The Study/Resource Guides are intended to serve as a resource for parents and students. They contain practice questions and learning activities for each content area. The standards identified in the Study/Resource Guides address a sampling of the state-mandated content standards.

For the purposes of day-to-day classroom instruction, teachers should consult the wide array of resources that can be found at www.georgiastandards.org.
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Dear Student,

This Georgia Milestones Grade 6 Study/Resource Guide for Students and Parents is intended as a resource for parents and students. It contains sample questions and helpful activities to give you an idea of what test questions look like on Georgia Milestones and what the Grade 6 End-of-Grade (EOG) assessment covers.

These sample questions are fully explained and will tell you why each answer is either correct or incorrect.

Get ready—open this guide—and get started!
How to Use This Guide

HOW TO USE THIS GUIDE

Let’s get started!

* Get it together!
  • This guide
  • Pen or pencil
  • Highlighter
  • Paper

* Gather materials
  • Classroom notebooks
  • Textbooks

* Study space
  • Find a comfortable place to sit.
  • Use good lighting.
  • Time to focus—no TV, games, or phones!

* Study time
  • Set aside some time after school.
  • Set a goal—how long are you going to study?
  • Remember—you cannot do this all at one time.
  • Study a little at a time, every day.

* Study buddy
  • Work with a friend, sister, brother, parent—anyone who can help!
  • Ask questions—it is better to ask now and get answers.
  • Make sure you know what you need to do—read the directions before you start.
  • Ask your teacher if you need help.

* Test-taking help
  • Read each question and all of the answer choices carefully.
  • Be neat—use scratch paper.
  • Check your work!
PREPARING FOR TAKING TESTS

Getting ready!

Here are some ideas to think about before you take a test.

- Get plenty of rest and eat right. Take care of your body and your mind will do the rest.

- If you are worried about a test, don’t be. Talk with a teacher, parent, or friend about what is expected of you.

- Review the things you have learned all year long. Feel good about it.

- Remember that a test is just one look at what you know. Your class work, projects, and other tests will also show your teachers how much you have learned throughout the year.

Try your best!
WHAT IS ON THE END-OF-GRADE ASSESSMENT?

✽ English Language Arts (ELA)
✽ Mathematics
✽ Science
✽ Social Studies

TYPES OF ITEMS

✽ Selected-response items—also called multiple-choice
  • English Language Arts (ELA), Mathematics, Science, and Social Studies
  • There is a question, problem, or statement that is followed by four answer choices.
  • There is only ONE right answer, so read EACH answer choice carefully.
  • Start by eliminating the answers that you know are wrong.
  • Then look for the answer that is the BEST choice.

✽ Constructed-response items
  • English Language Arts (ELA) and Mathematics only
  • There is a question, problem, or statement but no answer choices.
  • You have to write your answer or work out a problem.
  • Read the question carefully and think about what you are asked to do.
  • In English Language Arts (ELA), go back to the passage to look for details and information.
  • You will be scored on accuracy and how well you support your answer with evidence.

✽ Extended constructed-response items
  • English Language Arts (ELA) and Mathematics only
  • These are similar to the constructed-response items.
  • Sometimes they have more than one part, or they require a longer answer.
  • Check that you have answered all parts of the question.

✽ Extended writing prompt
  • English Language Arts (ELA) only
  • There is a question, problem, or statement.
  • You may be asked to do more than one thing.
  • In English Language Arts (ELA), you will be asked to read two passages and then write an essay.
  • You will be scored on how well you answer the question and the quality of your writing.
  • Organize your ideas clearly.
  • Use correct grammar, punctuation, and spelling.
  • Support your answer with evidence from the text.
DEPTH OF KNOWLEDGE

Test questions are designed with a Depth of Knowledge (DOK) level in mind. As you go from Level 1 to Level 4, the questions get more and more challenging. They take more thinking and reasoning to answer. You may have experienced these types of questions in your classroom as your teachers find ways to challenge you each day.

A Level 1 item may not require as much thinking as a Level 4 item—but that does not mean it’s easy.

A Level 4 item may have more than one part or ask you to write something.

Here is some information to help you understand just what a DOK level really is.

**Level 1 (Recall of Information)**
- Identify, list, or define something.
- Questions may start with *who, what, when, and where.*
- Recall facts, terms, or identify information.

**Level 2 (Basic Reasoning)**
- Think about things—it is more than just remembering something.
- Describe or explain something.
- Answer the questions “how” or “why.”

**Level 3 (Complex Reasoning)**
- Go beyond explaining or describing “how and why.”
- Explain or justify your answers.
- Give reasons and evidence for your response.
- Make connections and explain a concept or a “big idea.”

**Level 4 (Extended Reasoning)**
- Complex thinking required!
- Plan, investigate, or apply a deeper understanding.
- These items will take more time to write.
- Connect and relate ideas.
- Show evidence by doing a task, creating a product, or writing a response.
## Depth of Knowledge

### Level 1—Recall of Information
Level 1 asks you to identify, list, or define. You may be asked to recall *who, what, when, and where*. You may also be asked to recall facts and terms or identify information in documents, quotations, maps, charts, tables, graphs, or illustrations. Items that ask you to “describe” and/or “explain” could be Level 1 or Level 2. A Level 1 item requires that you just recall, recite, or repeat information.

<table>
<thead>
<tr>
<th>Skills Demonstrated</th>
<th>Question Cues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make observations</td>
<td>Tell who, what, when, or where</td>
</tr>
<tr>
<td>Recall information</td>
<td>Find</td>
</tr>
<tr>
<td>Recognize formulas, properties, patterns, processes</td>
<td>List</td>
</tr>
<tr>
<td>Know vocabulary, definitions</td>
<td>Define</td>
</tr>
<tr>
<td>Know basic concepts</td>
<td>Identify; label; name</td>
</tr>
<tr>
<td>Perform one-step processes</td>
<td>Choose; select</td>
</tr>
<tr>
<td>Translate from one representation to another</td>
<td>Compute; estimate</td>
</tr>
<tr>
<td>Identify relationships</td>
<td>Express as</td>
</tr>
<tr>
<td></td>
<td>Read from data displays</td>
</tr>
<tr>
<td></td>
<td>Order</td>
</tr>
</tbody>
</table>

### Level 2—Basic Reasoning
Level 2 includes some thinking that goes beyond recalling or repeating a response. A Level 2 “describe” and/or “explain” item would require that you go beyond a description or explanation of information to describe and/or explain a result or “how” or “why.”

<table>
<thead>
<tr>
<th>Skills Demonstrated</th>
<th>Question Cues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply learned information to abstract and real-life situations</td>
<td>Apply</td>
</tr>
<tr>
<td>Use methods, concepts, and theories in abstract and real-life situations</td>
<td>Calculate; solve</td>
</tr>
<tr>
<td>Perform multi-step processes</td>
<td>Complete</td>
</tr>
<tr>
<td>Solve problems using required skills or knowledge (requires more than habitual response)</td>
<td>Describe</td>
</tr>
<tr>
<td>Make a decision about how to proceed</td>
<td>Explain how; demonstrate</td>
</tr>
<tr>
<td>Identify and organize components of a whole</td>
<td>Construct data displays</td>
</tr>
<tr>
<td>Extend patterns</td>
<td>Construct; draw</td>
</tr>
<tr>
<td>Identify/describe cause and effect</td>
<td>Analyze</td>
</tr>
<tr>
<td>Recognize unstated assumptions; make inferences</td>
<td>Extend</td>
</tr>
<tr>
<td>Interpret facts</td>
<td>Connect</td>
</tr>
<tr>
<td>Compare or contrast simple concepts/ideas</td>
<td>Classify</td>
</tr>
<tr>
<td></td>
<td>Arrange</td>
</tr>
<tr>
<td></td>
<td>Compare; contrast</td>
</tr>
</tbody>
</table>
### Level 3—Complex Reasoning

Level 3 requires reasoning, using evidence, and thinking on a higher level than Level 1 and Level 2. You will go beyond explaining or describing “how and why” to justifying the “how and why” through reasons and evidence. Level 3 items often involve making connections across time and place to explain a concept or a “big idea.”

<table>
<thead>
<tr>
<th>Skills Demonstrated</th>
<th>Question Cues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solve an open-ended problem with more than one correct answer</td>
<td>Plan; prepare</td>
</tr>
<tr>
<td>Create a pattern</td>
<td>Predict</td>
</tr>
<tr>
<td>Generalize from given facts</td>
<td>Create; design</td>
</tr>
<tr>
<td>Relate knowledge from several sources</td>
<td>Ask “what if?” questions</td>
</tr>
<tr>
<td>Draw conclusions</td>
<td>Generalize</td>
</tr>
<tr>
<td>Make predictions</td>
<td>Justify; explain why; support; convince</td>
</tr>
<tr>
<td>Translate knowledge into new contexts</td>
<td>Assess</td>
</tr>
<tr>
<td>Compare and discriminate between ideas</td>
<td>Rank; grade</td>
</tr>
<tr>
<td>Assess value of methods, concepts, theories, processes, and formulas</td>
<td>Test; judge</td>
</tr>
<tr>
<td>Make choices based on a reasoned argument</td>
<td>Recommend</td>
</tr>
<tr>
<td>Verify the value of evidence, information, numbers, and data</td>
<td>Select</td>
</tr>
<tr>
<td></td>
<td>Conclude</td>
</tr>
</tbody>
</table>

### Level 4—Extended Reasoning

Level 4 requires the complex reasoning of Level 3 with the addition of planning, investigating, applying deeper understanding, and/or developing that will require a longer period of time. You may be asked to connect and relate ideas and concepts within the content area or among content areas in order to be at this highest level. The Level 4 items would be a show of evidence—through a task, a product, or an extended response—that the higher level demands have been met.

<table>
<thead>
<tr>
<th>Skills Demonstrated</th>
<th>Question Cues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyze and synthesize information from multiple sources</td>
<td>Design</td>
</tr>
<tr>
<td>Examine and explain alternative perspectives across a variety of sources</td>
<td>Connect</td>
</tr>
<tr>
<td>Describe and illustrate how common themes are found across texts from different cultures</td>
<td>Synthesize</td>
</tr>
<tr>
<td>Apply mathematical models to illuminate a problem or situation</td>
<td>Apply concepts</td>
</tr>
<tr>
<td>Design a mathematical model to inform and solve a practical or abstract situation</td>
<td>Critique</td>
</tr>
<tr>
<td>Combine and synthesize ideas into new concepts</td>
<td>Analyze</td>
</tr>
<tr>
<td></td>
<td>Create</td>
</tr>
<tr>
<td></td>
<td>Prove</td>
</tr>
</tbody>
</table>
**DESCRIPTION OF TEST FORMAT AND ORGANIZATION**

The Grade 6 Mathematics EOG assessment consists of a total of 73 items.

