtracting fractions with like denominators (including mixed numbers and fractions greater than one) that aligns with their understanding and learning style. Procedural reliability in addition and subtraction of fractions with unlike denominators is expected in Grade 5.

- Clarification 1 states that instruction should include word form (to build vocabulary), manipulatives and drawings (to model), and the properties of operations. Using properties of operations (e.g., commutative property of addition, associative property of addition) allows students to connect prior knowledge about whole number addition and subtraction to fractions. Properties of operations also allow for students to add and subtract fractions flexibly (e.g., students may add by rewriting the expression $1\frac{4}{5} + 4\frac{3}{5}$ as $1 + 4 + \frac{4}{5} + \frac{3}{5}$ using the associative property of addition).
- Students need to have experience regrouping a fraction equivalent to 1 as a whole number for addition and subtraction. For example, $\frac{5}{6} + \frac{4}{6} = \frac{9}{6} = \frac{6}{6} + \frac{3}{6} = 1\frac{3}{6}$.
- This benchmark should be taught with MA.4.AR.1.2 for students to solve real-world problems while adding and subtracting fractions.

**Common Misconceptions or Errors**

- Some students may have difficulty understanding that when adding or subtracting fractions with like denominators, the denominator does not change. To help students understand why this happens, addition and subtraction should be accompanied with models to justify solutions.

**Instructional Tasks**

*Instructional Task 1*

Find the sum and explain your method

a. $\frac{3}{4} + 2\frac{3}{4} =$

b. $2\frac{3}{10} + 1\frac{4}{10} =$

c. $2\frac{5}{8} - 1\frac{3}{8} =$
Instructional Items

Instructional Item 1
The point on a number line shows the value of the sum of two fractions.

Which expression has that sum?

a. \(\frac{4}{3} + \frac{4}{3}\)
b. \(\frac{6}{4} + \frac{2}{4}\)
c. \(\frac{5}{6} + \frac{3}{6}\)
d. \(\frac{2}{12} + \frac{6}{12}\)

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

MA.4.FR.2.3

Benchmark

MA.4.FR.2.3  Explore the addition of a fraction with denominator of 10 to a fraction with denominator of 100 using equivalent fractions.

Example: \(\frac{9}{100} + \frac{3}{10}\) is equivalent to \(\frac{9}{100} + \frac{30}{100}\) which is equivalent to \(\frac{39}{100}\).

Benchmark Clarifications:

Clarification 1: Instruction includes the use of visual models.
Clarification 2: Within this benchmark, the expectation is not to simplify or use lowest terms.

Related Benchmarks/Horizontal Alignment

- MA.4.NSO.2.7
- MA.4.FR.1.1/1.2/1.3

Terms from the K-12 Glossary

Vertical Alignment

Previous Benchmarks

- MA.3.FR.1.2

Next Benchmarks

- MA.5.FR.2.1
Purpose and Instructional Strategies

The purpose of this benchmark is to connect fraction addition to decimal addition through decimal fractions. This will be the first opportunity for students to create common denominators to add fractions. This benchmark continues the work of equivalent fractions (MA.3.FR.1.2) by having students rename fractions with denominators of 10 as equivalent fractions with denominators of 100 (MA.4.FR.1.1). Students who can generate equivalent fractions can adapt this new procedure to develop strategies for adding fractions with unlike denominators in Grade 5 (MA.5.FR.2.1).

- Instruction may include students shading decimal grids (10 x10 grids) to support their understanding.

- Subtraction of decimal fractions is not a requirement of Grade 4.

Common Misconceptions or Errors

- Students often will add the numerators and the denominators without finding the like denominator. Students will need visual models to understand what the like denominator means.

Instructional Tasks

Instructional Task 1

Determine the equivalent fraction \( \frac{5}{10} = \frac{50}{100} \)

Use your thinking from above to help you add the following fractions:

\[
\frac{31}{100} + \frac{5}{10} =
\]

Instructional Items

Instructional Item 1

An expression is shown.

\[
\frac{3}{10} + \frac{32}{100}
\]

What is the value of the expression?

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.*
**MA.4.FR.2.4**

**Benchmark**

Extend previous understanding of multiplication to explore the multiplication of a fraction by a whole number or a whole number by a fraction.

*Example:* Shanice thinks about finding the product $\frac{1}{4} \times 8$ by imagining having 8 pizzas that she wants to split equally with three of her friends. She and each of her friends will get 2 pizzas since $\frac{1}{4} \times 8 = 2$.

*Example:* Lacey thinks about finding the product $8 \times \frac{1}{4}$ by imagining having 8 pizza boxes each with one-quarter slice of a pizza left. If she put them all together, she would have a total of 2 whole pizzas since $8 \times \frac{1}{4} = \frac{8}{4}$ which is equivalent to 2.

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes the use of visual models or number lines and the connection to the commutative property of multiplication. Refer to *Properties of Operation, Equality and Inequality (Appendix D).*

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

*Clarification 3:* Fractions multiplied by a whole number are limited to less than 1. All denominators are limited to 2, 3, 4, 5, 6, 8, 10, 12, 16, 100.

**Related Benchmarks/Horizontal Alignment**

- MA.4.NSO.2.1
- MA.4.AR.1.3

**Terms from the K-12 Glossary**

- Equation
- Expression

**Vertical Alignment**

**Previous Benchmarks**

- MA.3.NSO.2.2
- MA.3.FR.1.2

**Next Benchmarks**

- MA.5.FR.2.2/2.3
**Purpose and Instructional Strategies**

The purpose of this benchmark is to connect previous understandings of whole-number multiplication concepts (MA.3.NSO.2.2) and apply them to the multiplication of fractions. This work builds a foundation for multiplying fractions with procedural reliability in Grade 5 (MA.5.FR.2.2).

- Contexts involving multiplying whole numbers and fractions lend themselves to modeling and examining patterns.
- This benchmark builds on students’ work of adding fractions with like denominators (MA.4.FR.2.2) and extending that work into the relationship between addition and multiplication.
- Students should use fraction models and drawings to show their understanding. Fraction models may include area models, number lines, set models, or equations.
- During instruction, teachers should relate “total group size” language that was used to introduce whole number multiplication—possibly changing from “total group size” to “total size” or “total amount” (see Appendix A). Using such language, the expression $5 \times \frac{3}{4}$ can be described as the total size or amount of 5 objects, each of which has size or amount of $\frac{3}{4}$. For example, the weight of 5 slabs of chocolate that each weigh $\frac{3}{4}$ of a pound is $5 \times \frac{3}{4}$ pounds. Students need to understand that when multiplying a whole number by a fraction, the most important idea is that the whole number describes the number of objects and the fraction describes the size of each object.
- Instruction should include representing a whole number times a fraction as repeated addition: $5 \times \frac{3}{4} = \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4}$.
- When multiplying a fraction by a whole number, teachers can use language like “portion of” to convey that the fraction represents the “portion of” the whole number. For example, the $\frac{3}{4}$ portion of a 5 mile run is $\frac{3}{4} \times 5$ miles.
- Exploring patterns of what happens to the numerator when a whole number is multiplied by a fraction will help students make sense of multiplying fractions by fractions in Grade 5. When multiplying whole numbers by mixed numbers, students can use the distributive property or write the mixed number as a fraction greater than one. During instruction, students should compare both strategies. Using the distributive property to multiply a whole number by a mixed number could look like this.

$$2 \times 6 \frac{1}{3} = (2 \times 6) + \left(2 \times \frac{1}{3}\right)$$

$$= 12 + \frac{2}{3}$$

$$= 12 \frac{2}{3}$$
Common Misconceptions or Errors

- Students may multiply both the numerator and the denominator by the whole number. It is important to provide students with visual models, manipulatives or context to model the computation.
- Students may be confused by the fact that a fraction times a whole number often represents something quite different than a whole number times a fraction, even though the commutative property says the order does not affect the value.
- Without conceptual understanding of how fraction multiplication is modeled, students can be confused regarding why the denominator remains the same when multiplying a whole number by a fraction. During instruction, teachers should relate fraction multiplication to repeated addition to explain why only the numerator changes.

