Inspect
CCR Performance Tasks

Math Grade 3: Reasoning About Multiplication and Area

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Inspect offers the following assessment products:

Content Bank for English/Language Arts and Math Grades 2 – High School	▪ More than 36,000 items ▪ More 1500 complex texts, including authentic permissioned texts ▪ Includes Literacy in History, Social Science, Science, and Technical Subjects
Quick Checks for English/Language Arts and Math Grades 2 – High School	▪ Fixed-form assessments with five to seven items including constructed response ▪ Key instructional concepts embedded in standards (clusters for Math, staircase of text complexity for ELA)
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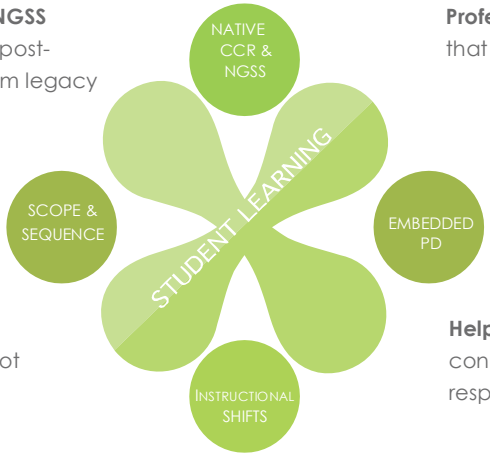
NGSS Formative Assessments Grades 5 – High School	▪ Prebuilt assessments with items linked to experimental contexts that assess the three dimensions of science learning ▪ Flexible and customizable ▪ Addresses the California Course Models and NGSS Bundles
Observational Tasks for English/Language Arts and Math Grades K - 1	▪ Developmentally appropriate for individual students and small groups

Inspect Assessment Content is available through a variety of assessment administration and data analysis platforms.

Inspect assessment content offers these benefits:

Native college- and career-ready and NGSS content prepares students to meet their post-secondary goals. Content re-aligned from legacy standards cannot do this.



Professional development embedded within content that

- shows the relationship between specific skills and higher-order thinking
- includes authentic, permissioned texts of appropriate complexity
- and documents student progress using DOK and learning progressions

Content that addresses your scope and sequence so that your assessments do not waste valuable instruction time

Help for teachers addressing the instructional shifts with content that elicits evidence of learning from each response

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CCR Performance Tasks

Math Grade 3: Reasoning About Multiplication and Area

Student Test Booklet

Name:

_____

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Student Rubric

This problem tests if you can:
- Solve a problem about area;
- Explain whether an argument is correct or not.

Your teacher will give your answer a 4, 3, 2, 1, or 0.

This is how you get a 4:
Your answer is correct and complete.
- You make a drawing that shows a correct solution to the problem.
- You write an explanation of your drawing that helps your teacher understand how it solves the problem.
- A statement and an explanation of the statement are presented. You explain why the statement and explanation are correct or not.

This is how you get a 3:
Your answer is correct but some of your explanations are not complete or you make a small mistake.
- You make a drawing that shows a mostly correct solution to the problem.
- You write an explanation of your drawing that helps your teacher understand how it solves the problem, but your explanation is not complete.
- A statement and an explanation of the statement are presented. You explain why the statement and explanation are correct or not correct, but your explanation is not complete.

This is how you get a 2:
You do not answer one part, or you make some mistakes.
- You make a drawing to solve the problem but your drawing is not completely correct.
- You write an explanation of your drawing that shows that you understand the problem and the idea of area.
- A statement and an explanation of the statement are presented. You do not explain why the statement and explanation are correct or not correct, or there are mistakes in your explanation.

This is how you get a 1:
Your answers are not correct.
- You make a drawing that is not correct.
- You do not explain your drawing or your explanation shows that you do not understand the idea of area.
- You do not explain why the statement is correct or not correct, or your explanation is not correct.

This is how you get a 0:
You do not answer the question or the teacher cannot understand your answer.

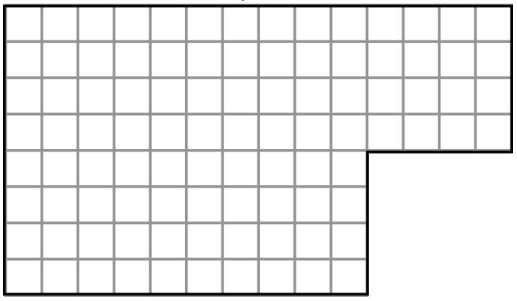
Name:_____

Math Grade 3: Reasoning About Multiplication and Area

Complete all the tasks in the test booklet.

