Inspect

CCR Performance Task

Math Grade 4: Model Large Numbers

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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)
Focused Interim Assessments for English/Language Arts and Math Grades 3 – High School	▪ Prebuilt assessments with up to 15 items that focus on groups of related standards within a Claim or domain ▪ More focused than summative assessments ▪ Flexible and customizable ▪ Mirrors SBAC IAB blueprints
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

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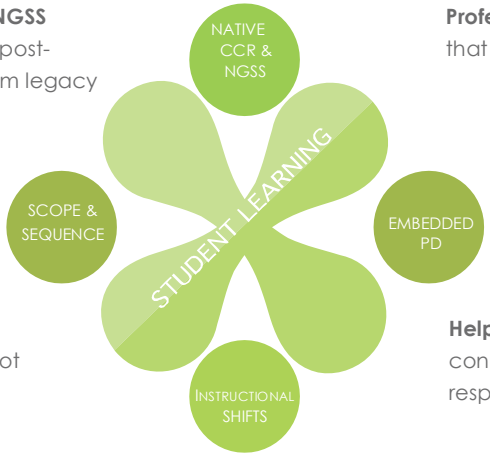
Inspect assessment content offers these benefits:

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 4: Model Large Numbers

Student Test Booklet

Name:

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Student Rubric

This problem tests if you can:
• Demonstrate understanding of large real-world distances;
• Calculate with large numbers.

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 correctly label and compare numbers using place value;
• You correctly set up and solve multiplication and division problems;
• You show work or write explanations that help your teacher understand how you compared numbers and solved problems, and why your work is correct.

This is how you get a 3:
Your answer is correct, but one or two of your explanations are incomplete, or you make some small mistakes.
• You correctly label and compare numbers;
• You set up and solve multiplication and division problems, but you make some small mistakes;
• You show work or write explanations that help your teacher understand how you compared numbers and solved problems and why your work is correct, but your work or explanations may be incomplete.

This is how you get a 2:
You answered only one part, or you make some mistakes.
• You correctly label numbers using place value, but your comparison has mistakes;
• You set up and solve some multiplication and division problems, but you make some big mistakes or leave out some problems;
• You show work or write explanations that help your teacher understand how you compared numbers and solved problems, but your work or explanations are not correct or are hard to understand.

This is how you get a 1:
Your answers are incorrect.
• You do not correctly label or compare numbers using place value;
• You do not set up or solve problems correctly;
• You do not show work or write explanations of how you compared numbers, or your work or explanations show that you do not understand how to compare numbers using a place value model.

This is how you get a 0:
Your answer is not related to the question, the teacher cannot understand your answer, or you do not write anything.

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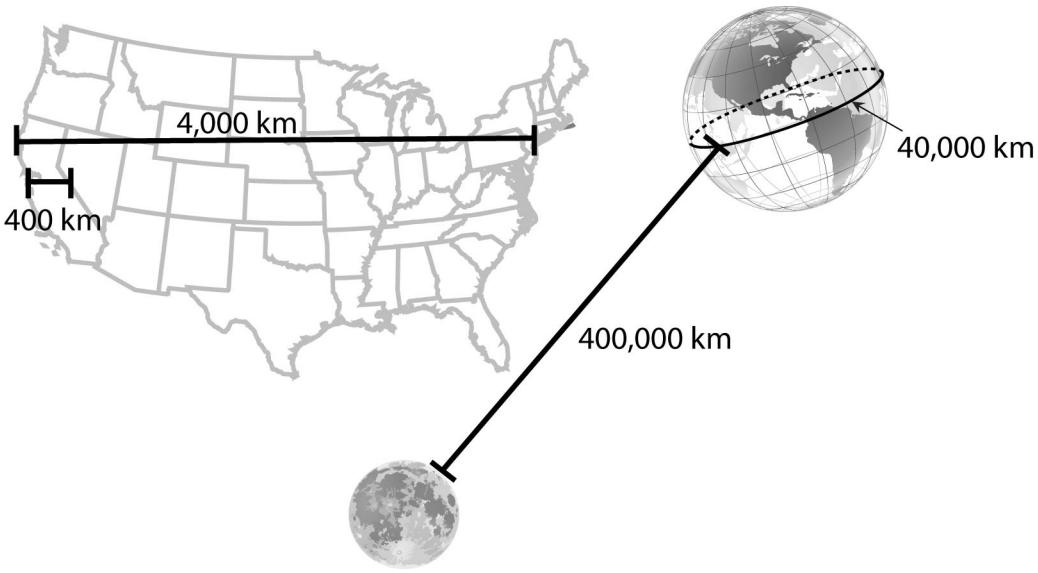
Name:_____

Math Grade 4: Model Large Numbers

Complete all the tasks in the test booklet.