Instructional Tasks

Instructional Task 1

How many \( \frac{2}{5} \) are in \( \frac{12}{5} \)? Use a visual model to explain your reasoning and show the relationship to the multiplication of a whole number by a fraction.

Instructional Item 1

An expression is shown. \( \frac{3}{4} \times 9 \)

What is the product?

a. \( \frac{3}{36} \)
b. \( \frac{27}{4} \)
c. \( \frac{27}{36} \)
d. \( \frac{39}{4} \)

Instructional Item 2

Choose all the ways to express the product of \( \frac{3}{4} \times 5 \).

a. \( 5 \frac{3}{4} \)
b. \( \frac{15}{4} \)
c. \( \frac{15}{20} \)
d. \( 3 \frac{2}{4} \)
e. \( \frac{3}{4} \)

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

**MA.4.AR.1** Represent and solve problems involving the four operations with whole numbers and fractions.

**MA.4.AR.1.1**

**Benchmark**

Solve real-world problems involving multiplication and division of whole numbers including problems in which remainders must be interpreted within the context.

*Example:* A group of 243 students is taking a field trip and traveling in vans. If each van can hold 8 students, then the group would need 31 vans for their field trip because 243 divided by 8 gives 30 with a remainder of 3.

**Benchmark Clarifications:**

*Clarification 1:* Problems involving multiplication include multiplicative comparisons. Refer to Situations Involving Operations with Numbers (Appendix A).

*Clarification 2:* 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.

*Clarification 3:* Multiplication is limited to products of up to 3 digits by 2 digits. Division is limited to up to 4 digits divided by 1 digit.

**Related Benchmarks/Horizontal Alignment**

- MA.4.NSO.2.2/2.3/2.4/2.5
- MA.4.M.1.2
- MA.4.M.2.1
- MA.4.GR.1.3
- MA.4.GR.2.1/2.2

**Terms from the K-12 Glossary**

- Equation
- Expression

**Vertical Alignment**

**Previous Benchmarks**

- MA.3.AR.1.2

**Next Benchmarks**

- MA.5.AR.1.1
Purpose and Instructional Strategies

The purpose of this benchmark is to have students solve problems involving multiplication and division by using and discussing various approaches. This work builds on problem solving using the four operations from Grade 3 (MA.3.AR.1.2).

- Students should use estimation, and this can include using compatible numbers (numbers that sum to 10 or 100) and rounding.
- Instruction should include allowing students many opportunities to solve multiplicative comparison situations.
- Students should have experience solving problems that require students to interpret the remainder to fit the situation. Students may have to round up to the next whole number, drop the remainder, use the remainder as a fraction or decimal, or use only the remainder as determined.
  - Add 1 to the quotient
    - Thirty students are going on a field trip. They want to put 4 people in each car so that people can sit comfortably. How many cars will be needed?
    - Solution: Divide 30 by 4. The answer is 7 r2.
    - The answer shows that 7 cars will be needed, but 2 people still need to go to a car.
    - Therefore, they will need 8 cars.
  - Use only the remainder
    - Gerardo has 19 dollars in his pocket. He wants to give the same amount of money to 4 friends. The rest of the money, if any, will go to his sister to buy toys. How much money will go to his sister if Gerardo wants to give away everything he has?
    - Solution: Divide 19 by 4. The answer is 4 r3.
    - The remainder is 3, so 3 dollars will go to his sister.
  - Drop the remainder
    - Alicia has 48 dollars in her pocket. She wants to buy meals for 5 friends. If each meal costs 10 dollars, will Darlene be able to keep all her friends happy?
    - Solution: Divide 48 by 10. The answer is 4 r8.
    - Alicia can only buy 4 complete meals. Therefore, she cannot buy one for each of her 5 friends.
Common Misconceptions or Errors

- Students 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, the student responds to the problem—there are 52 students in a class field trip. They plan to have 10 students in each van. How many vans will they need so that everyone can participate? And the student answers “5$r$2 vans.” The student does not understand that the two remaining students need another van to go on the field trip.

- Students may not understand that the remainder represents a portion of something, rather than a whole number. Referring back to the previous example students may think $r2$ means two additional vans rather than a portion of an additional van.

- Students may have trouble seeing a remainder as a fraction. For example, $7 ÷ 3 = 2r1$ means that $7 ÷ 3 = 2\frac{1}{3}$. If 7 cupcakes are divided among 3 people, then each person will get 2 and $\frac{1}{3}$ cupcakes.

Instructional Tasks

Instructional Task 1
Write an example of a word problem that will require the person solving the problem to “Add 1 to the quotient” as their solution.

Instructional Task 2
Write an example of a word problem that will require the person solving the problem to “Use only the remainder” as their solution.

Instructional Task 3
Write an example of a word problem that will require the person solving the problem to “Drop the remainder” as their solution.

Instructional Items

Instructional Item 1
Sam has $50 to spend on video games. He buys one video game for $26. With the money he has left over, how many $9 games can Sam buy?

a. 2 games
b. 3 games
c. 5 games
d. 6 games

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*
**MA.4.AR.1.2**

**Benchmark**

Solve real-world problems involving addition and subtraction of fractions with like denominators, including mixed numbers and fractions greater than one.

*Example:* Megan is making pies and uses the equation \( \frac{3}{4} + 3 \frac{1}{4} = x \) when baking. Describe a situation that can represent this equation.

*Example:* Clay is running a 10K race. So far, he has run \( 6 \frac{1}{5} \) kilometers. How many kilometers does he have remaining?

**Benchmark Clarifications:**

*Clarification 1:* Problems include creating real-world situations based on an equation or representing a real-world problem with a visual model or equation.

*Clarification 2:* Fractions within problems must reference the same whole.

*Clarification 3:* Within this benchmark, the expectation is not to simplify or use lowest terms.

*Clarification 4:* Denominators limited to 2, 3, 4, 5, 6, 8, 10, 12, 16 and 100.

**Related Benchmarks/Horizontal Alignment**

- MA.4.FR.1.3
- MA.4.FR.2.2
- MA.4.M.2.1
- MA.4.DP.1.3

**Terms from the K-12 Glossary**

- Equation

**Vertical Alignment**

**Previous Benchmarks**
- MA.3.FR.1.2

**Next Benchmarks**
- MA.5.AR.1.2

**Purpose and Instructional Strategies**

The purpose of this benchmark is to connect procedures for adding and subtracting fractions with like denominators (MA.4.FR.2.2) to real world situations. This builds on composing and decomposing fractions (MA.4.FR.2.1) to connect to addition and subtraction of fractions.

- Instruction should include providing students with the opportunity to recognize models or equations based on a real-world situation.
- Models may include fraction bars, fraction circles and relationship rods.
- Instruction should include allowing students to create world situations based on models or equations.
- Instruction should include having students connect adding and subtracting procedures to real-world situations.
Common Misconceptions or Errors

- Students tend to have trouble with addition and subtraction because much instruction focuses only on procedures. Students need to know how to treat the numerator and denominator when following the procedures to add and subtract. It is important for students to use models so they make sense of equations and real-world problems when they solve them.

Instructional Tasks

Instructional Task 1

Solve the following problem. Anna Marie has $\frac{3}{4}$ of a medium cheese pizza. Kent gives her $\frac{3}{4}$ of a medium pepperoni pizza. How much pizza does Anna Marie have now?