You will answer a variety of item types on the test. Some of the items are selected-response (multiple-choice), which means you choose the correct answer from four choices. Some items will ask you to write your response.

The test will be given in two sections.

- You may have up to 85 minutes per section to complete Sections 1 and 2.
- The test will take about 120 to 170 minutes.

**CONTENT**

The Grade 6 Mathematics EOG assessment will measure the Grade 6 standards that are described at [www.georgiastandards.org](http://www.georgiastandards.org).

The content of the assessment covers standards that are reported under these domains:

- Ratios and Proportional Relationships
- The Number System
- Expressions and Equations
- Geometry
- Statistics and Probability

**ITEM TYPES**

The Mathematics portion of the Grade 6 EOG assessment consists of selected-response (multiple-choice) items, constructed-response items, and extended constructed-response items.
MATHEMATICS DEPTH OF KNOWLEDGE EXAMPLE ITEMS

Example items that represent applicable DOK levels of the Mathematics assessment are provided for you on the following pages. The items and explanations of what is expected of you to answer them will help you prepare for the test.

All example and sample items contained in this guide are the property of the Georgia Department of Education.

Example Item 1

DOK Level 1: This is a DOK level 1 item because it requires students to recall information.

Mathematics Grade 6 Content Domain: The Number System

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

Which integer represents 10 degrees Fahrenheit below zero?

A. 10
B. 0
C. −10
D. −20

Correct Answer: C

Explanation of Correct Answer: The correct answer choice is (C) −10. Temperatures often fall below 0. When a temperature is colder than 0 degrees, we use negative integers to represent that temperature. Choice (A) is incorrect because it represents positive 10 degrees Fahrenheit, which is 20 degrees warmer than 10 degrees below zero. Choice (B) is incorrect because it is 10 degrees warmer than 10 degrees below zero. Choice (D) is incorrect because it represents a temperature that is 10 degrees colder than 10 degrees below zero.
Example Item 2

DOK Level 2: This is a DOK level 2 item that assesses basic reasoning. Student must solve a problem using knowledge of adding decimal numbers. Student must demonstrate how to solve the problem with valid evidence.

Mathematics Grade 6 Content Domain: The Number System


Find the sum for this addition problem.

6.42 + 27.58 = □

Show each step you used to find your answer.
## Scoring Rubric

<table>
<thead>
<tr>
<th>Points</th>
<th>Description</th>
</tr>
</thead>
</table>
| 2      | The response achieves the following:  
• Response demonstrates a complete understanding of how to use a strategy based on place value to add two decimal numbers.  
• Give 2 points for a correct response and a valid process.  
• Response is correct and complete.  
• Response shows application of a reasonable and relevant strategy.  
• Mathematical ideas are expressed coherently through a clear, complete, logical, and fully developed response using words, calculations, and/or symbols as appropriate. |
| 1      | The response achieves the following:  
• Response demonstrates a partial understanding of how to use a strategy based on place value to add two decimal numbers.  
• Give 1 point for a correct response that does not include a valid process or contains a calculation mistake made in an otherwise correct process.  
• Response includes the correct sum but no or incomplete explanation.  
• Response shows application of a relevant strategy, though it may be only partially applied or remain unexplained.  
• Mathematical ideas are expressed only partially using words, calculations, and/or symbols as appropriate. |
| 0      | The response achieves the following:  
• The response demonstrates limited to no understanding of how to use a strategy based on place value to add two decimal numbers.  
• Response shows no application of a strategy.  
• Mathematical ideas cannot be interpreted or lack sufficient evidence to support even a limited understanding. |

### Exemplar Response

<table>
<thead>
<tr>
<th>Points Awarded</th>
<th>Sample Response</th>
</tr>
</thead>
</table>
| 2              | 34  
AND  
6.42 + 27.58 = □  
□ = (6 + 7 + 20) + (0.4 + 0.5) + (0.02 + 0.08)  
□ = (13 + 20) + (0.9) + (0.1)  
□ = 33 + 1  
□ = 34  
OR other valid process |
| 1              | 34 with no explanation or incomplete work |
| 0              | Response is irrelevant, inappropriate, or not provided. |
Example Item 3

DOK Level 3: This is a DOK level 3 item that assesses complex reasoning. The student must evaluate another student’s work and explain why or why not expressions are equal. The student must change expressions to make them equivalent and provide evidence to support his or her reasoning.

Mathematics Grade 4 Content Domain: Expressions and Equations

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

Sam wrote these four expressions.

1. $n + n + n + n + 2$
2. $n + n + n + 2$
3. $4n + 2$
4. $2n + 2n + 2n$

Part A: Which expressions are equivalent?

Part B: Explain your reasoning for Part A.
Part C: Choose two of Sam’s expressions that are not equivalent. Explain how you know they are not equivalent.

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

Part D: How can you change one of the expressions from Part C to make the two expressions equivalent?

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________
## Scoring Rubric

<table>
<thead>
<tr>
<th>Points</th>
<th>Description</th>
</tr>
</thead>
</table>
| 4      | The response achieves the following:  
- The response demonstrates a complete understanding of evaluating expressions and identifying equivalent expressions.  
- Give 4 points for 4 parts answered correctly.  
- Response is correct and complete.  
- Response shows application of a reasonable and relevant strategy.  
- Mathematical ideas are expressed coherently through a clear, complete, logical, and fully developed response using words, calculations, and/or symbols as appropriate. |
| 3      | The response achieves the following:  
- The response demonstrates a nearly complete understanding of evaluating expressions and identifying equivalent expressions.  
- Give 3 points for correct responses for only three of the four parts OR two of the parts have errors or are incomplete.  
- Response is mostly correct but contains either a computation error or an unclear or incomplete explanation.  
- Response shows application of a relevant strategy, though it may be only partially applied or remain unexplained.  
- Mathematical ideas are expressed only partially using words, calculations, and/or symbols as appropriate. |
| 2      | The response achieves the following:  
- The response demonstrates a partial understanding of evaluating expressions and identifying equivalent expressions.  
- Give 2 points for correct responses for only two of the four parts OR three of the parts have errors or are incomplete.  
- Response is only partially correct.  
- Response shows application of a relevant strategy, though it may be only partially applied or remain unexplained.  
- Mathematical ideas are expressed only partially using words, calculations, and/or symbols as appropriate. |
| 1      | The response achieves the following:  
- The response demonstrates a minimal understanding of evaluating expressions and identifying equivalent expressions.  
- Give 1 point for correct responses for only one of the four parts OR three of the parts have errors or are incomplete.  
- Response is only partially correct.  
- Response shows incomplete or inaccurate application of a relevant strategy.  
- Mathematical ideas are expressed only partially using words, calculations, and/or symbols as appropriate. |
| 0      | The response achieves the following:  
- The response demonstrates limited to no understanding of evaluating expressions and identifying equivalent expressions.  
- Response shows no application of a strategy.  
- Mathematical ideas cannot be interpreted or lack sufficient evidence to support even a limited understanding. |
### Exemplar Response

<table>
<thead>
<tr>
<th>Points Awarded</th>
<th>Sample Response</th>
</tr>
</thead>
</table>
| 4              | Part A: Only expressions 1 and 3 are equivalent.  
AND  
Part B: To show that only two of the four expressions are equivalent, I set \( n \) equal to 3 in each expression and evaluated.  
1. When \( n \) is 3, the expression equals 14.  
2. When \( n \) is 3, the expression equals 11.  
3. When \( n \) is 3, the expression equals 14.  
4. When \( n \) is 3, the expression equals 18.  
Expressions 1 and 3 are equivalent because when you substitute \( n \) for a value, they both have the same result. If you substitute the same number for \( n \) in the other two expressions, the result is different. This is true for any value of \( n \).  
*OR other valid explanation*  
AND  
Part C: (answers will vary depending on which expression the student chooses)  
I chose expressions 2 and 3, which are not equivalent. I know they are not equivalent because when I substitute the same value for \( n \) in both expressions, they do not equal the same number.  
*OR other valid explanation*  
AND  
Part D: If I add one \( n \) to expression 2, they are equivalent. |
| 3              | The student correctly answers three out of the four parts. |
| 2              | The student correctly answers two out of the four parts. |
| 1              | The student correctly answers one of the four parts. |
| 0              | *Response is irrelevant, inappropriate, or not provided.* |
MATHEMATICS CONTENT DESCRIPTION AND ADDITIONAL SAMPLE ITEMS

In this section, you will find information about what to study in order to prepare for the Grade 6 Mathematics EOG assessment. This includes key terms and important vocabulary words. This section also contains practice questions, with an explanation of the correct answers, and activities that you can do on your own or with your classmates or family to prepare for the test.

All example and sample items contained in this guide are the property of the Georgia Department of Education.

CONTENT DESCRIPTION

- Apply and extend understanding of multiplication and division
- Divide fractions by fractions
- Compute fluently with multi-digit numbers and rational numbers
- Find common factors and multiples
- Apply and extend understandings of algebraic expressions
- Reason and solve one-variable equations and inequalities
- Analyze quantitative relationships between dependent and independent variables
- Understand ratio, area, surface area, and volume
- Develop understanding of statistical variability
- Summarize and describe distributions
You can find mathematics formula sheets on the Georgia Milestones webpage at http://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Pages/Georgia-Milestones-Assessment-System.aspx.

Look under “EOG Resources.”
Unit 1: Number System Fluency

In this unit, you will divide numbers and fractions by fractions and identify reciprocal fractions. You will work with decimals and solve multi-digit division. You will learn about factors and multiples of numbers.