1 **Jon read in a book that it took astronauts 3 days to get to the Moon in the Apollo spacecraft. The book said the distance from Earth to the Moon is about 400,000 kilometers. That seemed like a large distance to Jon, but he had trouble understanding exactly how large it is. In the following activities, you explore how far 400,000 kilometers really is.**

Look at the picture below. It shows the distance from Earth to the Moon, the distance around the Earth along its equator (its circumference), the distance across the United States from California to New York, and the distance across the state of California.



A. The numbers that show the distance from Earth to the Moon and the distance around Earth are shown below with blank lines above each digit. On the blank lines, write the place value of each digit in the number.

_____	_____	_____	_____	_____	_____
4	0	0	0	0	0

_____	_____	_____	_____	_____
4	0	0	0	0

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Name:_____

B. How many times further is 400,000 km (the distance from Earth to the Moon) than 40,000 km (the distance around Earth)? How many times further is 400,000 km (the distance from Earth to the Moon) than 4,000 km (the distance across the United States)? Explain how you can use place value to find your answers. Then write and solve division problems that show your answers.

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C. The table gives information about how long it takes to travel 4 km and 40 km.

Distance	Time to Travel This Distance
4 km	About one hour by walking
40 km	About a half-hour by car (going 50 miles per hour)

Use your understanding of place value to calculate about how long it takes to walk 40 kilometers, and about how long it takes to drive 400 kilometers. Explain how you found your answers.

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Name:_____

D. It might help Jon to understand how far it really is from Earth to the Moon if he knew how long it would take to get there by driving. Use place values and multiplication to fill in the table below. Start with your answer from part C for how long it takes to drive 400 km, the width of California. Show your work.

	Distance (kilometers)	Time Spent Driving (hours)
Width of California	400	
From California to New York	4,000	
Around Earth's Equator	40,000	
From Earth to Moon	400,000	

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CCR Performance Tasks

Math Grade 4: Model Large Numbers

Teacher Guide

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About the Teacher Guide

This document contains support materials for “Math Grade 4: Model Large Numbers.”
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 reteach strategies.

Test Definition File

Item #	Correct Answer	Practice Standard	Content Standards
1	See Scoring Rubric	Mathematical Practice 4	4.OA.1; 4.NBT.1; 4.NBT.2; 4.NBT.5

SBAC Claims	PARCC Sub-Claims
1 and 4	A and D

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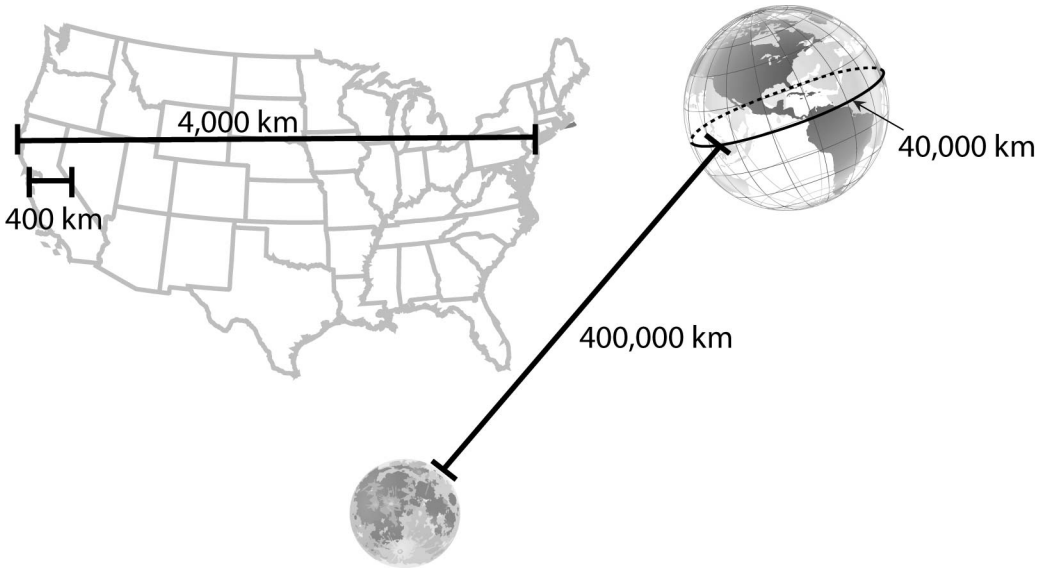
Performance Task

Jon read in a book that it took astronauts 3 days to get to the Moon in the Apollo spacecraft. The book said the distance from Earth to the Moon is about 400,000 kilometers. That seemed like a large distance to Jon, but he had trouble understanding exactly how large it is. In the following activities, you explore how far 400,000 kilometers really is.