Explain why this problem cannot be solved by adding $\frac{5}{8} + \frac{4}{8}$.

Anna Marie has $\frac{5}{8}$ of a medium pizza. Kent gives her $\frac{4}{8}$ of a large pizza. How much pizza does Anna Marie have now?

Instructional Items

Instructional Item 1

Jose was completing an exercise program. $\frac{8}{12}$ of the exercise program was sit-ups. The rest of the exercise program was pull-ups. What fraction of the exercise program was pull-ups?

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

MA.4.AR.1.3

Benchmark

Solve real-world problems involving multiplication of a fraction by a whole number or a whole number by a fraction.

Example: Ken is filling his garden containers with a cup that holds $\frac{2}{5}$ pounds of soil. If he uses 8 cups to fill his garden containers, how many pounds of soil did Ken use?

Benchmark Clarifications:

Clarification 1: Problems include creating real-world situations based on an equation or representing a real-world problem with a visual model or equation.

Clarification 2: Fractions within problems must reference the same whole.

Clarification 3: Within this benchmark, the expectation is not to simplify or use lowest terms.

Clarification 4: Fractions limited to fractions less than one with denominators of 2, 3, 4, 5, 6, 8, 10, 12, 16 and 100.

Related Benchmarks/Horizontal Alignment

- MA.4.FR.2.4
- MA.4.M.1.2
- MA.4.DP.1.3

Terms from the K-12 Glossary

- Equation
- Expression
- Whole Number
**Vertical Alignment**

**Previous Benchmarks**
- MA.3.FR.1.2

**Next Benchmarks**
- MA.5.AR.1.2/1.3

**Purpose and Instructional Strategies**

The purpose of this benchmark is to complement the instruction of MA.4.FR.2.4 with real-world context.

- Instruction should refer back to the two types of problems described in MA.4.FR.2.4 (whole number times a fraction and fraction times a whole number), and give students opportunities to work with real-world examples of both types.
- Instruction should help students bring their understanding of working with units involving whole numbers (1 cup, 3 miles, etc.) to working with units involving fractions (\(\frac{1}{2}\) cup, \(\frac{3}{4}\) mile, etc.).
- During instruction it is acceptable to have students work with problems where fractional parts represent more than 1 whole (e.g., a cake recipe calls for \(\frac{1}{3}\) cup of water and \(\frac{1}{8}\) oz of vanilla extract, and the baker wants to double the recipe).
- Instruction may include having students create real-world situations that can be modeled by a given expression like \(\frac{3}{5} \times 10\) (I have completed \(\frac{3}{5}\) of my 10 mile run).
- During instruction, models and explanations should relate fraction multiplication to equal groups. This will activate prior knowledge and relate what students know to whole number multiplication. For example, teachers can help students make connections to multiplication from Grade 3 by referring to an expression like \(4 \times \frac{3}{5}\) as “four groups of \(\frac{3}{5}\)” that is, “four groups that each contain 3 items and each item is one fifth” (K12.MTR.2.1, K12.MTR.5.1).
  - Example: have table/bar to show that there are 4 groups of \(\frac{3}{5}\).
- Exploring patterns of what happens to the numerator when a whole number is multiplied by a fraction will help students make sense of multiplying fractions by fractions in Grade 5 (K12.MTR.2.1). When multiplying whole numbers by mixed numbers, students can use the distributive property or write the mixed number as a fraction greater than one. During instruction, students should compare both strategies (K12.MTR.6.1). Using the distributive property to multiply a whole number by a mixed number could look like this.

\[
2 \times 6 \frac{1}{3} = (2 \times 6) + \left(2 \times \frac{1}{3}\right) = 12 + \frac{2}{3} = 12 \frac{2}{3}
\]

In the example, 2 groups of \(6 \frac{1}{3}\) was written as “the sum of 2 groups of 6 and 2 groups of 1 third.” The products of 12 and 2 thirds are added to show the product of \(12 \frac{2}{3}\).
Common Misconceptions or Errors

- Students may not understand that fractions are numbers (just as whole numbers are numbers) and this misconception may at first be reinforced by the fact that the phrase “group size” works well with whole numbers, but not so well with fractions; therefore, special attention should be given with many different real-world examples.
- Students may not understand what a fractional portion represents within context of a real-world situation.

Instructional Tasks

Instructional Task 1

Lorelei is having a dessert party and wants to determine how much sugar she will need. For the party, she will make 4 batches of chocolate chip cookies and 8 vanilla smoothies. 1 batch of chocolate chip cookies requires \( \frac{2}{3} \) cup of sugar and 1 vanilla smoothie requires \( \frac{1}{3} \) cup of sugar. How much total sugar will she need for her dessert party? Draw a model to explain your thinking.

Instructional Items

Instructional Item 1

A butcher has 10 pounds of meat and sells \( \frac{2}{3} \) of it in one day. How many pounds does the butcher sell?

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

MA.4.AR.2 Demonstrate an understanding of equality and operations with whole numbers.

MA.4.AR.2.1

Benchmark

MA.4.AR.2.1 Determine and explain whether an equation involving any of the four operations with whole numbers is true or false.

Example: The equation \( 32 \div 8 = 32 - 8 - 8 - 8 - 8 \) can be determined to be false because the expression on the left side of the equal sign is not equivalent to the expression on the right side of the equal sign.

Benchmark Clarifications:

Clarification 1: Multiplication is limited to whole number factors within 12 and related division facts.

Related Benchmarks/Horizontal Alignment

- MA.4.NSO.2.1

Terms from the K-12 Glossary

- Equation
- Expression
Vertical Alignment

Previous Benchmarks
- MA.2.AR.2.2
- MA.3.AR.2.2

Next Benchmarks
- MA.5.AR.2.3

Purpose and Instructional Strategies

The purpose of this benchmark is to determine if students can connect their understanding of using the four operations fluently (K12.MTR.3.1) to the concept of the meaning of the equal sign. This concept builds on the understanding of determining if addition and subtraction equations (MA.2.AR.2.2) and multiplication and division equations (MA.3.AR.2.2) are true and false.

- Students will determine if the expression on the left of the equal sign is equivalent to the expression to the right of the equal sign. If these expressions are equivalent, then the equation will be deemed true.
- Students may use comparative relational thinking or estimation, instead of solving, to determine if the equation is true or false.

Common Misconceptions or Errors

- Many students have difficulty understanding that the equal sign is a relational symbol. They believe that the equal sign makes the expression on the right side of the equation equal to the expression on the left side so that all equations would be true. Instead an equation with an equal sign can be true or false, depending on whether the expressions on each side of the equal sign are equal to each other or not.

Instructional Tasks

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

\[ _X_ + _X_ = _X_ \]

3, 5, 6, 10

Instructional Items

Instructional Item 1
Determine whether the equation below is true or false.

\[ 86 + 58 = 144 \div 12 \]

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*
**MA.4.AR.2.2**

**Benchmark**

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

*Example:* The equation $96 = 8 \times t$ can be used to determine the cost of each movie ticket at the movie theatre if a total of $96 was spent on 8 equally priced tickets. Then each ticket costs $12.

**Benchmark Clarifications:**

*Clarification 1:* Instruction extends the development of algebraic thinking skills where the symbolic representation of the unknown uses a letter.

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

*Clarification 3:* Multiplication is limited to factors within 12 and related division facts.