KEY TERMS

Quotients of fractions: Dividing a number by a fraction is determining how many parts equal to the fraction are in the number. For example, $4 \div \frac{1}{4}$ is asking for how many $\frac{1}{4}$ parts are in 4, which is 16. This same strategy can be used to divide a fraction by a fraction. For example, $\frac{5}{4} \div \frac{1}{4}$ is asking for how many $\frac{1}{4}$ parts are in $\frac{5}{2}$, which is 10. Represent division of fractions using equations and fraction models to solve. (NS.1)

Remainder: A part of the dividend that is left over when dividing. The remainder is listed as the amount of the equal part that is left over. For example, in the equation $\frac{3}{8} \div \frac{1}{4}$, there is a remaining number of $\frac{1}{8}$, which is $\frac{1}{2}$ of an equal part. The quotient of this division equation is $1\frac{1}{2}$. (NS.1)

Reciprocal: Two numbers that have a product of 1. In fractions, reversing the numerator and denominator creates a reciprocal fraction, such as $\frac{2}{3} \times \frac{3}{2} = \frac{6}{6}$. When dividing two fractions, it is also possible to multiply by the reciprocal to determine the quotient. For example, $\frac{5}{2} \div \frac{1}{4}$ can be solved using $\frac{5}{2} \times \frac{4}{1} = \frac{20}{2}$. (NS.1)

Standard algorithm: A method used to solve a problem that includes a set of specific steps. (NS.2)

Solve multi-digit division equations using the standard algorithm. (NS.2)

Operations with decimals:

Addition and subtraction of decimal numbers requires close attention to the place value of each digit. Operations must be completed on the digit in the same location such as adding the tenths place in one number with the tenths place in another number. (NS.3)

When multiplying a number by a decimal number, the product will have a smaller value than the whole number factor. The equation $2 \times 0.01 = 0.02$ shows that 2 groups of 1 hundredth is equal to 2 hundredths. (NS.3)

When dividing a number by a decimal number, the quotient will have a greater value than the dividend. The equation $2 \div 0.01 = 200$ shows that there are 200 hundredths in the number 2. (NS.3)

A number can be broken down into factors. The factors of a number are two numbers that, when multiplied together, equal the given number. A greatest common factor is the largest factor that two numbers share. (NS.4)

A multiple of a number is the product of that number and another factor. A least common multiple is the smallest multiple that two numbers share. (NS.4)
An addition equation can be rewritten using the **Distributive Property** with **common factors**. For example, $21 + 35$ can be rewritten because both addends have a common factor of 7. So $(7 \times 3) + (7 \times 5)$ can also be written as $7 (3 + 5)$. (NS.4)

**Important Tips**

 мер 2 is to determine how many $\frac{1}{2}$ parts there are in a given number.
- Dividing in half means dividing by 2 to determine the quantity in 2 equal parts.
- The quotient of a division equation can be less than the dividend when the divisor is greater than 1. The quotient can be greater than the dividend if the divisor is smaller than 1. Or, the quotient can be equal to the dividend if the divisor is equal to 1.

**Sample Items 1–3**

**Item 1**

Which expression is equivalent to $36 + 24$?

A. $6 + 4$
B. $4(6 + 4)$
C. $4(6 + 6)$
D. $6(6 + 4)$
Item 2

Solve the problem.

\[
\frac{3}{6} \div \frac{1}{4} = \square
\]

\[
\square = \underline{______}
\]

Explain how you found your answer. Write your answer on the space provided.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
Item 3

Elena divided a decimal by a whole number.

\[ 84.36 \div 12 = \square \]

Part A: Explain each step needed to divide 84.36 by 12.

\[
\]

Part B: What is the correct quotient?

quotient = _______
Unit 2: Rate, Ratio, and Proportional Reasoning
Using Equivalent Fractions

In this unit, you will work with ratios and percentages. You will use measurement conversions and describe the relationship between quantities, including rate and constant speed. You will use equivalent fractions, ratio tables, diagrams, double number lines, equations, and proportions.

KEY TERMS

Ratio: Describes the multiplicative relationship between two quantities.

- **Part-to-part ratio**: A ratio that relates two parts of the same whole. For example, a class has 12 boys and 9 girls; the ratio of boys to girls is 12 to 9.
- **Part-to-whole ratio**: A ratio that relates a part of the whole to the whole. For example, there are 12 boys in the class of 21 students. The ratio of boys to the class is 12 to 21. (RP.1)

**Unit Ratio**: A ratio that has a number related to 1. For example, there is a ratio of red cars to blue cars of 2 to 1. (RP.2)

Use ratios to solve problems and find missing values using these strategies:

- **Equivalent ratio table**: A table listing ratios that have the same value, such as 2 to 3 and 4 to 6.
- **Tape diagrams**: Also called bar models or strip diagrams, these are drawing strategies used to create a numerical operation from a written description.
- **Double number line**: Two number lines used to represent the two quantities in a ratio to find equivalent ratios.
- **Equation**: A proportion that shows two ratios as being equivalent. (RP.3a)

Rate: Describes the relationship between two quantities that have different units of measure. For example, price per yard of fabric (unit pricing) or miles per hour (constant speed). (RP.3b)

Unit pricing and constant speed require creating an equivalent rate where a value is 1. For example, the car travels 75 miles in 3 hours. The rate or constant speed of the car is 25 miles per 1 hour. (RP.3b)

Percent: A part-to-whole ratio that has a number related to 100. It can be written as a fraction with the denominator of 100 or using the symbol %. For example, there are 40 comic books out of 200 total books. The ratio of comic books to the total is 20 to 100, or \(\frac{20}{100}\), or 20%. (RP.3c)

Measurement conversion: Using the relationship between measurement units to change units such as feet to inches as well as converting centimeters to inches. For example, 36 inches can be converted into feet using the ratio 1 foot to 12 inches. (RP.3d)

**Important Tip**

- Percentages can be used in a variety of situations and include numbers that are greater than 100 as well as less than 1.
Sample Items 4–6

Item 4

Fran has 18 paperback books and 24 hardcover books. What is the ratio of paperback to hardcover books?

A. 3 to 4  
B. 4 to 3  
C. 3 to 7  
D. 7 to 3

Item 5

A tomato sauce recipe uses 96 ounces of crushed tomatoes.

How many pints of crushed tomatoes are needed to make the tomato sauce? 
(32 ounces = 2 pints)

A. 2 pints  
B. 3 pints  
C. 4 pints  
D. 6 pints
Item 6

At the farmers’ market, 2 watermelons cost $6. At the grocery store, 4 watermelons cost $20.

<table>
<thead>
<tr>
<th>Number of Watermelons (Farmers’ Market) \n( (n) )</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Watermelons (Grocery Store) \n( (n) )</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>20</td>
</tr>
</tbody>
</table>

Part A: Complete the table that shows the ratio of number of watermelons to price at the farmers’ market. Explain what each row means.

Part B: Complete the table that shows the ratio of the number of watermelons to price at the grocery store. Explain what each row means.

Part C: At which place do watermelons cost less? Explain how you got your answer.
Unit 3: Expressions

In this unit, you will work with exponents, variables, and written and numerical expressions. You will use the order of operations to find the value of equations and equivalent expressions.

KEY TERMS

**Exponent:** Represents repeated multiplication. For example, \(10 \cdot 10 \cdot 10 = 10^3\), so 10 is multiplied by itself 3 times, so the number 10 is written with an exponent of 3. The same strategy for writing exponents can be used with any number or variable. (EE.1)

**Variables:** A letter used in an expression or equation to represent an unknown number or a number that may have different values. (EE.2a)

Use variables, numbers, and operations to represent **written expressions as numerical expressions.** For example, “multiply the sum of 2 and \(n\) by 3” can be written as \(3(2 + n)\). (EE.2a)

**Parts of an expression:**
- **Term:** A number, variable, or a product of a number and a variable.
- **Factor:** A number that is multiplied by another number to find the product.
- **Sum:** The total of terms that are added together.
- **Difference:** The total of terms that are subtracted.
- **Product:** The total of terms that are multiplied.
- **Quotient:** The total of terms that are divided.
- **Coefficient:** A number multiplied by a variable. (EE.2b)

**Order of operations:** The specific order used to complete operations when finding the value of an equation or expression.
- Parenthesis
- Exponents
- Multiplication or division
- Addition or subtraction (EE.2c)

**Equivalent expressions:** Two expressions that represent the same number regardless of the value of the variable. (EE.4) Equivalent expressions can be created using the **Properties of Operations** such as using the Distributive Property to change \(24 + 6x\) to the equivalent expression of \(6(4 + x)\). (EE.2)

**Greatest Common Factor:** The greatest factor that divides two numbers. (NS.4)

**Least Common Multiple:** The smallest positive integer that is divisible by two numbers. (NS.4)
**Important Tips**

- Variables are often used to represent unknown numbers in an equation. A specific letter can be used to represent several different numbers in different equations. Use the equation to determine the value of the variable in each problem.
- The coefficient relates to the variable it is paired with. The value of $5n + 3$ is $n + n + n + n + n + 3$ and is determined based on the value of $n$. If $n = 2$, then there are 5 groups of 2 and $5n + 3$ has a value of $10 + 3$.
- A variable listed alone has a coefficient of 1. For example, $3x - x$ is the same as $3x - 1x$ for a total of $2x$.

**Item 7**

Adam is $n$ years old. Mary Beth is $3n + 4$ years old. If Adam is 9 years old, how old is Mary Beth?

A. 23  
B. 27  
C. 31  
D. 43
**Sample Items 8–9**

**Item 8**

Look at this expression.

\[ \frac{1}{5} \times \frac{1}{5} \times \frac{1}{5} \]

Which expression is equivalent?

A. \(2 \times \frac{1}{5}\)

B. \(3 \times \frac{1}{5}\)

C. \(\left(\frac{1}{5}\right)^2\)

D. \(\left(\frac{1}{5}\right)^3\)

**Item 9**

Look at this expression.

\[5(4x – 3)\]

Which expression is equivalent?

A. \(20x – 3\)

B. \(20x – 15\)

C. \(4x – 15\)

D. \(9x – 8\)
Unit 4: One-Step Equations and Inequalities

In this unit, you will work with one-step equations and inequalities. You will use variables to represent unknown numbers. You will use rational numbers as well as dependent and independent variables.

KEY TERMS

Equation: A grouping of numbers, variables, and operations with an equal sign. The solution to an equation is a specific number that makes the equation true. (EE.5)

Inequality: A grouping of numbers, variables, and operations with an inequality symbol such as <, >, ≤, or ≥. The solution for an inequality is a set of numbers or multiple numbers that make the inequality true. (EE.5)

A variable in an equation or inequality represents an unknown number or a number in a given set of numbers. (EE.6)

A word problem can be represented using an equation before solving. Using rational numbers from a problem, write equations such as \( x + 42 = 56 \) and \( 8x = 72 \). (EE.7)

A word problem can also be represented using an inequality using rational numbers such as \( x < 24 \). Solutions to inequalities can be represented on the number line by placing an open or closed point on the given number and an arrow towards greater or less than. For example, for \( x < 24 \), place an open circle on 24 and draw an arrow to the left over numbers that are less than 24. For \( x \geq 2 \), place a closed circle on 2 and draw an arrow to the right, over numbers that are greater than 2. (EE.8)

Dependent variable: A variable whose value changes based on other factors. (EE.9)

Independent variable: A variable whose value does not change based on other factors. (EE.9)

An equation can include an independent and a dependent variable. The relationship between the two variables can be seen by graphing the values of each variable or creating a table. (EE.9)

Use ratios to solve problems and find missing values using these strategies:

- **Equivalent ratio table:** A table listing ratios that have the same value, such as 2 to 3 and 4 to 6.
- **Tape diagrams:** Also called bar models or strip diagrams, these are drawing strategies used to create a numerical expression from a written description.
- **Double number line:** Two number lines used to represent the two quantities in a ratio to find equivalent ratios.
- **Equation:** A proportion that shows two ratios as being equivalent. (RP.3)

A proportional relationship will change by the same value over time. This constant of proportionality is represented by the value of the ratio \( k \) between \( y \) and \( x \) as \( y = kx \). (RP.3)
Percent: A part-to-whole ratio that has a number related to 100. It can be written as a fraction with the denominator of 100 or using the symbol %. For example, there are 40 comic books out of 200 total books. The ratio of comic books to the total is 20 to 100, or \( \frac{20}{100} \), or 20%. (RP.3c)

Measurement conversion: Using the relationship between measurement units to change units. For example, 36 inches can be converted into feet using the ratio 1 foot to 12 inches. (RP.3d)

Important Tips

- An equal sign (=) represents that the two sides of the equation have the same value. Operations may need to be completed before finding the solution to the equation.
- When writing a verbal or written expression as a numerical expression, focus on the chosen wording. The way an expression is written will identify the operation to use as well as the order of the terms. For example, “six less than \( x \)” is written as \( x - 6 \), and “4 is greater than \( x \)” is written as \( 4 > x \).