Look at the picture below. It shows the distance from Earth to the Moon, the distance around the Earth along its equator (its circumference), the distance across the United States from California to New York, and the distance across the state of California.



A. The numbers that show the distance from Earth to the Moon and the distance around Earth are shown below with blank lines above each digit. On the blank lines, write the place value of each digit in the number.

_____	_____	_____	_____	_____	_____
4	0	0	0	0	0

_____	_____	_____	_____	_____
4	0	0	0	0

B. How many times further is 400,000 km (the distance from Earth to the Moon) than 40,000 km (the distance around Earth)? How many times further is 400,000 km (the distance from Earth to the Moon) than 4,000 km (the distance across the United States)? Explain how you can use place value to find your answers. Then write and solve division problems that show your answers.

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C. The table gives information about how long it takes to travel 4 km and 40 km.

Distance	Time to Travel This Distance
4 km	About one hour by walking
40 km	About a half-hour by car (going 50 miles per hour)

Use your understanding of place value to calculate about how long it takes to walk 40 kilometers, and about how long it takes to drive 400 kilometers. Explain how you found your answers.

D. It might help Jon to understand how far it really is from Earth to the Moon if he knew how long it would take to get there by driving. Use place values and multiplication to fill in the table below. Start with your answer from part C for how long it takes to drive 400 km, the width of California. Show your work.

	Distance (kilometers)	Time Spent Driving (hours)
Width of California	400	
From California to New York	4,000	
Around Earth's Equator	40,000	
From Earth to Moon	400,000	

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Standards Alignment

Practice Standards

MP4 > DOK 3

Model with mathematics. -- Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

Content Standards

4.OA.1

Interpret a multiplication equation as a comparison; e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.

4.NBT.1

Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.

4.NBT.2

Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.

4.NBT.5

Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

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 #4:
Modeling and Data Analysis. Students can analyze complex, real-world scenarios and can use mathematical models to interpret and solve problems.

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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 D:
Highlighted Practice MP.4 with Connections to Content: Modeling/Application. The student solves real-world problems with a degree of difficulty appropriate to the grade/course by applying knowledge and skills articulated in the standards for the current grade/course (or, for more complex problems, knowledge and skills articulated in the standards for previous grades/courses), engaging particularly in the Modeling practice, and where helpful making sense of problems and persevering to solve them (MP.1), reasoning abstractly and quantitatively (MP.2), using appropriate tools strategically (MP.5), looking for and making use of structure (MP.7), and/or looking for and expressing regularity in repeated reasoning (MP.8).

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Scoring Rubric

4 Point Response:

The response demonstrates a high level of understanding. A level 4 response is characterized by:

- A strong understanding of place values for numbers up to hundred thousands;
- An ability to work with large numbers to model and comprehend large distances.

A level 4 response should include:

- A correct labeling of place values for places up to hundred thousands;
- A correct comparison of 400,000 and 40,000 based on place value, a correct explanation of how place value is used, and correct division problems that illustrate the comparison;
- Correct calculations comparing travel times for distances based on place-value comparisons of those distances, with correct work or explanation for the calculations.

A sample 4 point response is shown below.

Part A:

hundred thousands	ten thousands	thousands	hundreds	tens	ones
4	0	0	0	0	0

ten thousands	thousands	hundreds	tens	ones
4	0	0	0	0

Part B: “400,000 is ten times 40,000, since the 4 in 400,000 is one place to the left of the 4 in 40,000. 400,000 is one hundred times 4,000, since the 4 in 400,000 is two places to the left of the 4 in 4,000. Every time you move a place to the left, you multiply by 10. So, 400,000 ÷ 40,000 = 10 and 400,000 ÷ 4,000 = 100.”

Part C: “Since it takes about an hour to walk 4 km, it should take 10 x 1 hour = 10 hours to walk 40 km. The 4 in 40 km is one place to the left of the 4 in 4, so 40 ÷ 4 = 10 or 4 x 10 = 40. Since it takes about half an hour to drive 40 km, it should take 10 times that to drive 400 km. The 4 in 400 km is one place to the left of the 4 in 40, so 400 ÷ 40 = 10, or 40 x 10 = 400. 10 times a half hour is 10 x $\frac{1}{2} = \frac{10}{2}$ = 5 hours (or, by repeated addition, $\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}+\frac{1}{2}$ = 5 hours).”