**Related Benchmarks/Horizontal Alignment**

- MA.4.NSO.2.1

**Terms from the K-12 Glossary**

- Equation

**Vertical Alignment**

**Previous Benchmarks**

- MA.3.AR.2.3

**Next Benchmarks**

- MA.5.AR.2.1
- MA.5.AR.2.4

**Purpose and Instructional Strategies**

The purpose of this benchmark is for students to continue connecting real world situations to multiplication and division by writing equations to represent these situations and using the relationship between multiplication and division to solve problems. This connects the work from Grade 3 of determining the value of the unknown number in multiplication and division equations that are given (MA.3.AR.2.3).

- Instruction of this benchmark should emphasize helping students to see the relationship between multiplication and division (MA.4.NSO.2.1) when solving for an unknown in any position in an equation.
- Success with this benchmark will facilitate automaticity with multiplication and division facts (MA.4.NSO.2.1).
- Within this benchmark, students may use multiplicative comparison ($50 = 5$ times as many as 10).
- Using a bar or tape diagram can be helpful for students to model the real-world situations presented (see example below).

$$96 = 8 \times t$$

| t | t | t | t | t | t | t | t | t |

$$96$$
Common Misconceptions or Errors

- Even though many students know their multiplication and related division facts with automaticity, students without a firm conceptual understanding of multiplication and division may have difficulty problem solving with multiplication and division and writing equations to model situations. Provide opportunities for students to explain their models and justify solutions.

Instructional Tasks

Instructional Task 1

A typical Dalmatian weighs 54 pounds and a typical Yorkshire terrier weighs 9 pounds. Write an equation to model this situation. Use your equation to determine how many more times does the typical Dalmatian weigh than the typical Yorkshire terrier?

Instructional Items

Instructional Item 1

Shernice has 84 comic books which is 12 times as many as Cindy. Which equation below represents how many comic books, \( c \), Cindy has?

a. \( 84 = 12 + c \)

b. \( 84 = 12 \times c \)

c. \( c = 12 + 84 \)

d. \( c = 12 \times 84 \)

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

MA.4.AR.3 Recognize numerical patterns, including patterns that follow a given rule.

MA.4.AR.3.1

Benchmark

MA.4.AR.3.1 Determine factor pairs for a whole number from 0 to 144. Determine whether a whole number from 0 to 144 is prime, composite or neither.

Benchmark Clarifications:
Clarification 1: Instruction includes the connection to the relationship between multiplication and division and patterns with divisibility rules.
Clarification 2: The numbers 0 and 1 are neither prime nor composite.

Related Benchmarks/Horizontal Alignment

- MA.4.NSO.2.1

Terms from the K-12 Glossary

- Composite Number
- Factors
- Prime Number
Purpose and Instructional Strategies

The purpose of this benchmark is for students to begin understanding of factors of whole numbers which sets the foundation for determining prime factorization in Grade 6 (MA.6.NSO.3.4).

- This benchmark also refers to prime and composite numbers. Prime numbers have exactly two factors, the number one and the number itself (e.g., the number 13 has the factors of 1 and 13 only so it is a prime number). Composite numbers have more than two factors. For example, 14 has the factors of 1, 2, 7 and 14. Since this number has more factors than 1 and 14, it is a composite number.
- Instruction may allow students to use divisibility rules to determine the factors of a number.
  - All numbers are divisible by 1.
  - All even numbers are divisible by 2.
  - A number is divisible by 3 if the sum of the digits is divisible by 3.
  - A number is divisible by 4 if the 2-digit number in the tens and ones places is divisible by 4.
  - A number is divisible by 5 if the number in the ones place is a 0 or 5.
  - A number is divisible by 6 if it is an even number and the sum of the digits is divisible by 3.
  - A number is divisible by 9 if the sum of the digits is divisible by 9.
- Students should use models (arrays) to determine why a number would be prime or composite.

Common Misconceptions or Errors

- Students may think of the number 1 as a prime number. It is neither prime nor composite.
- Students may also think that all odd numbers are prime.
- Some students may think that larger numbers have more factors. Have students share all factor pairs and how they found the factors.

Instructional Tasks

**Instructional Task 1**

Find all the factors for the numbers between 20 and 30. What is the greatest prime number in this set of primes? What is the least prime number in this set of primes?
**Instructional Items**

**Instructional Item 1**

Select all the statements that are true about the number 84.

- a. 42 is a factor of 84.
- b. 84 is a composite number.
- c. 84 has exactly 4 distinct factor pairs.
- d. The prime factors of 84 are 2, 6 and 7.
- e. 84 can be written as the product $2 \times 2 \times 3 \times 7$.

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

**MA.4.AR.3.2**

### Benchmark

**MA.4.AR.3.2** Generate, describe and extend a numerical pattern that follows a given rule.

*Example:* Generate a pattern of four numbers that follows the rule of adding 14 starting at 5.

**Benchmark Clarifications:**

**Clarification 1:** Instruction includes patterns within a mathematical or real-world context.

### Related Benchmarks/Horizontal Alignment

- MA.4.NSO.2.2
- MA.4.FR.2.2
- MA.4.M.2.2

### Terms from the K-12 Glossary

- Expression

### Vertical Alignment

**Previous Benchmarks**

- MA.3.AR.3.3

**Next Benchmarks**

- MA.5.AR.3.1
- MA.5.AR.3.2

### Purpose and Instructional Strategies

The purpose of this benchmark is to build understanding of numerical patterns. Students should generate numerical patterns that follow a given rule with one step. This concept builds on identifying, creating and extending numerical patterns (MA.3.AR.3.3).

- As students use numerical patterns, they will reinforce facts and develop fluency with operations (K12.MTR.5.1).
- A pattern is a sequence that repeats the same rule over and over. Patterns and rules are related. A rule dictates what that pattern will look like.
- Students need multiple opportunities creating and extending number patterns.
- Students investigate different patterns to find rules, identify features in the patterns and justify the reason for those features.
- Students should look for relationships in the patterns they create and be able to describe and generalize.
Common Misconceptions or Errors

- Students often make mistakes due to lack of fluency with the four operations which hinders them from being able to extend the pattern according to the rule.

Instructional Tasks

Instructional Task 1

The first term of a pattern is an odd number. The rule is add 13. Will the 4th term be odd or even? Based on the pattern described, will the 4th term always be odd or even? Explain your reasoning.

Instructional Task 2

Part A. Find the areas of the squares shown in which the side lengths start at 1 and increase by 1 each time: (1x1) (2x2) (3x3) (4x4), etc.

Extend the pattern up to 10 terms.

Part B. Find the perimeters of the squares shown in which the side lengths start at 1 and increase by 1 each time: (1x1) (2x2) (3x3) (4x4), etc.

Extend the pattern up to 10 terms.

Instructional Items

Instructional Item 1

The first term in a pattern is 6. The pattern follows the rule “add 4.”

Which of the numbers below is a term in the pattern?

A. 1
B. 8
C. 14
D. 16

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

**MA.4.M.1** Measure the length of objects and solve problems involving measurement.

**MA.4.M.1.1**

### Benchmark

**MA.4.M.1.1** Select and use appropriate tools to measure attributes of objects.

**Benchmark Clarifications:**
*Clarification 1:* Attributes include length, volume, weight, mass and temperature.
*Clarification 2:* Instruction includes digital measurements and scales that are not linear in appearance.
*Clarification 3:* When recording measurements, use fractions and decimals where appropriate.

### Related Benchmarks/Horizontal Alignment

- MA.4.FR.1.2/1.4
- MA.4.GR.1.2
- MA.4.DP.1.1

### Terms from the K-12 Glossary

### Vertical Alignment

#### Previous Benchmarks
- MA.3.M.1.1

#### Next Benchmarks
- MA.5.M.1.1
Purpose and Instructional Strategies

The purpose of this benchmark is to select and use tools to measure with precision. This concept builds on work to connect linear measurement to number lines (MA.3.M.1.1).