Sample Items 10–12

Item 10

Look at this inequality.

\[ 5y > 14 \]

Which value for \( y \) makes the inequality true?

A. 1.5  
B. 2  
C. 2.8  
D. 3

Item 11

It costs $60 to reserve a movie theater for a party. There is also a charge of $3 for each person.

Which expression represents the total cost to reserve a movie theater for \( n \) persons?

A. \( 60 + 3n \)  
B. \( 60 - 3n \)  
C. \( 3 + 60n \)  
D. \( 3 - 60n \)
Item 12

A bike shop needs to order new wheels for 10 tricycles. Hannah orders 10 new wheels. As this illustration shows, each tricycle has 3 wheels.

Part A: Did Hannah order the correct number of wheels? Explain your answer.

______________________________

______________________________

Part B: The equation $3x = y$ can be used to calculate the number of wheels to order for any number of tricycles. What does each part of the equation represent?

______________________________

______________________________

Part C: How many wheels should be ordered for 15 tricycles? Explain how you used the equation from Part B to get your answer.

______________________________

______________________________

______________________________

______________________________
Unit 5: Area and Volume

In this unit, you will find the area of plane figures and the volume of solid figures. You will continue to work with fractions. You will work with three-dimensional figures to unfold nets and find the surface area.

KEY TERMS

Two-dimensional figures: A plane figure that has two dimensions such as length and width. (G.1)

Area: The number of square units used to fill a two-dimensional figure without gaps or overlaps.

- Rectangle: Multiply the length and width of the rectangle. \( A = bh \)
- Triangle: Multiply the height and base of the triangle, then divide by 2. \( A = \frac{1}{2}bh \). (G.1)

The area of a polygon can be found by composing or decomposing the shape into rectangles and triangles. Determine the area of each triangle or rectangle that forms the polygon. The total area of the polygon is equal to the sum of the area of each part. (G.1)

The volume of a shape is the amount of space the shape takes up in three dimensions: length, width, and height. A solid figure or three-dimensional figure such as a rectangular prism has a volume. (G.2)

A solid figure can be packed with equally sized cubes leaving no gaps and without overlapping cubes. The number of cubes packed into the solid figure is used to find the volume of the figure. (G.2)

A three-dimensional figure with fractional edge lengths can be packed with cubes that have edge lengths equal to a unit fraction. For example, a figure with a length of 2, width of 2, and height of \( \frac{3}{2} \) can be filled with 48 cubes with edge lengths of \( \frac{1}{2} \) unit.

The volume of each cube is \( \frac{1}{8} \) unit, multiplied by 48 cubes gives the figure a total volume of 6 units. (G.2)

The volume of a right rectangular prism can be determined using two formulas.

- \( l \cdot w \cdot h \) multiplies the length, width, and height of the figure to find the cubic units of volume.
- \( B \cdot h \) finds the area of the base using the width and length, and then multiplies it by the height of the figure to find the cubic units of volume. (G.2)

Surface area: The total area of each face of a three-dimensional figure. (G.3)

Net: A strategy used to unfold a three-dimensional figure to see each face as a two-dimensional figure. (G.3)
Important Tips

- Identify shapes using the attributes. Shapes can be turned and may appear different, but that does not change the shape.
- In a right triangle, the height can be a side of the triangle. In triangles with acute or obtuse angles, the height must be measured from the highest point and be perpendicular to the base. This measurement may be taken inside or outside of the figure, depending on the type of angle.

Sample Items 13–15

Item 13

Mitch drew this quadrilateral.

What is the area of the quadrilateral?

A. 28 cm²
B. 80 cm²
C. 96 cm²
D. 128 cm²
**Item 14**

Consider this rectangular prism.

How many $\frac{1}{2}$-unit cubes are needed to fill the rectangular prism?

A. 8  
B. 16  
C. 32  
D. 64
Item 15

Mia found the area of a polygon. The area is 32 cm².

Which of these polygons has an area of 32 cm²?

A. 3 cm

B. 4 cm 8 cm

C. 6 cm 6 cm 4 cm 4 cm

D. 6 cm 4 cm 4 cm 2 cm 6 cm 2 cm
Unit 6: Statistics

In this unit, you will work with statistics, numerical data, distribution of data, quartiles, plots, and histograms. You will calculate the mode of numbers and identify outliers.

KEY TERMS

Statistical questions: Questions used to collect data that will allow for a variety of different answers. (SP.1)

Numerical data set (Data set): Information collected as rational numbers that can be represented using graphs and plots. (SP.2, SP.3, SP.4, SP.5)

Distribution of data can be described by:

- **Center**: The one number that summarizes data by giving the middle or center value. (SP.3) This can be measured using the **mean** if the data are symmetrical or **median** if the data are **skewed**. (SP.2)
- **Mean**: The “average” or “fair share” value for the data. The mean is also the balance point of the corresponding data distribution. (SP.3)
- **Median**: The value for which half the numbers are larger and half are smaller. If there are two middle numbers, the median is the arithmetic mean of the two middle numbers. (SP.3)
- **Range**: A measure of spread for a set of data. To find the range, subtract the smallest value from the largest value in a set of data. (SP.3)
- **Skewed Data**: When a set of data is not symmetrical it can be skewed, meaning it tends to have a long tail on the left or right side. (SP.2)
- **Spread**: The one number that summarizes the variation in the data. (SP.3) This can be measured by the **range**. (SP.2)
- **Overall shape**: The **frequency** of data and any data that is **skewed** to the left or right. (SP.2)

A set of data can be written in order and separated into four equal parts. Each part is a **quartile**. The **lower quartile** is the first quartile and is the center number between the minimum value and the median. The **upper quartile** is the third quartile and is the center number between the median and the maximum value. (SP.5)

Data can be displayed on a **number line** using:

- **Box plots**: Uses the minimum value, lower quartile, median, upper quartile, and maximum value to create a representation of the data. A box is placed around the Interquartile range with a line at the median. Lines or whiskers extend out of the box to the minimum and maximum values.
- **Dot plots (Line plots)**: Displays a dot, a circle, or an “X” on a number line corresponding to the value of each piece of data.
- **Histograms**: Displays data using a bar. The length of the bar on the number line shows the frequency of that value of data. (SP.4)

**Interquartile range**: The range, or difference, in values of the first and third quartiles. (SP.5)
**Important Tips**

- When finding the median of a data set, the numbers must be placed in order before finding the centermost value.
- If data are **skewed** to the left, there is a large quantity of data on the right side of the number line and smaller quantity of data or a tail on the left side of the number line.

**Sample Items 16–18**

**Item 16**

This list shows the number of math problems solved each week by a sixth-grade student.

23, 19, 26, 20, 31, 16, 20, 29, 27

Which box plot BEST represents this list?

A. [Box plot diagram]

B. [Box plot diagram]

C. [Box plot diagram]

D. [Box plot diagram]
Item 17

The dot plot shows the number of times 14 students have attended a sporting event.

Number of Sporting Events
Attended by Students

What number is the median of the data set?

A. 1
B. 4
C. 5
D. 7

Item 18

Which of these questions is a statistical question because it could have more than one answer?

A. “Where does the current U.S. president live?”
B. “What size coat am I wearing now?”
C. “Did Jack wear sneakers or boots to school today?”
D. “What size shirt do the kids in the school wear?”
Unit 7: Rational Explorations: Numbers and Their Opposites

In this unit, you will work with negative and rational numbers. You will compare inequalities. You will learn about coordinate pairs, quadrants, polygons, and absolute value.

**KEY TERMS**

**Negative number:** A number with a value less than zero. For example, the temperature is $-4^\circ$. (NS.5)

**Rational number:** A number that can be made by dividing two integers or whole numbers. Rational numbers can be displayed as a point on a number line or coordinate plane. (NS.6)

A negative number represents the **opposite** location on the number line as a positive number. For example, $-2$ is the opposite of $2$. (NS.6)

The opposite of the opposite of a number is the number itself. For example, $-(-2)$ is equal to $2$. (NS.6)

**Absolute value:** The distance between the given number and zero on a number line. For example, $|-5| = 5$. (NS.7)

**Inequalities:** A statement comparing the value and location of two or more numbers. For example, $x < -5$ shows that the value of $x$ is less than $-5$, so the value of $x$ could be $-6$, $-7$, etc.

**Ordered pairs:** A set of numbers that are used to label the location of a point on the coordinate plane written as $(1, 2)$. (NS.8)

A **coordinate plane** is created by **intersecting** two perpendicular number lines at 0. The point where the two lines meet is called the **origin**. The **horizontal** line is called the **x-axis** and the **vertical** line is called the **y-axis**. (NS.8)

The coordinate plane is made up of four regions, or **quadrants**.

- First Quadrant: The values of the $x$-coordinate and $y$-coordinate are both positive.
- Second Quadrant: The values of the $x$-coordinates are negative and the $y$-coordinates are positive.
- Third Quadrant: The values of the $x$-coordinates and $y$-coordinates are both negative.
- Fourth Quadrant: The values of the $x$-coordinates are positive and the $y$-coordinates are negative. (NS.8)

On the coordinate plane, ordered pairs that differ only by their **signs** represent a **reflection** over one or both of the **axes**. (NS.6)

Draw **polygons** on the coordinate plane by placing a point at given coordinates for the **vertices**. The length of the sides of the polygon can be determined by counting the distance between points on the grid. (G.3)

**Important Tip**

- An ordered pair lists the $x$-coordinate first, then the $y$-coordinate. When graphing a point using the ordered pair, move horizontally on the $x$-axis using the $x$-coordinate, then move vertically on the $y$-axis using the $y$-coordinate.
Sample Items 19–21

Item 19

Which list shows the numbers in descending order?