1 Ted and his brother Cyrus share a room. They decide to divide their room into two equal parts so they can each have their own part of the room. The shape of the room is shown on the grid below.

Ted and Cyrus' Room



A. Draw lines on the picture of the room to show how Ted and Cyrus can divide it into two equal parts.

B. Explain how you know each part is the same size.

Go On

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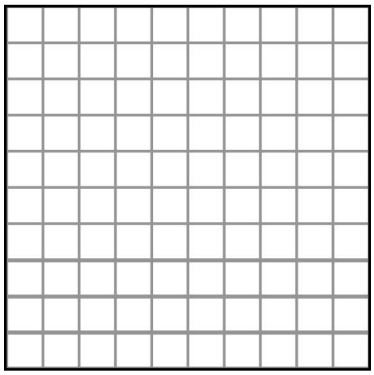
Name:_____

Ted and Cyrus have a younger sister name Leah. Leah has her own room. The shape of Leah's room is shown below.

Leah's Room



C. Cyrus says that he and Ted have a bigger room than Leah because their room is 14 feet long and her room is only 10 feet long. Is this a correct argument? Explain why or why not.

STOP

CCR Performance Tasks

Math Grade 3: Reasoning About Multiplication and Area

Teacher Guide

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About the Teacher Guide

This document contains support materials for “Math Grade 3: Reasoning About Multiplication and Area.” This includes:

(a) The task
(b) The standards and depth of knowledge level of the task
(c) The scoring rubric
(d) Discussion questions
(e) Extension activities

These specifications have been included to help you connect the task to the Common Core content standards and the standards for mathematical practice. The rubric is designed to help you look for the development of mathematical practices in student work. It is also here to help you look for consistencies in student content errors that can help guide intervention and re-teach strategies.

Test Definition File

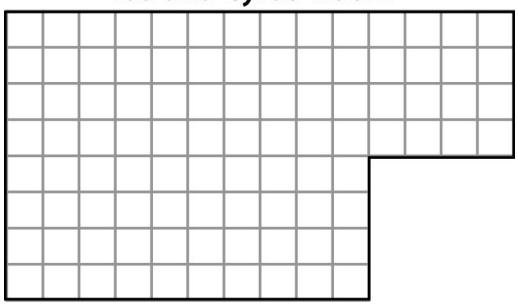
Item #	Correct Answer	Practice Standard	Content Standards
1	See Scoring Rubric	Mathematical Practice 3	3.MD.5, 3.MD.6, 3.MD.7, 3.OA.3

SBAC Claims	PARCC Sub-Claims
1 and 3	A and C

Performance Task

Ted and his brother Cyrus share a room. They decide to divide their room into two equal parts so they can each have their own part of the room. The shape of the room is shown on the grid below.

Ted and Cyrus' Room

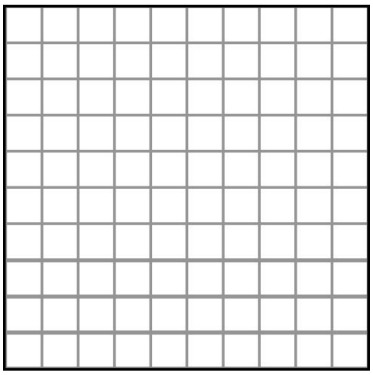


A. Draw lines on the picture of the room to show how Ted and Cyrus can divide it into two equal parts.

B. Explain how you know each part is the same size.

Ted and Cyrus have a younger sister name Leah. Leah has her own room. The shape of Leah's room is shown below.

Leah's Room



C. Cyrus says that he and Ted have a bigger room than Leah because their room is 14 feet long and her room is only 10 feet long. Is this a correct argument? Explain why or why not.

Standards Alignment

Practice Standards

MP3 > DOK 3

Construct viable arguments and critique the reasoning of others. -- Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and--if there is a flaw in an argument--explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

Content Standards

3.MD.5

Recognize area as an attribute of plane figures and understand concepts of area measurement.

- A square with side length 1 unit, called “a unit square,” is said to have “one square unit” of area, and can be used to measure area.
- A plane figure which can be covered without gaps or overlaps by *n* unit squares is said to have an area of *n* square units.

3.MD.6

Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).

3.MD.7

Relate area to the operations of multiplication and addition.

- Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths.
- Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.
- Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths a and $b + c$ is the sum of $a \times b$ and $a \times c$. Use area models to represent the distributive property in mathematical reasoning.
- Recognize area as additive. Find areas of rectilinear figures by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real world problems

3.OA.3

Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.

SBAC Claims

Mathematics Claim #1:
Concepts and Procedures. Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency.

Mathematics Claim #3:
Communicating Reasoning. Students can clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.