- Students will measure using the customary units of linear measurement to the nearest $\frac{1}{8}$ and $\frac{1}{16}$ of an inch.
- Students will measure volume, weight, mass and temperature using fractions or decimals where appropriate. As students work with this benchmark, they will begin to see relationships between units. For example, they will see that 10 millimeters is equivalent to one centimeter so one millimeter is $\frac{1}{10}$ of a centimeter.
- For instruction of linear measurement, spend time showing students equivalent fractions on a number line and how that connects to rulers and tape measures. Students should also gain experience measuring things larger than their piece of paper or their textbook so they can make decisions about what the best tool to measure is.
- Students should be given multiple opportunities to measure the same object with different measuring units. For example, have the students measure the length of a room with one-inch tiles, one-foot rulers and yardsticks. Students should notice that it takes fewer yard sticks to measure the room than rulers or tiles and explain their reasoning.
- For instruction of liquid volume, give students experiences with real-world measuring cups and graduated cylinders.
- For instruction of mass and weight, give students opportunities to use real-world balances and scales so they understand how they work and how to read measurements.
- For measuring temperature, provide examples of digital and analog thermometers.
- Examples of nonlinear scales include weight scales commonly used in grocery stores and many thermometers.
- Using protractors to measure angles provides the connection between MA.4.GR.2.1 and measurement with nonlinear scales.

Common Misconceptions or Errors

- Students who struggle to identify benchmarks on number lines can also struggle to measure units of length, liquid volume, weight, mass and temperature. To assist students with this misconception, during instruction teachers should allow students to measure often and provide feedback. Students can also complete error and reasoning analysis activities to identify this common measurement misconception.

Instructional Tasks

Instructional Task 1

Use a thermometer to measure the temperature to the nearest 0.1 degree Fahrenheit at 8:30 a.m., 11:00 a.m. and 1:30 p.m. every day for one week. Record each temperature in a table.
**Instructional Items**

**Instructional Item 1**

A pencil is shown. Using the ruler provided, what is the length of the pencil to the nearest $\frac{1}{8}$ inch?

![Ruler](image)

Using the ruler provided, what is the length of the pencil to the nearest $\frac{1}{8}$ inch?

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

**MA.4.M.1.2**

**Benchmark**

**MA.4.M.1.2** Convert within a single system of measurement using the units: yards, feet, inches; kilometers, meters, centimeters, millimeters; pounds, ounces; kilograms, grams; gallons, quarts, pints, cups; liter, milliliter; and hours, minutes, seconds.

*Example:* If a ribbon is 11 yards 2 feet in length, how long is the ribbon in feet?

*Example:* A gallon contains 16 cups. How many cups are in $3 \frac{1}{2}$ gallons?

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes the understanding of how to convert from smaller to larger units or from larger to smaller units.

*Clarification 2:* Within the benchmark, the expectation is not to convert from grams to kilograms, meters to kilometers or milliliters to liters.

*Clarification 3:* Problems involving fractions are limited to denominators of 2, 3, 4, 5, 6, 8, 10, 12, 16 and 100.
Purpose and Instructional Strategies

The purpose of this benchmark is for students to see the relationships between the units they use for measurement. Students should begin to generalize that the smaller the unit is, the more precise measurement they will get, but will also need more of the unit to measure (K12.MTR.5.1). Work in this benchmark builds from Grade 3 foundations of using customary measurements (MA.3.M.1.1).

- For instruction, students need to use measuring devices in class to develop a sense of the attributes being measured to have a better understanding of the relationships between units.
- The number of units relates to the size of the unit. Students need to develop an understanding that there are 12 inches in 1 foot and 3 feet in 1 yard. Allow students to use rulers or a yardstick to discover these relationships among units of measurements. Using 12-inch rulers and yardsticks, students will see that three of the 12-inch rulers are the same length as a yardstick, so 3 feet is equivalent to one yard. A similar strategy can be used with rulers marked with centimeters and a meter stick to discover the relationships between centimeters and meters.
- To help students to visualize the size of units, they should be given multiple opportunities to measure the same object with different measuring tools. For example, have the students measure the length of a room with one-inch tiles, with one-foot rulers, and with yardsticks. Students should notice that it takes fewer yard sticks to measure the room than rulers or tiles and explain their reasoning.
- During instruction, have students record measurement relationships in a two-column table or t-chart.
- Students are not expected to memorize conversions. Students should be provided conversion tools (e.g., charts) during instruction.

Common Misconceptions or Errors

- Students can assume that converting from smaller units to larger units (e.g., ounces to pounds), that multiplication is used, and when converting from larger units to smaller units (e.g., pounds to ounces), that division is used. To assist students with this misconception, expect them to estimate reasonable solutions.

Instructional Tasks

**Instructional Task 1**

Calculate how many minutes there are in 1 week.
**Instructional Items**

*Instructional Item 1*

There are 3 paperclip chains. Chain A is 50 inches long, Chain B is $4 \frac{1}{4}$ feet long. Chain C is 1 yard long. Order the chains from the longest length to the shortest length.

- a. Chain A, Chain B, Chain C
- b. Chain B, Chain C, Chain A
- c. Chain C, Chain B, Chain A
- d. Chain B, Chain A, Chain C

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

**MA.4.M.2** *Solve problems involving time and money.*

**MA.4.M.2.1**

**Benchmark**

**MA.4.M.2.1** Solve two-step real-world problems involving distances and intervals of time using any combination of the four operations.

**Benchmark Clarifications:**

*Clarification 1:* Problems involving fractions will include addition and subtraction with like denominators and multiplication of a fraction by a whole number or a whole number by a fraction.

*Clarification 2:* Problems involving fractions are limited to denominators of 2, 3, 4, 5, 6, 8, 10, 12, 16 and 100.

*Clarification 3:* Within the benchmark, the expectation is not to use decimals.

**Related Benchmarks/Horizontal Alignment**

- MA.4.M.1.2

**Terms from the K-12 Glossary**

**Vertical Alignment**

**Previous Benchmarks**

- MA.3.M.2.2

**Next Benchmarks**
Purpose and Instructional Strategies
The purpose of this benchmark is to connect concepts of unit conversions to time and distance and solve problems with these conversions. In Grade 3, students solved one- and two-step elapsed time problems without converting units of time or crossing from a.m. to p.m. or p.m. to a.m. (MA.3.M.2.2).

- For distance problems, students may need to understand multiplicative comparison (e.g., 20 is twice as many as 10).
- For instruction, an open number line is strategy students can use to solve elapsed time problems.

- Students need to spend time solving problems crossing between a.m. and p.m., and vice-versa.
- Students should also have a firm understanding of the terms quarter hour (15 minutes) and half hour (30 minutes).

Common Misconceptions or Errors
- Students can confuse when time crosses the hour because it does not follow the base-ten pattern where they are familiar. For example, students can misinterpret that the elapsed time between 9:55 a.m. and 10:05 a.m. and state that the elapsed time is 50 minutes because they have found the difference from 55 to 105. The use of number lines and clocks side-by-side help students build understanding about how elapsed time is calculated.

Instructional Tasks

Instructional Task 1
Steve drove 2,465 miles away to college. On Parents’ Weekend, his parents drove the distance round trip from home, with an additional 385 miles traveled to visit his sister on their return trip. How many total miles did his parents drive on Parents’ Weekend?

Instructional Items

Instructional Item 1
After lunch, Billy walked the dog for 17 minutes and then immediately after, did his chores for 58 minutes. If he finished his chores at 12:15 p.m., what time did he start walking the dog?

a. 1:30 p.m.

b. 1:13 p.m.

c. 11:17 a.m.

d. 11:00 a.m.