A. $\{-2.5\}, -2.25, 2.75$
B. $-2.25, -2.5, |2.75|$
C. $-2.5, 2.5, |-2.75|$
D. $2.75, |-2.5|, -2.25$

Item 20

Erin plotted the opposite of $-3$ on the number line.

Part A: Explain the error Erin made.

Part B: Explain how Erin should correctly plot the opposite of $-3$ on the number line.
Item 21

You may use the coordinate grid to help you answer the question.

Part A: In which quadrant is each point located?

(-3, 4): ___________

(2, 3): ___________

(3, -2): ___________

Part B: Explain how you identified the quadrant for each point.

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________________________________________________________________________
<table>
<thead>
<tr>
<th>Item</th>
<th>Standard/Element</th>
<th>DOK Level</th>
<th>Correct Answer</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MGSE6.NS.4</td>
<td>1</td>
<td>D</td>
<td>The correct answer is choice (D) 6(6 + 4). The student finds the greatest common factor of the two addends, which is 6. Then student multiplies by the sum of 6 and 4, which are the factors that equal the initial addends when multiplied by the greatest common factor, 6. Choice (A) is incorrect because the response equals 10, rather than 60. Choice (B) is incorrect because the response equals 40, rather than 60. Choice (C) is incorrect because the response equals 48, not 60.</td>
</tr>
<tr>
<td>2</td>
<td>MGSE6.NS.1</td>
<td>2</td>
<td>N/A</td>
<td>See scoring rubric and sample response on page 116.</td>
</tr>
<tr>
<td>3</td>
<td>MGSE6.NS.3</td>
<td>2</td>
<td>N/A</td>
<td>See scoring rubric and sample response on page 117.</td>
</tr>
<tr>
<td>4</td>
<td>MGSE6.RP.1</td>
<td>1</td>
<td>A</td>
<td>The correct answer is choice (A) 3 to 4. The ratio of paperback to hardcover books can be written as the fraction $\frac{18}{24}$. Reduce the fraction by dividing both the numerator and the denominator by 6 to get $\frac{3}{4}$. Then write the ratio as 3 to 4. Choice (B) is incorrect because it results from finding the ratio of hardcover books to paperback books. Choice (C) is incorrect because it results from finding the ratio of paperback books to the total number of books. Choice (D) is incorrect because it results from finding the ratio of the total number of books to paperback books.</td>
</tr>
<tr>
<td>5</td>
<td>MGSE6.RP.3d</td>
<td>1</td>
<td>D</td>
<td>The correct answer is choice (D) 6 pints. The student uses the proportion of $\frac{32}{2} = \frac{96}{6}$ or another viable method to find the number of pints in 96 ounces. Choice (A) is incorrect because it shows the number of pints in 32 ounces. Choice (B) is incorrect because it is the factor used to change 32 ounces to 96 ounces. Choice (C) is incorrect because it shows the number of pints in 64 ounces.</td>
</tr>
<tr>
<td>6</td>
<td>MGSE6.RP.3a, b</td>
<td>3</td>
<td>N/A</td>
<td>See scoring rubric and sample response beginning on page 118.</td>
</tr>
<tr>
<td>Item</td>
<td>Standard/Element</td>
<td>DOK Level</td>
<td>Correct Answer</td>
<td>Explanation</td>
</tr>
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<td>------</td>
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<tr>
<td>7</td>
<td>MGSE6.EE.2c</td>
<td>1</td>
<td>C</td>
<td>The correct answer is choice (C) 31. Replace ( n ) in the expression with 9, which is the value given for Adam’s age, and evaluate ( 3n + 4 = 3(9) + 4 = 27 + 4 = 31 ). Choice (A) is incorrect because 23 is the result of substituting 9 for ( n ) in the expression ( 3n - 4 ). Choice (B) is incorrect because 27 is the result of only computing 3(9). Choice (D) is incorrect because it is the result of writing the expression as ( 39 + 4 ) rather than ( 3(9) + 4 ).</td>
</tr>
<tr>
<td>8</td>
<td>MGSE6.EE.1</td>
<td>1</td>
<td>D</td>
<td>The correct answer is choice (D) ( \left( \frac{1}{5} \right)^3 ). An exponent of 3 can be used to write ( \frac{1}{5} ) when it is multiplied by itself 3 times. Choice (A) is incorrect because it is equal to ( \frac{2}{5} ). Choice (B) is incorrect because it is equal to ( \frac{3}{5} ). Choice (C) is incorrect because it is equal to ( \frac{1}{25} ).</td>
</tr>
<tr>
<td>9</td>
<td>MGSE6.EE.3</td>
<td>1</td>
<td>B</td>
<td>The correct answer is choice (B) ( 20x - 15 ). Apply the distributive property to the equation by multiplying 5 by each term inside the parentheses. Choice (A) is incorrect because it is the result of only multiplying 5 by 4( x ). Choice (C) is incorrect because it is the result of only multiplying 5 by 3 only. Choice (D) is incorrect because it shows the result of adding 5 to 4( x ) and 3, rather than multiplying.</td>
</tr>
<tr>
<td>10</td>
<td>MGSE6.EE.5</td>
<td>1</td>
<td>D</td>
<td>The correct answer is choice (D) 3. The inequality is true when you substitute ( y = 3 ) into ( 5y &gt; 14; 15 &gt; 14 ). Choices (A) and (B) are both incorrect because those values for ( y ) result in numbers less than 14 (( 5 \times 1.5 = 7.5 ) and ( 5 \times 2 = 10 )). Choice (C) is incorrect because that value of ( y ) results in a number equal to 14 (( 5 \times 2.8 = 14 )).</td>
</tr>
<tr>
<td>11</td>
<td>MGSE6.EE.6</td>
<td>1</td>
<td>A</td>
<td>The correct answer is choice (A) ( 60 + 3n ). The reservation cost for the theater is a constant, at $60. The additional $3 per person charge will vary depending on the number of people, ( n ), for a variable charge of ( 3n ) that would need to be added to the initial cost of $60. Choice (B) is incorrect because it subtracts ( 3n ) from 60 instead of adding. Choices (C) and (D) are incorrect because they multiply the variable number of people, ( n ), by the constant 60.</td>
</tr>
<tr>
<td>12</td>
<td>MGSE6.EE.7</td>
<td>3</td>
<td>N/A</td>
<td>See scoring rubric and sample response beginning on page 121.</td>
</tr>
<tr>
<td>Item</td>
<td>Standard/Element</td>
<td>DOK Level</td>
<td>Correct Answer</td>
<td>Explanation</td>
</tr>
<tr>
<td>------</td>
<td>------------------</td>
<td>-----------</td>
<td>----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>13</td>
<td>MGSE6.G.1</td>
<td>2</td>
<td>B</td>
<td>The correct answer is choice (B) 80 cm². The quadrilateral can be decomposed into a rectangle that is 8 cm long and 8 cm wide and a right triangle with a base of 4 cm and height of 8 cm. So, its area is 64 + 16 = 80 cm². Choice (A) is incorrect because it is the sum of the three labeled side lengths. Choice (C) is incorrect because it uses 12 cm for one side of the rectangle part instead of 8 cm. Choice (D) is incorrect because it does not multiply the base and height of the triangle part by $\frac{1}{2}$.</td>
</tr>
<tr>
<td>14</td>
<td>MGSE6.G.2</td>
<td>2</td>
<td>D</td>
<td>The correct answer is choice (D) 64. Since the volume is $V = l \times w \times h$, the volume of this prism is $V = 4 \times \left(\frac{1}{2} + \frac{1}{2}\right) \times 2 = 8$ units³, and the volume of each unit cube is $V = \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \frac{1}{8}$ units³. The number of cubes needed is the volume of the prism divided by the volume of each cube: $8 \div \frac{1}{8} = 8 \times 8 = 64$. OR Since the volume is $V = l \times w \times h$ and we are looking for the number of cubes, we find the dimensions in terms of cubes: $w = 2$ cubes, $l = 4 \div \frac{1}{2} = 8$ cubes, and $h = 2 \div \frac{1}{2} = 4$ cubes. So the volume, in cubes, of this prism is $V = 2 \times 8 \times 4 = 64$. Choice (A) is incorrect because it is the volume of the prism. Choice (B) is incorrect because it is the volume of the prism divided by $\frac{1}{2}$. Choice (C) is incorrect because it is the volume of the prism divided by $\frac{1}{4}$.</td>
</tr>
<tr>
<td>Item</td>
<td>Standard/Element</td>
<td>DOK Level</td>
<td>Correct Answer</td>
<td>Explanation</td>
</tr>
<tr>
<td>------</td>
<td>------------------</td>
<td>-----------</td>
<td>---------------</td>
<td>-------------</td>
</tr>
<tr>
<td>15</td>
<td>MGSE6.G.1</td>
<td>1</td>
<td>D</td>
<td>The correct answer is choice (D) trapezoid with side lengths of 6 cm and 10 cm and a height of 4 cm. Student finds the area by breaking apart the trapezoid into 2 right triangles and a rectangle and adding the areas of the 3 shapes. The total area is 32 cm², which is the given area. Choice (A) is incorrect because it shows a rectangle with an area of 24 cm². Choice (B) is incorrect because it shows a triangle with an area of 16 cm². Choice (C) is incorrect because it shows a parallelogram with an area of 36 cm².</td>
</tr>
<tr>
<td>16</td>
<td>MGSE6.SP.4</td>
<td>1</td>
<td>A</td>
<td>The correct answer is choice (A) box plot with the minimum and maximum at 16 and 31. Choice (B) is incorrect because it shows a box plot with the minimum and maximum extending from 0 to 45 and the data only ranges from 16 to 31. Choice (C) is incorrect because, although it shows the correct minimum and maximum, it shows an incorrect median. Choice (D) is incorrect because it shows a box plot with second and third quartiles that are either too small or too large.</td>
</tr>
<tr>
<td>17</td>
<td>MGSE6.SP.2</td>
<td>1</td>
<td>C</td>
<td>The correct answer is choice (C) 5. The median of the 14 data points is the average of the 7th and 8th points, which are both 5, so the median is 5. Choice (A) is incorrect because it is the minimum value. Choice (B) is incorrect because it is the middle number on the number line (not data). Choice (D) is incorrect because it is the range of the data set.</td>
</tr>
<tr>
<td>18</td>
<td>MGSE6.SP.1</td>
<td>1</td>
<td>D</td>
<td>The correct answer is choice (D) “What size shirt do the kids in the school wear?” The student identifies a statistical question that will include variability. Answer choices (A), (B), and (C) are not statistical questions as they only elicit a single response with no variability.</td>
</tr>
<tr>
<td>19</td>
<td>MGSE6.NS.7</td>
<td>1</td>
<td>D</td>
<td>The correct answer is choice (D) 2.75,</td>
</tr>
<tr>
<td>20</td>
<td>MGSE6.NS.6a</td>
<td>3</td>
<td>N/A</td>
<td>See scoring rubric and sample response beginning on page 124.</td>
</tr>
<tr>
<td>21</td>
<td>MGSE6.NS.6b</td>
<td>2</td>
<td>N/A</td>
<td>See scoring rubric and sample response beginning on page 126.</td>
</tr>
</tbody>
</table>
## MATHEMATICS SAMPLE SCORING RUBRICS AND EXEMPLAR RESPONSES