PARCC Sub-Claims

Sub-Claim A:
Major Content with Connections to Practices. The student solves problems involving the Major Content for her grade/course with connections to the Standards for Mathematical Practice.

Sub-Claim C:
Highlighted Practices MP.3, 6 with Connections to Content: expressing mathematical reasoning. The student expresses grade/course-level appropriate mathematical reasoning by constructing viable arguments, critiquing the reasoning of others, and/or attending to precision when making mathematical statements.

Scoring Rubric

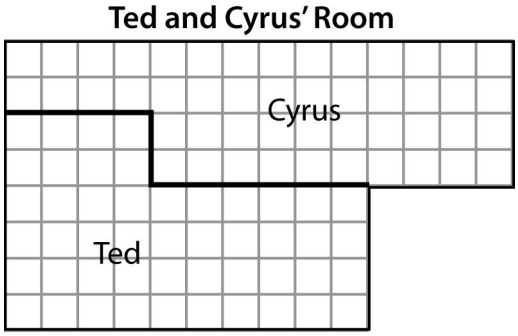
4 Point Response:
The student response demonstrates:

- The ability to solve a problem involving area;
- A strong understanding of the concept of area;
- The ability to critique an argument based on calculations and mathematical reasoning about area.

A level 4 response should include:

- A drawing in part A that divides the area into two parts of equal area;
- An explanation that demonstrates strong understanding of the concept of area;
- A critique of the argument in part C which indicates a strong understanding of the difference between length and area.

Example response for part A:



Example responses for part B include:

- "I divided the room into two rectangles, a 10 by 8 and a 4 by 4.Then I divided each rectangle into two equal parts. But then I really had 4 parts, so I moved 8 squares from the part of the second rectangle and attached it to the part of the first rectangle. So now I have two parts. Each part can be seen as two rectangles, one that is 4 by 10 and one that is 2 by 4";
- "I counted the squares in each part. Each part has the same number of squares (48 squares), so the area of both parts is the same."

Example response for part C:

"Cyrus is not right. Just because a room is longer does not mean it has more area. You have to think about the shape of the room, and the width. Leah's room is a different shape than her brothers' room. But if you figure out the area of each room, you can see that Leah's has more area. Her room is 100 square feet and her brothers' room is 96 square feet."

3 Point Response:
The student response demonstrates:

- The ability to solve a problem involving area, but the student may still depend on counting squares and not fully connect area with multiplication. This may result in an incorrect answer in part A due to counting errors;
- A strong understanding of the concept of area and the difference between length and area;
- The ability to critique an argument based on calculations and mathematical reasoning about area, but the explanation may be incomplete.

2 Point Response:
The student response demonstrates:

- The basic ability to solve a problem involving area. The student may divide the room into rectangular parts and divide the parts but may not manage to create two contiguous parts of equal area;
- A basic understanding of the concept of area;
- A weak ability to critique an argument based on calculations and mathematical reasoning about area. The explanation in part C may be missing or vague.

1 Point Response:
The student response demonstrates:

- A weak ability to solve a problem involving area;
- A weak understanding of the concept of area;
- A weak ability to critique an argument based on calculations and mathematical reasoning about area.

0 Point Response:
There is no response, or the response is off topic.

Discussion Questions

Use the following questions to stimulate discussion:

1. How can a picture drawn on graph paper be helpful when finding the area of a rectangle?

Possible Response 1: *The area of the rectangle is equal to the number of squares that are covered. If a rectangle is drawn on graph paper, the number of squares could be counted to find its area.*

Possible Response 2: *The rectangle could be divided into smaller regions (10 squares each to make counting or multiplication easy), then you find the area of each smaller region, and then add the smaller areas together to get the whole area.*

2. How can you divide the figure in part A into rectangles?

Possible Response: *Draw a line that separates the small section from the larger section, so you have a 4 by 4 rectangle and a 10 by 8 rectangle.*

3. How can dividing the figure into rectangles help you divide the whole area into two equal parts?

Possible Response: *You can add the parts, so you can take half of the small rectangle and add it to half of the large rectangle. Then those two parts together make half of the whole room.*