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.
**MA.4.M.2.2**

**Benchmark**

MA.4.M.2.2 Solve one- and two-step addition and subtraction real-world problems involving money using decimal notation.

*Example:* An item costs $1.84. If you give the cashier $2.00, how much change should you receive? What coins could be used to give the change?

*Example:* At the grocery store you spend $14.56. If you do not want any pennies in change, how much money could you give the cashier?

**Related Benchmarks/Horizontal Alignment**
- MA.4.NSO.2.7

**Terms from the K-12 Glossary**

**Vertical Alignment**

**Previous Benchmarks**
- MA.2.M.2.2

**Next Benchmarks**
- MA.5.M.2.1

**Purpose and Instructional Strategies**

The purpose of this benchmark is to connect money concepts to adding and subtracting decimals. This benchmark can be taught in tandem with the addition and subtraction of decimals to the hundredths (MA.4.NSO.2.7). Students solve problems within a real-world context using money (K12.MTR.7.1).

- For instruction, students should have opportunities using multiplication to count collections of coins (e.g., How much money is 50 nickels?).
- When students solve problems, invite flexible strategies that students learned with whole number addition and subtraction. For example, when finding the change for $2.00 on an item that costs $1.84, students may count up $0.16 instead of subtracting $2.00 - $1.84.
- Students need to understand how different coins and bills relate to each other.

**Common Misconceptions or Errors**

- Students can add and subtract incorrectly when they do not add or subtract like place values.

**Instructional Tasks**

*Instructional Task 1*

Jordan was saving his money to buy a remote control motorcycle. He saved $45.00 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 $73.00, does Jordan have enough money to buy the motorcycle?
Instructional Items

Instructional Item 1

Maria went to the comic bookstore and bought a comic book for $5.34 and a comic book for $9.55. If she paid with a $20 bill, how much change would she get back?

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

MA.4.GR.1 *Draw, classify and measure angles.*

**MA.4.GR.1.1 Benchmark**

Informally explore angles as an attribute of two-dimensional figures. Identify and classify angles as acute, right, obtuse, straight or reflex.

**Benchmark Clarifications:**
*Clarification 1:* Instruction includes classifying angles using benchmark angles of 90° and 180° in two-dimensional figures.  
*Clarification 2:* When identifying angles, the expectation includes two-dimensional figures and real-world pictures.

**Related Benchmarks/Horizontal Alignment**

- MA.4.GR.1.2
- MA.4.GR.1.3

**Terms from the K-12 Glossary**

- Acute Angle
- Angle
- Obtuse Angle
- Reflex Angle
- Right Angle
- Straight Angle

**Vertical Alignment**

**Previous Benchmarks**

- MA.3.GR.1.2

**Next Benchmarks**

- MA.5.GR.1.1

**Purpose and Instructional Strategies**

The purpose of this benchmark is to begin the understanding of angles and how they can be identified in lines and shapes. Understanding angles will be used to define shapes by their attributes. This builds on the work students completed in Grade 3 to identify perpendicular lines in shapes in mathematical and real-world situations (MA.3.GR.1.1).

- During instruction, students should gain experience using benchmark angles of 90° and 180° (K12.MTR.6.1). For right angles (90°) students can use the corner of a piece of paper. By lining the edge of the corner of the paper on one ray to the vertex of the angle, students can determine that angles that are smaller than the corner are acute and angles that are larger than the corner are obtuse. Similarly, students can use the side of a piece of paper to determine if the angles are greater than 180°.
Common Misconceptions or Errors

- Students believe a wide angle with short sides may seem smaller than a narrow angle with long sides. Students can compare two angles by tracing one and placing it over the other. Students will then realize that the length of the sides does not determine whether one angle is larger or smaller than another angle. The measure of the angle does not change.

Instructional Tasks

Instructional Task 1

Part A: Draw and label an example of 3 objects that have a right angle.
Part B: Draw and label an example of 3 objects that have an acute angle.
Part C: Draw and label an example of 3 objects that have an obtuse angle.
Part D: Is it possible to find an object with a reflex angle? Why or why not?

Instructional Items

Instructional Item 1

Which statement correctly describes the figure?

a. It has 5 acute angles.

b. It has 4 obtuse angles.

c. It has 1 right angle and 2 acute angles.

d. It has 2 right angles and 2 obtuse angles.

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*
MA.4.GR.1.2

Benchmark

Estimate angle measures. Using a protractor, measure angles in whole-number degrees and draw angles of specified measure in whole-number degrees.

Demonstrate that angle measure is additive.

Benchmark Clarifications:

Clarification 1: Instruction includes measuring given angles and drawing angles using protractors.

Clarification 2: Instruction includes estimating angle measures using benchmark angles (30°, 45°, 60°, 90° and 180°).

Clarification 3: Instruction focuses on the understanding that angles can be decomposed into non-overlapping angles whose measures sum to the measure of the original angle.

Related Benchmarks/Horizontal Alignment

<table>
<thead>
<tr>
<th>Terms from the K-12 Glossary</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Acute Angle</td>
</tr>
<tr>
<td>• Angle</td>
</tr>
<tr>
<td>• Obtuse Angle</td>
</tr>
<tr>
<td>• Right Angle</td>
</tr>
</tbody>
</table>

Terms from the K-12 Glossary

Vertical Alignment

Previous Benchmarks

• MA.4.GR.1.1

Current Benchmark

• MA.4.GR.1.2

Next Benchmarks

• MA.5.GR.1.1

Purpose and Instructional Strategies

The purpose of this benchmark is to build understanding that angles can be measured. Students have experience identifying acute, obtuse, and right angles (MA.4.GR.1.1). Through instruction in this benchmark, students will attach precise measurements to their informal understanding of the angles they have explored.

• Students will also estimate angle measures based on their growing familiarity of the size of angles according to the benchmark angles 30°, 45°, 60°, 90° and 180°.

• Instruction should allow students to draw angles of all sizes, including situations where they must make angles that are larger than their protractor or their piece of paper. This will ensure that students have an understanding that the angle measure does not change even if the length of the rays do.

• Instruction should use explicit and direct instruction to show students how to use a protractor (standard or circle) to measure and draw angles. Using circle protractors helps students explore reflex angles.

• Instructional time should also be spent breaking apart angles into smaller angles so that students build understanding that angle measures are additive.
Common Misconceptions or Errors

- Students that have difficulty using a protractor to measure. To assist students with this misconception, they may:
  - use the centimeter ruler or inch ruler instead of the baseline when measuring the angles.
  - measure the length of each ray and find the sum of the lengths.
  - not correctly line up the angle to be measured on the protractor.

Instructional Tasks

**Instructional Task 1**

Use a protractor to find the measure of each indicated angle.

\[
\angle A \\
\angle B \\
\angle C \\
\angle D
\]
Instructional Items

Instructional Item 1

Which angles when added together make a right angle?

a.

b.

c.

d.

e.

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.*
**MA.4.GR.1.3**

**Benchmark**

MA.4.GR.1.3 Solve real-world and mathematical problems involving unknown whole-number angle measures. Write an equation to represent the unknown.

*Example:* A 60° angle is decomposed into two angles, one of which is 25°. What is the measure of the other angle?