### Item 2

#### Scoring Rubric

<table>
<thead>
<tr>
<th>Points</th>
<th>Description</th>
</tr>
</thead>
</table>
| **2** | The response achieves the following:  
• Response demonstrates a complete understanding of how to divide a fraction by a fraction.  
• Give 2 points for a correct response and a valid process.  
• Response is correct and complete.  
• Response shows application of a reasonable and relevant strategy.  
• Mathematical ideas are expressed coherently through a clear, complete, logical, and fully developed response using words, calculations, and/or symbols as appropriate. |
| **1** | The response achieves the following:  
• Response demonstrates a partial understanding of how to divide a fraction by a fraction.  
• Give 1 point for a correct response but no valid process.  
• Response includes the correct quotient but no or incomplete work shown on using the fraction models.  
• Response shows application of a relevant strategy, though it may be only partially applied or remain unexplained.  
• Mathematical ideas are expressed only partially using words, calculations, and/or symbols as appropriate. |
| **0** | The response achieves the following:  
• The response demonstrates limited to no understanding of how to divide a fraction by a fraction.  
• Response shows no application of a strategy.  
• Mathematical ideas cannot be interpreted or lack sufficient evidence to support even a limited understanding. |

#### Exemplar Response

<table>
<thead>
<tr>
<th>Points Awarded</th>
<th>Sample Response</th>
</tr>
</thead>
</table>
| **2** | I used equivalent factors to find the quotient. I know $\frac{3}{6}$ is $\frac{1}{2}$, which is also $\frac{2}{4}$. So I found the number I need to multiply $\frac{1}{4}$ by to get $\frac{2}{4}$. And that number is 2.  
*OR other valid explanation* |
| **1** | 2 |
| **0** | *Response is irrelevant, inappropriate, or not provided.* |
### Scoring Rubric

<table>
<thead>
<tr>
<th>Points</th>
<th>Description</th>
</tr>
</thead>
</table>
| 2      | The response achieves the following:  
- Response demonstrates a complete understanding of how to use a strategy based on place value to divide a decimal number by a whole number.  
- Give 2 points for a correct response and a valid process.  
- Response is correct and complete.  
- Response shows application of a reasonable and relevant strategy.  
- Mathematical ideas are expressed coherently through a clear, complete, logical, and fully developed response using words, calculations, and/or symbols as appropriate. |
| 1      | The response achieves the following:  
- Response demonstrates a partial understanding of how to use a strategy based on place value to divide a decimal number by a whole number.  
- Give 1 point for a correct response but no valid process.  
- Response includes the correct quotient but no or incomplete work shown.  
- Response shows application of a relevant strategy, though it may be only partially applied or remain unexplained.  
- Mathematical ideas are expressed only partially using words, calculations, and/or symbols as appropriate. |
| 0      | The response achieves the following:  
- The response demonstrates limited to no understanding of how to use a strategy based on place value to divide a decimal number by a whole number.  
- Response shows no application of a strategy.  
- Mathematical ideas cannot be interpreted or lack sufficient evidence to support even a limited understanding. |

### Exemplar Response

<table>
<thead>
<tr>
<th>Points Awarded</th>
<th>Sample Response</th>
</tr>
</thead>
</table>
| 2              | Part A: First, find the number of sets of 12 in 84. That is 7. Next use a place holder 0 for the tenths place. Find the number of sets of 12 in 36. That is 84.36 divided by 12 equals 7.03.  
**OR other valid explanation**  
AND  
Part B: 7.03 |
| 1              | Part A: First, find the number of sets of 12 in 84. That is 7. Next use a place holder 0 for the tenths place. Find the number of sets of 12 in 36. That is 84.36 divided by 12 equals 7.03.  
**OR**  
Part B: 7.03 |
### Points Awarded: Sample Response

<table>
<thead>
<tr>
<th>Points Awarded</th>
<th>Sample Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td><em>Response is irrelevant, inappropriate, or not provided.</em></td>
</tr>
</tbody>
</table>

### Item 6

**Scoring Rubric**

<table>
<thead>
<tr>
<th>Points</th>
<th>Description</th>
</tr>
</thead>
</table>
| 4      | The response achieves the following:  
  - The response demonstrates a complete understanding of using ratio and rate to solve real-world mathematical problems by using tables with equivalent ratios and by using unit rates.  
  - Give 4 points for all 3 parts answered correctly.  
    - Response is correct and complete.  
    - Response shows application of a reasonable and relevant strategy.  
    - Mathematical ideas are expressed coherently through a clear, complete, logical, and fully developed response using words, calculations, and/or symbols as appropriate. |
| 3      | The response achieves the following:  
  - The response demonstrates a nearly complete understanding of using ratio and rate to solve real-world mathematical problems by using tables with equivalent ratios and by using unit rates.  
  - Give 3 points if student response indicates one error in one or within both of the tables for Parts A and B and completes Part C correctly OR student completes Parts A and B correctly, but has one minor error in Part C.  
    - Response is mostly correct, but contains either a computation error or an unclear or incomplete explanation.  
    - Response shows application of a relevant strategy, though it may be only partially applied or remain unexplained.  
    - Mathematical ideas are expressed only partially using words, calculations, and/or symbols as appropriate. |
| 2      | The response achieves the following:  
  - The response demonstrates a partial understanding of using ratio and rate to solve real-world mathematical problems by using tables with equivalent ratios and by using unit rates.  
  - Give 2 points if student response indicates two errors in one or within both of the tables for Parts A and B OR student completes Parts A and B correctly, and makes a correct comparison for Part C but fails to provide evidence to support comparison.  
    - Response is only partially correct.  
    - Response shows application of a relevant strategy, though it may be only partially applied or remain unexplained.  
    - Mathematical ideas are expressed only partially using words, calculations, and/or symbols as appropriate. |
<table>
<thead>
<tr>
<th>Points</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1      | The response achieves the following:  
• The response demonstrates a minimal understanding of using ratio and rate to solve real-world mathematical problems by using tables with equivalent ratios and by using unit rates.  
• Give 1 point if student response indicates more than two errors in one or within both of the tables for Parts A and B. Student makes a correct comparison in Part C, but fails to provide evidence to support comparison. OR student has more than two errors in Parts A and B and Part C’s comparison is incorrect.  
• Response is only partially correct.  
• Response shows incomplete or inaccurate application of a relevant strategy.  
• Mathematical ideas are expressed only partially using words, calculations, and/or symbols as appropriate. |
| 0      | The response achieves the following:  
• The response demonstrates limited to no understanding of using ratio and rate to solve real-world mathematical problems by using tables with equivalent ratios and by using unit rates.  
• Response shows no application of a strategy.  
• Mathematical ideas cannot be interpreted or lack sufficient evidence to support even a limited understanding. |

**Exemplar Response**

<table>
<thead>
<tr>
<th>Points Awarded</th>
<th>Sample Response</th>
</tr>
</thead>
</table>
| 4              | Part A:  
At the farmers’ market,  
1 watermelon costs 3 dollars.  
2 watermelons cost 6 dollars.  
3 watermelons cost 9 dollars.  
4 watermelons cost 12 dollars.  
AND  
Part B:  
At the grocery store,  
1 watermelon costs 5 dollars.  
2 watermelons cost 10 dollars.  
3 watermelons cost 15 dollars.  
4 watermelons cost 20 dollars.  
AND  
Part C: A watermelon purchased at the farmers’ market is 2 dollars less than a watermelon purchased at the grocery store.  
The ratio of watermelon to dollars is 1 to 3 at the farmers’ market.  
The ratio of watermelon to dollars is 1 to 5 at the grocery store.  
So the unit price at the farmers’ market is 2 dollars less than at the grocery store. |
### Item 12

#### Scoring Rubric

<table>
<thead>
<tr>
<th>Points Awarded</th>
<th>Sample Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3</strong></td>
<td>The student correctly answers three out of the four parts.</td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>The student correctly answers two out of the four parts.</td>
</tr>
<tr>
<td><strong>1</strong></td>
<td>The student correctly answers one of the four parts.</td>
</tr>
<tr>
<td><strong>0</strong></td>
<td>Response is irrelevant, inappropriate, or not provided.</td>
</tr>
</tbody>
</table>

**4**

The response achieves the following:
- The response demonstrates a complete understanding of solving real-world and mathematical problems by writing and solving equations of the form $px = q$, in which $p$, $q$, and $x$ are all nonnegative rational numbers.
- Give 4 points for all 3 parts answered correctly.
  - Response is correct and complete.
  - Response shows application of a reasonable and relevant strategy.
  - Mathematical ideas are expressed coherently through a clear, complete, logical, and fully developed response using words, calculations, and/or symbols as appropriate.