4. How is length different from area?

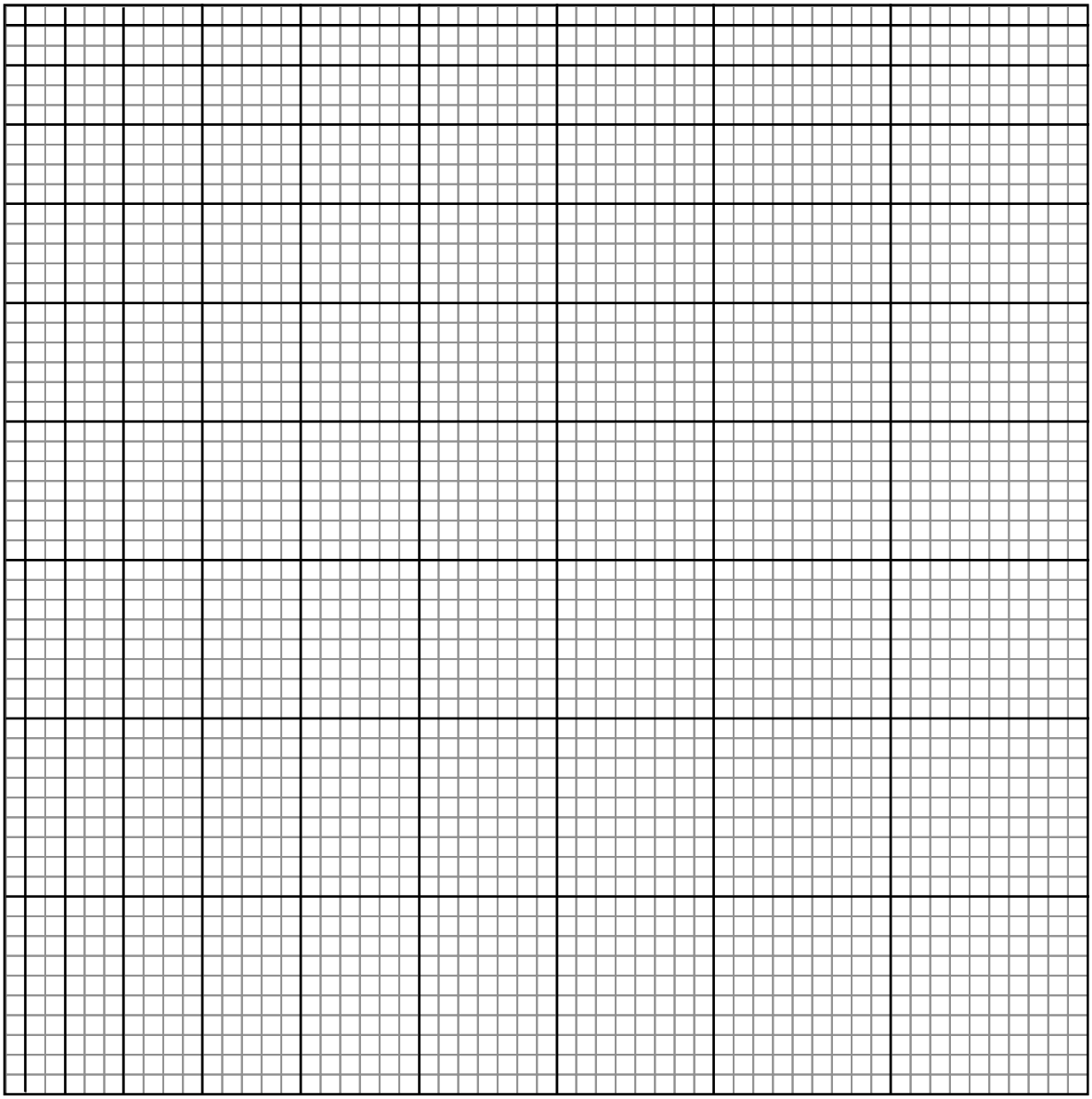
Possible Response: *Length is just like a straight line. You can't cover a surface with it; you can only measure one side of something. To measure area you need a square or another shape that you could use to cover something like the top of a table.*

Extension Activities

1. Developing an understanding of how multiplication is related to area by using a “spatial multiplication chart.”

With students, develop a spatial multiplication chart on a large piece of poster board.

The standard multiplication chart uses text only; for instance, in the square corresponding to 7 x 8, there is a 56 in the box. With text only, remembering the product becomes rote memorization only. With a spatial multiplication chart, however, each square shows the area with gridlines, as shown below.



2. Developing a deeper understanding of multiplication by using decomposition to calculate the area of regular and irregular figures.

Decompose a large rectangle into smaller rectangles in various ways, to show how decomposition can be used to simplify a problem.

Sample: Ask students to divide a 24 x 17 rectangle into several smaller rectangles. Use their decompositions to show how the area of the entire rectangle can be found by finding the area of each smaller rectangle and then adding them together. Inevitably, students will use different decompositions. This can lead to a valuable discussion about why some decompositions are better than others. For instance, it might be better to divide a 24 x 17 rectangle into smaller rectangles as shown below, since multiplying by 10 (or multiples of 10) and by numbers less than 10 is often easier than multiplying by other numbers.