**Benchmark Clarifications:**
*Clarification 1:* Instruction includes the connection to angle measure as being additive.

<table>
<thead>
<tr>
<th>Related Benchmarks/Horizontal Alignment</th>
<th>Terms from the K-12 Glossary</th>
</tr>
</thead>
<tbody>
<tr>
<td>• MA.4.AR.1.1</td>
<td>• Angle</td>
</tr>
<tr>
<td>• MA.4.AR.2.2</td>
<td>• Circle</td>
</tr>
<tr>
<td></td>
<td>• Right Angle</td>
</tr>
<tr>
<td></td>
<td>• Straight Angle</td>
</tr>
</tbody>
</table>

**Vertical Alignment**

**Previous Benchmarks**

- MA.3.GR.1.1

**Next Benchmarks**

- MA.8.G.1.4

**Purpose and Instructional Strategies**

The purpose of this benchmark is to extend student thinking about angle measures beyond right angles that were taught in Grade 3 (MA.3.GR.1.1) and introducing the idea that angle measures are additive (MA.4.GR.1.2). Students will use this idea to find a missing angle measure.

- For instruction, students should use protractors to draw angles that add up to make right angles, straight angles and circles.
- With the knowledge that angle measures are additive, students can solve interesting and challenging problem with all four operations to find the measurements of unknown angles on a diagram in real world and mathematical problems.
- Students can use a protractor to ensure that they develop understanding of benchmark angles (e.g., 30°, 45°, 60° and 90°).

**Common Misconceptions or Errors**

- Students may make errors when writing equations used to solve angle measurement problems. During instruction, expect students to justify their equations and solutions.
- Students may not understand that straight lines, even if intersected, measure 180°.
Instructional Tasks

Instructional Task 1

Two straight lines, $AC$ and $BD$, intersect at point $E$. Using the given angle $<AEB$, find the measure of the other 3 angles.

*This item may seem a bit challenging but it fits within the benchmark, because it can be solved by repeatedly using additivity, and that fact that a straight line is $180^\circ$.*

Instructional Items

Instructional Item 1

Carlos is adding angles together to create a $150^\circ$ angle. Select all the angle measures that Carlos can use to create a $150^\circ$ angle.

a. $50^\circ + 100^\circ$
b. $45^\circ + 95^\circ$
c. $50^\circ + 90^\circ$
d. $50^\circ + 20^\circ + 20^\circ$
e. $50^\circ + 50^\circ + 50^\circ$

*The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.
MA.4.GR.2 Solve problems involving the perimeter and area of rectangles.

MA.4.GR.2.1

**Benchmark**

MA.4.GR.2.1 Solve perimeter and area mathematical and real-world problems, including problems with unknown sides, for rectangles with whole-number side lengths.

**Benchmark Clarifications:**

*Clarification 1:* Instruction extends the development of algebraic thinking where the symbolic representation of the unknown uses a letter.

*Clarification 2:* Problems involving multiplication are limited to products of up to 3 digits by 2 digits. Problems involving division are limited to up to 4 digits divided by 1 digit.

*Clarification 3:* Responses include the appropriate units in word form.

**Related Benchmarks/Horizontal Alignment**

- MA.4.NSO.2.2/2.3/2.4/2.5
- MA.4.AR.1.1

**Terms from the K-12 Glossary**

- Perimeter

**Vertical Alignment**

*Previous Benchmarks*

- MA.3.GR.2.3

*Next Benchmarks*

- MA.5.GR.2.1

**Purpose and Instructional Strategies**

The purpose of this benchmark is for students to connect perimeter and area problems to algebraic concepts to find the measures of unknown side lengths. This new idea builds from solving area and perimeter problems with whole number side lengths when using models and formulas in Grade 3 (MA.3.GR.2.3) and will form the foundation for problems involving fractional and decimal side lengths in Grade 5 (MA.5.GR.2.1).

- During instruction, students should use a letter (variable) to represent the missing side length and have experiences solving for unknowns in perimeter situations with a given area and vice-versa.
- Instruction includes having students use the fact that opposite sides in rectangles and squares are equal when solving problems involving area and perimeter.

**Common Misconceptions or Errors**

- Students frequently confuse area and perimeter. Instruction should provide lots of opportunity for students to work with both measures on the same object and have them explain which measure is area and which is perimeter and why? Instruction should also focus on naming the units properly.
Instructional Tasks

Instructional Task 1
The perimeter of the patio below is 98 square feet.

40 feet

What is the area of the patio?

Instructional Items

Instructional Item 1
A soccer field with its dimensions is shown.

Which equation can be used to find the area of the soccer field?

a. 75 yards + 120 yards = A yards
b. 75 yards + 75 yards + 120 yards + 120 yards = A yards
c. 75 yards x 120 yards = A square yards
d. 75 yards x 120 yards x 75 yards x 120 yards = A square yards

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

MA.4.GR.2.2
Solve problems involving rectangles with the same perimeter and different areas or with the same area and different perimeters.

*Example:* Possible dimensions of a rectangle with an area of 24 square feet include 6 feet by 4 feet or 8 feet by 3 feet. This can be found by cutting a rectangle into unit squares and rearranging them.

**Benchmark Clarifications:**
*Clarification 1:* Instruction focuses on the conceptual understanding of the relationship between perimeter and area.
*Clarification 2:* Within this benchmark, rectangles are limited to having whole-number side lengths.
*Clarification 3:* Problems involving multiplication are limited to products of up to 3 digits by 2 digits. Problems involving division are limited to up to 4 digits divided by 1 digit.
*Clarification 4:* Responses include the appropriate units in word form.

**Related Benchmarks/Horizontal Alignment**
- MA.4.NSO.2.2/2.3/2.4/2.5
- MA.4.AR.1.1

**Terms from the K-12 Glossary**
- Perimeter

**Vertical Alignment**

**Previous Benchmarks**
- MA.3.GR.2.3

**Next Benchmarks**
- MA.5.GR.2.1

**Purpose and Instructional Strategies**
The purpose of this benchmark is for students to understand the relationship between perimeter and area. Students will explore situations where the multiple shapes have the same area and different perimeters and same perimeters and different areas. This benchmark supports the perimeter and area work in MA.4.GR.2.1.

- Instruction will help students begin to generalize that when working with rectangles with the same area, squares will have the smallest perimeter and the longer one side is, the greater the perimeter is going to be.

**Common Misconceptions or Errors**
- Students may believe that a rectangle with a large perimeter must also have a large area.

**Instructional Tasks**

*Instructional Task I*
Steve has 600 feet of fencing. He is trying to figure out how to build his fence so that he has a rectangle with the greatest square footage inside the fence.

Part A. What are the dimensions of the fence he can build with the greatest area inside?

Part B. What is the area inside his fence?
**Instructional Items**

**Instructional Item 1**

Skylar built a rectangular table for her doll house. The area of the table is 105 square inches and the side lengths are whole-number inches. What are some possible perimeters of the table?

a. 26 inches  

b. 44 inches  

c. 52 inches  

d. 76 inches  

e. 210 inches

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

MA.4.DP.1 Collect, represent and interpret data and find the mode, median and range of a data set.

MA.4.DP.1.1

**Benchmark**

Collect and represent numerical data, including fractional values, using tables, stem-and-leaf plots or line plots.

*Example:* A softball team is measuring their hat size. Each player measures the distance around their head to the nearest half inch. The data is collected and represented on a line plot.

**Benchmark Clarifications:**

*Clarification 1:* Denominators are limited to 2, 3, 4, 5, 6, 8, 10, 12, 16 and 100.

**Related Benchmarks/Horizontal Alignment**

- MA.4.NSO.1.5
- MA.4.FR.1.3/1.4
- MA.4.M.1.1

**Terms from the K-12 Glossary**

- Line Plot
- Stem-and-Leaf Plot

**Vertical Alignment**

**Previous Benchmarks**

- MA.3.DP.1.1

**Next Benchmarks**

- MA.5.DP.1.1
Purpose and Instructional Strategies

The purpose of this benchmark is to collect authentic data and display the data using the appropriate format. This concept builds on collecting and displaying whole number data using line plots, bar graphs, and tables in Grade 3 (MA.3.DP.1.1). Student data in Grade 4 will be displayed using stem-and-leaf plots, in addition to other methods. In Grade 5, fractional and decimal data will be included (MA.5.DP.1.1).