Part D:

	Distance (kilometers)	Time Spent Driving (hours)
Width of California	400	5
From California to New York	4,000	50
Around Earth’s Equator	40,000	500
From Earth to Moon	400,000	5,000

“It takes 5 hours to drive the width of California because 10 x $\frac{1}{2}$ hour is 5. Every time the 4 moves one place value to the left, it takes 10 times as long (since the number is ten times bigger). If it takes 5 hours to drive 400 km, it takes 10 x 5 = 50 to drive 4,000 km, 10 x 50 = 500 to drive 40,000 km, and 10 x 500 = 5,000 hours to drive 400,000 km. “

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3 Point Response:

The response demonstrates a strong understanding, but the work contains minor errors. A level 3 response is characterized by:

- A strong understanding of place values for numbers up to hundred thousands;
- An ability to carry out multiplication and division operations based on place-value models, although there may be one or two minor errors;
- The ability to work with large numbers to model and comprehend large distances. The explanations may be incomplete.

2 Point Response:

The response demonstrates a basic but incomplete understanding. A level 2 response is characterized by:

- An understanding of place values for numbers up to hundred thousands, although there may be one or two minor errors;
- An ability to carry out multiplication and division operations based on place-value models, possibly with multiple minor errors;
- A weak ability to work with large numbers to model and comprehend large distances.

1 Point Response:

The response demonstrates minimal understanding. A level 1 response is characterized by:

- A poor understanding of place values for numbers up to hundred thousands, with major errors in labeling places and writing comparisons between numbers;
- An inability to carry out multiplication and division operations based on place-value models, evidenced by major errors;
- A weak ability to work with large numbers to model and comprehend large distances.

0 Point Response:

There is no response, or the response is off topic.

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Discussion Questions

Use the following questions to help students struggling to access the problem:

1. Compare 2 and 20: 20 is how many times as many as 2? What is a rule for comparing numbers that have the same first digit but different numbers of zeros?

Possible response: *Numbers that have the same first digit but a different number of zeroes are numbers like 2, 20, 200, 2000, and 20,000. For every zero you add to the right, you multiply the original number by 10. So a general rule is if a number is exactly the same as another number except it has one more zero in the place furthest to the right, then it is 10 times the original number. If it has 2 more zeroes, it is 100 times the original number. If it has 3 more zeroes, then it is 1,000 times the original number.*

2. How can you find out how many days or weeks is the same as 4,800 hours?

Possible response: *There are 24 hours in a day, so if you multiply 24 times the number of days, you can find the number of hours in that many days. If you want to know how many days there are in 4,800 hours, you have to divide 4,800 by 24: 4,800 ÷ 24 = 200 days. To find the number of weeks, you first divide by 24 to find the number of days, and then divide by 7 to find the number of weeks, since there are 7 days in a week: 200 days ÷ 7 = 28 R4 ≈ 28 weeks and 4 days.*

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Extension Activities

1. Construct physical models to express magnitude of large numbers. This activity can be DOK 4. It can be made extra challenging by letting students develop their own scales.

Sample: Use a single length of bathroom tissue (or other long paper roll) with labels for distances at different orders of magnitude. Use 1 cm = 4 km and 10 cm = 40 km, up to 400,000 km as in the main task. Is one roll enough? If the largest number requires too long a piece of bathroom tissue, look on a map centered on the classroom and mark where the end of the piece of bathroom tissue needs to end to represent that distance. This activity may be done outdoors on a sports field so that sufficiently large, straight distances can be used. It is likely that for 400,000 km, the map method must be used, since 400,000 km at a scale of 1 cm = 4 km requires 1 km (100,000 cm) of tissue. How long a piece of bathroom tissue do you need to represent 4 million km?

2. Make sense of large numbers by analyzing how long something takes. This task can be DOK4 if students think of the activity they want to time, determine an approximate rate experimentally, and then create a table based on that rate.

Sample: How fast can you count to 10? (The average is about 5 seconds.) Using that rate, how long does it take you to count to 40? To 400? To 4,000? To 40,000? To 400,000? It may help to make a table and look for patterns.

Count	Seconds	Minutes	Hours
10	5		
40	20		
400	200	3 minutes and 20 seconds	
4,000	2,000	33 minutes and 20 seconds	
40,000	20,000	333 minutes and 20 seconds	5 hours, 33 minutes, and 20 seconds
400,000	200,000	3,333 minutes and 20 seconds	55 hours, 33 minutes, and 20 seconds

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