**3**

The response achieves the following:
- The response demonstrates a nearly complete understanding of solving real-world and mathematical problems by writing and solving equations of the form $px = q$, in which $p$, $q$, and $x$ are all nonnegative rational numbers.
- Give 3 points if student performs the correct evaluation in Part A, but does not include a complete explanation. Student presents correct responses for Parts B and C.
  - Response is mostly correct, but contains either a computation error or an unclear or incomplete explanation.
  - Response shows application of a relevant strategy, though it may be only partially applied or remain unexplained.
  - Mathematical ideas are expressed only partially using words, calculations, and/or symbols as appropriate.
<table>
<thead>
<tr>
<th>Points</th>
<th>Description</th>
</tr>
</thead>
</table>
| 2      | The response achieves the following:  
|        | • The response demonstrates a partial understanding of solving real-world and  
|        |    mathematical problems by writing and solving equations of the form \( px = q \), in which \( p \), \( q \), and \( x \) are all nonnegative rational numbers.  
|        | • Give 2 points if student response indicates correct evaluation for Parts A and C, but  
|        |    lacks explanations. Student provides correct response for Part B.  
|        | • Response is only partially correct.  
|        | • Response shows application of a relevant strategy, though it may be only partially  
|        |    applied or remain unexplained.  
|        | • Mathematical ideas are expressed only partially using words, calculations, and/or  
|        |    symbols as appropriate. |
| 1      | The response achieves the following:  
|        | • The response demonstrates a minimal understanding of solving real-world and  
|        |    mathematical problems by writing and solving equations of the form \( px = q \), in which \( p \), \( q \), and \( x \) are all nonnegative rational numbers.  
|        | • Give 1 point if student indicates only 1 correct response for either Parts A, B, or C.  
|        |    Incomplete explanations are provided.  
|        | • Response is only partially correct.  
|        | • Response shows incomplete or inaccurate application of a relevant strategy.  
|        | • Mathematical ideas are expressed only partially using words, calculations, and/or  
|        |    symbols as appropriate. |
| 0      | The response achieves the following:  
|        | • The response demonstrates limited to no understanding of solving real-world and  
|        |    mathematical problems by writing and solving equations of the form \( px = q \), in which \( p \), \( q \), and \( x \) are all nonnegative rational numbers.  
|        | • Response is incorrect.  
|        | • Response shows no application of a strategy.  
|        | • Mathematical ideas cannot be interpreted or lack sufficient evidence to support even  
|        |    a limited understanding. |
### Exemplar Response

<table>
<thead>
<tr>
<th>Points Awarded</th>
<th>Sample Response</th>
</tr>
</thead>
</table>
| 4              | Part A: No, Hannah did not order the correct number of wheels. A tricycle has 3 wheels on it, so if you were to order new wheels for 10 tricycles, you would need to order 3 wheels for each tricycle, not 1 wheel per tricycle.  
AND  
Part B: In the equation, 3 represents the number of wheels per tricycle, \( x \) represents the number of tricycles, and \( y \) represents the total number of wheels.  
AND  
Part C: 45 wheels; I substituted 15 for \( x \) in the equation and solved for \( y \). Since 3 times 15 is 45, 45 wheels should be ordered for 15 new tricycles. |
| 3              | The student correctly answers three out of the four parts. |
| 2              | The student correctly answers two out of the four parts. |
| 1              | The student correctly answers one of the four parts. |
| 0              | Response is irrelevant, inappropriate, or not provided. |
## Item 20

### Scoring Rubric

<table>
<thead>
<tr>
<th>Points</th>
<th>Description</th>
</tr>
</thead>
</table>
| 2      | The response achieves the following:  
  - Response demonstrates a complete understanding of recognizing opposite signs of numbers as indicating locations on opposite sides of 0 on the number line, as well as recognizing that the opposite of the opposite of a number is the number itself.  
  - Give 2 points for both parts correct.  
  - Response is correct and complete.  
  - Response shows application of a reasonable and relevant strategy.  
  - Mathematical ideas are expressed coherently through a clear, complete, logical, and fully developed response using words, calculations, and/or symbols as appropriate. |
| 1      | The response achieves the following:  
  - Response demonstrates a partial understanding of recognizing opposite signs of numbers as indicating locations on opposite sides of 0 on the number line, as well as recognizing that the opposite of the opposite of a number is the number itself.  
  - Give 1 point for only one part correct.  
  - Response shows all three points plotted correctly but lacks a complete or valid explanation for why student plotted the coordinates in those locations.  
  - Response shows application of a relevant strategy, though it may be only partially applied or remain unexplained.  
  - Mathematical ideas are expressed only partially using words, calculations, and/or symbols as appropriate. |
| 0      | The response achieves the following:  
  - The response demonstrates limited to no understanding of recognizing opposite signs of numbers as indicating locations on opposite sides of 0 on the number line, as well as recognizing that the opposite of the opposite of a number is the number itself.  
  - Response is incorrect.  
  - Response shows no application of a strategy.  
  - Mathematical ideas cannot be interpreted or lack sufficient evidence to support even a limited understanding. |
## Exemplar Response

<table>
<thead>
<tr>
<th>Points Awarded</th>
<th>Sample Response</th>
</tr>
</thead>
</table>
| 2              | Part A: Erin plotted the opposite of the opposite of $-3$, rather than the opposite of $-3$, which is 3.  
OR  
Erin plotted $-3$ instead of the opposite of $-3$.  
AND  
Part B: The opposite of a number is the number that is the same distance from 0 on a number line but on the opposite side of 0. $-3$ is 3 units to the left of 0 on the number line. So, the opposite of $-3$ is 3 units to the right of 0 on the number line, which is 3. |
| 1              | Part A: Erin plotted the opposite of the opposite of $-3$, rather than the opposite of $-3$, which is 3. Erin plotted $-3$ instead of the opposite of $-3$.  
OR  
Erin plotted $-3$ instead of the opposite of $-3$.  
OR  
Part B: The opposite of a number is the number that is the same distance from 0 on a number line but on the opposite side of 0. $-3$ is 3 units to the left of 0 on the number line. So, the opposite of $-3$ is 3 units to the right of 0 on the number line, which is 3. |
| 0              | *Response is irrelevant, inappropriate, or not provided.* |
### Item 21

#### Scoring Rubric

<table>
<thead>
<tr>
<th>Points</th>
<th>Description</th>
</tr>
</thead>
</table>
| **2**  | The response achieves the following:  
  • Response demonstrates a complete understanding of signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.  
  • Give 2 points for a correct response and a valid process.  
  • Response is correct and complete.  
  • Response shows application of a reasonable and relevant strategy.  
  • Mathematical ideas are expressed coherently through a clear, complete, logical, and fully developed response using words, calculations, and/or symbols as appropriate. |
| **1**  | The response achieves the following:  
  • Response demonstrates a partial understanding of signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.  
  • Give 1 point for a correct response but no valid process.  
  • Response shows all three points plotted correctly but lacks a complete or valid explanation for why student plotted the coordinates in those locations.  
  • Response shows application of a relevant strategy, though it may be only partially applied or remain unexplained.  
  • Mathematical ideas are expressed only partially using words, calculations, and/or symbols as appropriate. |
| **0**  | The response achieves the following:  
  • The response demonstrates limited to no understanding of signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.  
  • Response shows no application of a strategy.  
  • Mathematical ideas cannot be interpreted or lack sufficient evidence to support even a limited understanding. |
### Exemplar Response

<table>
<thead>
<tr>
<th>Points Awarded</th>
<th>Sample Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Part A:</td>
</tr>
<tr>
<td></td>
<td>Quadrant 2</td>
</tr>
<tr>
<td></td>
<td>Quadrant 1</td>
</tr>
<tr>
<td></td>
<td>Quadrant 3</td>
</tr>
<tr>
<td></td>
<td>AND</td>
</tr>
<tr>
<td></td>
<td>Part B: The first point is in Quadrant 2 because its $x$-coordinate is negative and its $y$-coordinate is positive. The second point is in Quadrant 1 because both of its coordinates are positive. The last point is in Quadrant 3 because its $x$-coordinate is positive and its $y$-coordinate is negative.</td>
</tr>
<tr>
<td>1</td>
<td>Part A:</td>
</tr>
<tr>
<td></td>
<td>Quadrant 2</td>
</tr>
<tr>
<td></td>
<td>Quadrant 1</td>
</tr>
<tr>
<td></td>
<td>Quadrant 3</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
<tr>
<td></td>
<td>Part B: The first point is in Quadrant 2 because its $x$-coordinate is negative and its $y$-coordinate is positive. The second point is in Quadrant 1 because both of its coordinates are positive. The last point is in Quadrant 3 because its $x$-coordinate is positive and its $y$-coordinate is negative.</td>
</tr>
<tr>
<td>0</td>
<td>Response is irrelevant, inappropriate, or not provided.</td>
</tr>
</tbody>
</table>
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CONSTRUCTED-RESPONSE ITEM

MGSE6.EE.9a

5. The table shows the proportional relationship between the number of computers a company sold, \( x \), and the profit that the company made, \( y \).

<table>
<thead>
<tr>
<th>Number of Computers Sold</th>
<th>Profit (dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>450</td>
</tr>
<tr>
<td>7</td>
<td>1,050</td>
</tr>
<tr>
<td>11</td>
<td>1,650</td>
</tr>
<tr>
<td>15</td>
<td>2,250</td>
</tr>
</tbody>
</table>

The profit, \( y \), can be written in terms of \( x \), the number of computers sold.

\[
y = \text{__________________________}
\]

What expression completes the equation? Explain how you found your answer. Write your answer in the space provided on your answer document.

#5 Item Information

**Standard:** MGSE6.EE.9a

Use variables to represent two quantities in a real-world problem that change in relationship to one another.

a. Write an equation to express one quantity, the dependent variable, in terms of the other quantity, the independent variable.

**Item Depth of Knowledge:** 2

Basic Application of Skill/Concept

Student uses information, conceptual knowledge, and procedures.
<table>
<thead>
<tr>
<th>Score Point</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2</strong></td>
<td>Response demonstrates a complete understanding of the standard. Give 2 points for student identifying that ( y ) is 150 times greater than ( x ) and providing a correct explanation.</td>
</tr>
<tr>
<td></td>
<td><strong>Exemplar Response:</strong></td>
</tr>
<tr>
<td></td>
<td>[ 150x \quad (1 \text{ point}) ]</td>
</tr>
<tr>
<td></td>
<td>[ \text{AND} ]</td>
</tr>
<tr>
<td></td>
<td>I divided 450 by 3, 1,050 by 7, and so on to get the coefficient of ( x ). (1 point)</td>
</tr>
<tr>
<td></td>
<td><strong>OR</strong></td>
</tr>
<tr>
<td></td>
<td>Other valid response</td>
</tr>
<tr>
<td><strong>1</strong></td>
<td>Response demonstrates partial understanding of the standard. Student earns 1 point for answering 1 key element.</td>
</tr>
<tr>
<td><strong>0</strong></td>
<td>Response demonstrates limited to no understanding of the standard. Student earns 0 points because the student does not show understanding of analyzing the relationship between dependent and independent variables using tables and relating these to the equation.</td>
</tr>
</tbody>
</table>
STUDENT RESPONSES

MGSE6.EE.9a

Response Score: 2

5. The table shows the proportional relationship between the number of computers a company sold, $x$, and the profit that the company made, $y$.

<table>
<thead>
<tr>
<th>Number of Computers Sold</th>
<th>Profit (dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>450</td>
</tr>
<tr>
<td>7</td>
<td>1,050</td>
</tr>
<tr>
<td>11</td>
<td>1,650</td>
</tr>
<tr>
<td>15</td>
<td>2,250</td>
</tr>
</tbody>
</table>

The profit, $y$, can be written in terms of $x$, the number of computers sold.

$$y = \frac{150x}{450 \text{ and divided by 3.}}$$

What expression completes the equation? Explain how you found your answer. **Write your answer in the space provided on your answer document.**

The response demonstrates complete understanding by providing the correct equation ($y = 150x$) and by providing a correct explanation for how the coefficient of $x$ was calculated. The student shows the relationship between the dependent and independent variables and is able to use the table to calculate the rate of profit per computer sold and complete the equation.
MGSE6.EE.9a

Response Score: 1

5. The table shows the proportional relationship between the number of computers a company sold, $x$, and the profit that the company made, $y$.