- A stem-and-leaf plot displays numerical data and use place value to display data frequencies. In a stem-and-leaf-plot, a number is decomposed so that leaves represent the smallest part of a number (e.g., ones, fraction less than 1) and the stem consists of all its other place values (e.g., hundreds, tens, ones in fractions greater than 1). Stem-and-leaf plots help students build line plots. Stem-and-leaf plots can help students identify benchmarks for their number lines when creating a line plot.

- During instruction connections should be made between how data is represented on stem-and-leaf and line plots. Stem-and-leaf plots can help students identify benchmarks for their number lines when creating a line plot.

- A stem-and-leaf plot organizes data by size (e.g., least to greatest or greatest to least) and identifies the mode of a data set as the stem with the greatest number of leaves. It can be used to find the median and range of the data set.

- Measurement data can be gathered (including measuring with precision to the nearest \( \frac{1}{16}\) inch) and displayed on tables, line plots, and stem and leaf plots. The data is the same for each of the displays below.

- Instruction of line plots should first focus on creating appropriate number lines that allow a data set to be displayed.

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. Students also count the tick marks on the number line to determine the fraction, rather than looking at the “distance” or “space” between the marks.

- For stem-and-leaf plots, students may read they key incorrectly. Some students may try to represent numerical data in a stem-and-leaf plot without first arranging the leaves for each stem in order.
**Instructional Tasks**

*Instructional Task 1*

Measure the length of 10 used pencils in the class to the nearest $\frac{1}{8}$ inch. Create a stem-and-leaf plot and a line plot to represent the lengths of all ten pencils.

**Instructional Items**

*Instructional Item 1*

Laura was given the data in the chart below.

<table>
<thead>
<tr>
<th>High Jump Measurements (in feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$3\frac{3}{8}$</td>
</tr>
<tr>
<td>$4\frac{3}{8}$</td>
</tr>
<tr>
<td>$3\frac{1}{4}$</td>
</tr>
<tr>
<td>$4\frac{3}{8}$</td>
</tr>
<tr>
<td>$4\frac{1}{8}$</td>
</tr>
</tbody>
</table>

She was asked to create a line plot to represent her data. How many X’s will she place above $4\frac{3}{8}$?

a. 3  

b. 4  

c. 8  

d. 12

*The strategies, tasks and items included in the BIG-M are examples and should not be considered comprehensive.*
**MA.4.DP.1.2**

**Benchmark**

Determine the mode, median or range to interpret numerical data including fractional values, represented with tables, stem-and-leaf plots or line plots.

*Example:* Given the data of the softball team’s hat size represented on a line plot, determine the most common size and the difference between the largest and the smallest sizes.

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes interpreting data within a real-world context.

*Clarification 2:* Instruction includes recognizing that data sets can have one mode, no mode or more than one mode.

*Clarification 3:* Within this benchmark, data sets are limited to an odd number when calculating the median.

*Clarification 4:* Denominators are limited to 2, 3, 4, 5, 6, 8, 10, 12, 16 and 100.

**Related Benchmarks/Horizontal Alignment**

- MA.4.FR.1.3/1.4

**Terms from the K-12 Glossary**

- Line Plot
- Median
- Mode
- Range
- Stem-and-Leaf Plot

**Vertical Alignment**

**Previous Benchmarks**

- MA.3.DP.1.2

**Next Benchmarks**

- MA.5.DP.1.2

**Purpose and Instructional Strategies**

The purpose of this benchmark is to introduce concepts of mode, median, and range as measures of center and spread in a set of data. This work builds on interpreting different kinds of graphs with numerical and categorical data in Grade 3 (MA.3.DP.1.2). The mean as a measure of center introduced in Grade 5 (MA.5.DP.1.2).

- Instruction includes providing students multiple opportunities to organize their data (MA.4.FR.1.4). During instruction it is important for students to organize their data from least to greatest which will help them 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.
  - For example, Fifteen students were asked to rate how much they like Fourth grade on a scale from one to ten. Here is the data collected: 1, 10, 9, 6, 5, 10, 9, 8, 3, 3, 8, 9, 7, 4, 5. The first step is to put the data in ascending order.
  - 1, 3, 3, 4, 5, 5, 6, 7, 8, 8, 9, 9, 9, 10, 10. The median is 7, the mode is 9 and the range is 9.
Common Misconceptions or Errors

- Students sometimes have difficulty understanding that there may be no mode or more than one mode of a data set. Examples should be given to explicitly teach this concept.
- Students may confuse the range with the number of data points.

Instructional Tasks

**Instructional Task 1**

Measure the length of 10 used pencils in the class to the nearest $\frac{1}{8}$ inch.

Part A. Create a stem-and-leaf plot and a line plot to represent the length of all ten pencils.

Part B. From your completed line plot, find the median, range and mode of your data set.

Instructional Items

**Instructional Item 1**

The line plot below shows all of the results of the sum of two six-sided dice.

**Number of Ways to Roll a 2, 3, 4 … with a Pair of Dice**

<table>
<thead>
<tr>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
</table>

What is the mode of the data on the line plot?

a. 12  
b. 10  
c. 7  
d. 6

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

MA.4.DP.1.3

Benchmark

**MA.4.DP.1.3** Solve real-world problems involving numerical data.

*Example:* Given the data of the softball team’s hat size represented on a line plot, determine the fraction of the team that has a head size smaller than 20 inches.

**Benchmark Clarifications:**

*Clarification 1:* Instruction includes using any of the four operations to solve problems.

*Clarification 2:* Data involving fractions with like denominators are limited to 2, 3, 4, 5, 6, 8, 10, 12, 16 and 100. Fractions can be greater than one.

*Clarification 3:* Data involving decimals are limited to hundredths.
### Related Benchmarks/Horizontal Alignment
- MA.4.NSO.1.5
- MA.4.NSO.2.7
- MA.4.AR.1.2/1.3

### Terms from the K-12 Glossary
- Numerical Data

### Vertical Alignment

<table>
<thead>
<tr>
<th>Previous Benchmarks</th>
<th>Next Benchmarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA.3.DP.1.2</td>
<td>MA.5.DP.1.2</td>
</tr>
</tbody>
</table>

### Purpose and Instructional Strategies
The purpose of this benchmark is to use data sets as real-world context for doing arithmetic with whole numbers, fractions and decimals beyond finding measures of center and spread.

- Instruction includes having students solve one- and two-step problems from a given data set or by comparing two data sets in the same units.
- Instruction includes problems that involve addition, subtraction, multiplication or division.
- This benchmark should be taught with MA.4.DP.1.1 and MA.4.DP.1.2 (collecting and representing data). Students should have a strong command of creating and interpreting line plots and stem-and-leaf plots to be successful with the interpretation these data displays.

### Common Misconceptions or Errors
- Students can make errors when writing equations used to solve problems with numerical data. During instruction, expect students to justify their equations and solutions.

### Instructional Tasks

**Instructional Task 1**

Collect 10 used pencils from people in your class. Measure the length of each pencil to the nearest $\frac{1}{8}$ inch and record the lengths on a line plot. What is difference in length of the longest pencil and the shortest pencil?
Instructional Items

Instructional Item 1

The last 5 putt lengths, in feet, for the 18\textsuperscript{th} hole of a golf tournament are shown below on a stem-and-leaf plot.

<table>
<thead>
<tr>
<th>Stem</th>
<th>Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

What is the sum of the 5 putt lengths?

a. 8 feet  
b. 9 feet  
c. 12 feet  
d. 15 feet

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