<table>
<thead>
<tr>
<th>Number of Computers Sold</th>
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</thead>
<tbody>
<tr>
<td>3</td>
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<td>11</td>
<td>1,650</td>
</tr>
<tr>
<td>15</td>
<td>2,250</td>
</tr>
</tbody>
</table>

The profit, $y$, can be written in terms of $x$, the number of computers sold.

$$y = \boxed{150x}$$

What expression completes the equation? Explain how you found your answer. **Type your answer in the space provided.**

150x, it is a linear equation

The response demonstrates a partial understanding by providing the correct equation ($y = 150x$). Though the student identifies the equation as linear, the explanation is incomplete and does not demonstrate a complete understanding.
MGSE6.EE.9a

5. The table shows the proportional relationship between the number of computers a company sold, $x$, and the profit that the company made, $y$.

<table>
<thead>
<tr>
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</tr>
</tbody>
</table>

The profit, $y$, can be written in terms of $x$, the number of computers sold.

$$ y = \text{______________________________} $$

What expression completes the equation? Explain how you found your answer. Type your answer in the space provided.

150

The response demonstrates inadequate understanding of the concepts being tested. The student provides the value of the coefficient of $x$ but no explanation of how this value was found, and the expression does not correctly complete the equation.
CONSTRUCTED-RESPONSE ITEM

MGSE6.RP.3

6. Alex hiked up a mountain. The graph shows Alex’s distance traveled, \( y \), after \( x \) hours.

![Graph showing Alex's Hike](image)

Part A: What was Alex’s average hiking rate, in kilometers per hour, between hour 0 and hour 2? Explain how you found your answer. Write your answer in the space provided on your answer document.

Part B: Did Alex hike faster, in kilometers per hour, between hour 3 and hour 7 or between hour 0 and hour 2? Explain how you found your answer. Write your answer in the space provided on your answer document.

Part C: Alex hiked a total of 8 kilometers. How many METERS did Alex hike? (1 kilometer = 1,000 meters) Write your answer in the space provided on your answer document.

#6 Item Information

**Standard:** MGSE6.RP.3
Use ratio and rate reasoning to solve real-world and mathematical problems utilizing strategies such as tables of equivalent ratios, tape diagrams (bar models), double number line diagrams, and/or equations.

**Item Depth of Knowledge:** 3
Strategic Thinking
Student uses reasoning and develops a plan or sequence of steps; process has some complexity.
ITEM-SPECIFIC SCORING GUIDELINE

<table>
<thead>
<tr>
<th>Score Point</th>
<th>Description</th>
</tr>
</thead>
</table>
| **4**       | Response demonstrates a complete understanding of the standard. Give 4 points for correctly identifying Alex’s average hiking rate between hours 0 and 2, explaining how this rate was determined, explaining how the graph shows that Alex hiked faster between hours 0 and 2 than between hours 3 and 7, and identifying the total distance, in meters, Alex hiked. **Exemplar Response:**  
  Part A: 2  (*1 point*)  
  AND  
  Alex hiked 4 kilometers in 2 hours. I divided 4 by 2 to find his speed.  (*1 point*)  
  Part B: Alex hiked faster between hour 0 and hour 2 because between hour 3 and hour 7, he hiked 4 kilometers in 4 hours. That is only 1 kilometer per hour.  (*1 point*)  
  Part C: 8000  (*1 point*)  
  OR  
  Other valid response |
| **3**       | Response demonstrates nearly complete understanding of the standard. Student earns 3 points for answering 3 key elements.* |
| **2**       | Response demonstrates partial understanding of the standard. Student earns 2 points for answering 2 key elements.* |
| **1**       | Response demonstrates minimal understanding of the standard. Student earns 1 point for answering 1 key element.* |
| **0**       | Response demonstrates limited to no understanding of the standard. Student earns 0 points because the student does not show understanding of solving unit rate problems and using ratio reasoning to convert measurement units within one system of measurement. |

*If a student makes an error in Part A that is carried through to Part B (or subsequent parts), then the student is not penalized again for the same error.*
6. Alex hiked up a mountain. The graph shows Alex’s distance traveled, $y$, after $x$ hours.

Part A: What was Alex’s average hiking rate, in kilometers per hour, between hour 0 and hour 2? Explain how you found your answer. **Type your answer in the space provided.**

Part B: Did Alex hike faster, in kilometers per hour, between hour 3 and hour 7 or between hour 0 and hour 2? Explain how you found your answer. **Type your answer in the space provided.**

Part C: Alex hiked a total of 8 kilometers. How many METERS did Alex hike? (1 kilometer = 1,000 meters) **Type your answer in the space provided.**

A: 2 because after 1 hour she had walked 2 miles
B: between hour 0-2 because she is going twice as fast
C: 8000

The response demonstrates a complete understanding by providing a correct answer in Part A (2) and in Part C (8000), by providing a correct explanation of how the rate was found for Part A, and by providing an explanation of when Alex was hiking at the faster rate in Part B. The student correctly states that Alex walked 2 miles in 1 hour and understands that this gives the rate. The student correctly states that Alex was walking twice as fast during hours 0 to 2, which shows understanding of using the right information in the graph to compare rates. The student correctly converts the number of kilometers to the number of meters in Part C. The misunderstanding between units (miles and kilometers) does not show misunderstanding of the concepts measured.
6. Alex hiked up a mountain. The graph shows Alex’s distance traveled, \( y \), after \( x \) hours.

Part A: What was Alex’s average hiking rate, in kilometers per hour, between hour 0 and hour 2? Explain how you found your answer. **Type your answer in the space provided.**

Part B: Did Alex hike faster, in kilometers per hour, between hour 3 and hour 7 or between hour 0 and hour 2? Explain how you found your answer. **Type your answer in the space provided.**

Part C: Alex hiked a total of 8 kilometers. How many METERS did Alex hike? (1 kilometer = 1,000 meters) **Type your answer in the space provided.**

2 kilometers per hour

- Hour 0-2: \( (4-0)/(2-0) = 2 \)
- Hour 3-7: \( (8-4)/(7-3) = 4/4 = 1 \)

2 is bigger than 1

800

The response demonstrates a partial understanding by providing a correct answer in Part A (2) and a correct explanation of how the rate was found for Part A and by providing an explanation of when Alex was hiking at the faster rate in Part B. The student correctly calculates the rate during hours 0–2 and the rate during hours 3–7 and compares them correctly. The student uses an incorrect conversion factor in Part C, and the response provided for Part C (800) is incorrect.
6. Alex hiked up a mountain. The graph shows Alex’s distance traveled, $y$, after $x$ hours.

![Graph showing distance traveled vs. time]

Part A: What was Alex’s average hiking rate, in kilometers per hour, between hour 0 and hour 2? Explain how you found your answer. Write your answer in the space provided on your answer document.

Part B: Did Alex hike faster, in kilometers per hour, between hour 3 and hour 7 or between hour 0 and hour 2? Explain how you found your answer. Write your answer in the space provided on your answer document.

Part C: Alex hiked a total of 8 kilometers. How many METERS did Alex hike? (1 kilometer = 1,000 meters) Write your answer in the space provided on your answer document.

A: 0.5 kilometers per hour
B: the first part because the slope is steeper
C: 8000 meters

The response demonstrates a partial understanding by providing a correct answer in Part B (the first part because the slope is steeper) and in Part C (8000). The student shows understanding that a steeper positive slope on the graph indicates a greater rate of speed and correctly states that Alex’s rate is greater at the beginning. The student correctly converts the number of kilometers to the number of meters in Part C.
6. Alex hiked up a mountain. The graph shows Alex’s distance traveled, \( y \), after \( x \) hours.

![Graph showing distance traveled vs. time]

Part A: What was Alex’s average hiking rate, in kilometers per hour, between hour 0 and hour 2? Explain how you found your answer. **Write your answer in the space provided on your answer document.**

Part B: Did Alex hike faster, in kilometers per hour, between hour 3 and hour 7 or between hour 0 and hour 2? Explain how you found your answer. **Write your answer in the space provided on your answer document.**

Part C: Alex hiked a total of 8 kilometers. How many METERS did Alex hike? (1 kilometer = 1,000 meters)

**Write your answer in the space provided on your answer document.**

<table>
<thead>
<tr>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hr 0-2</td>
</tr>
<tr>
<td>8 kilometers</td>
</tr>
</tbody>
</table>

The response demonstrates a minimal understanding of the concepts being measured by providing a correct answer for Part A, though no process is shown. Though the student has correctly identified the period during which Alex was hiking at the faster rate, the required explanation is not present. The student does not convert the 8 kilometers to meters in Part C.
6. Alex hiked up a mountain. The graph shows Alex’s distance traveled, $y$, after $x$ hours.

Part A: What was Alex’s average hiking rate, in kilometers per hour, between hour 0 and hour 2? Explain how you found your answer. **Type your answer in the space provided.**

Part B: Did Alex hike faster, in kilometers per hour, between hour 3 and hour 7 or between hour 0 and hour 2? Explain how you found your answer. **Type your answer in the space provided.**

Part C: Alex hiked a total of 8 kilometers. How many METERS did Alex hike? (1 kilometer = 1,000 meters) **Type your answer in the space provided.**

1

Between 3-7 because it goes up higher

8000 meters

The response demonstrates minimal understanding by providing a correct answer to Part C. The answers in Parts A and B are incorrect and show misunderstanding of the necessary parts of the graph to find a rate.
6. Alex hiked up a mountain. The graph shows Alex’s distance traveled, $y$, after $x$ hours.

![Graph of Alex’s Hike]

Part A: What was Alex’s average hiking rate, in kilometers per hour, between hour 0 and hour 2? Explain how you found your answer. Write your answer in the space provided on your answer document.

Part B: Did Alex hike faster, in kilometers per hour, between hour 3 and hour 7 or between hour 0 and hour 2? Explain how you found your answer. Write your answer in the space provided on your answer document.

Part C: Alex hiked a total of 8 kilometers. How many METERS did Alex hike? (1 kilometer = 1,000 meters) Write your answer in the space provided on your answer document.

4

They are equal between hour 0 and 2 Alex went 4
and between hour 3 and hour 7 he went 4 also
They are the same

80

The response demonstrates inadequate understanding of the concepts being tested. The student misunderstands the key parts of the graph to find the rate in Part A and in Part B. The student provides the number of miles for both hours 0–2 and hours 3–7. The student attempts to convert 8 kilometers to meters but uses an incorrect conversion factor.