CCSS-Aligned Mathematical Task

Chorus Line-up, Grade 3

By Monica Esparza

Mrs. Smith, the chorus teacher, is preparing for the school winter program. She wants to set up the 56 chorus members on stage in the auditorium in equal rows. Show two ways to organize the members, using numbers, pictures, words and/or models to explain your thinking.

The honors chorus is joining the school chorus. They have 16 members. Explain how you included the 16 honors chorus members using numbers, pictures, words and/or models.

Rationale for Lesson

Beginning in grade three, students will focus on concepts, skills, and problem solving for multiplication and division. Students develop multiplication strategies, they make a shift from additive to multiplicative reasoning, and they relate division to multiplication. After students understand the situational equal groups and array/area meanings of multiplication and division, reasoning about patterns in products (e.g., products involving factors of 5 or 9) can help students remember particular products and quotients. This work will continue in grades four and five, preparing the way for work with ratios and proportions in grades six and seven.

A critical area of instruction is to develop student understanding of the meanings of multiplication and division of whole numbers through activities and problems involving equal-sized groups, arrays, and area models. (CCSS Framework)

Common Core State Standards for Content

Focus Standard:

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.

Supporting Standard:

3.OA.2 Interpret whole-number quotients of whole numbers, e.g., interpret 56 divided by 8 as the number of objects in each share when 56 objects are partitioned equally into 8 shares, or as a number of shares when 56 objects are partitioned into equal shares of 8 objects each. For example, describe a context in which a number of shares or a number of groups can be expressed as 56 divided by 8.

Common Core State Standards for Mathematical Practice

MP 1

In third grade, mathematically proficient students know that doing mathematics involves solving problems and discussing how they solved them. Students explain to themselves the meaning of a problem and look for ways to solve it. Students may use concrete objects, pictures, or drawings to help them conceptualize and solve problems, such as "Jim purchased 5 packages of muffins. Each package contained 3 muffins. How many muffins did Jim purchase?" or "Describe another situation where there would be 5 groups of 3 or 5 × 3." Students may check their thinking by asking themselves, "Does this make sense?" Students listen to other students' strategies and are able to make connections between various methods for a given problem.

MP 2

Students recognize that a number represents a specific quantity. They connect the quantity to written symbols and create a logical representation of the problem at hand, considering both the appropriate units involved and the meaning of quantities. For example, students apply their understanding of the meaning of the equal sign as "the same as" to interpret an equation with an unknown. When given 4 × ? = 40, they might think:

* 4 groups of some number is the same as 40

* 4 times some number is the same as 40

* I know that 4 groups of 10 is 40 so the unknown number is 10

* The missing factor is 10 because 4 times 10 equals 40.

Teachers might ask, "How do you know" or "What is the relationship between the quantities?" to reinforce students' reasoning and understanding.

MP 3
Students may construct arguments using concrete referents, such as objects, pictures, and drawings. They refine their mathematical communication skills as they participate in mathematical discussions that the teacher facilitates by asking questions such as "How did you get that?" and "Why is that true?" Students explain their thinking to others and respond to others' thinking.

MP 4
Students represent problem situations in multiple ways using numbers, words (mathematical language), drawing pictures, and objects. They might also represent a problem by acting it out or by creating charts, lists, graphs, or equations. Students use models to represent both equations and story problems and can explain their thinking. They evaluate their results in the context of the situation and reflect on whether the results make sense. Students should be encouraged to answer questions, such as "What math drawing or diagram could you make and label to represent the problem?" or "What are some ways to represent the quantities?"

MP 5
Mathematically proficient students consider the available tools (including drawings or estimation) when solving a mathematical problem and decide when certain tools might be helpful. For instance, they may use graph paper to find all the possible rectangles that have a given perimeter. They compile the possibilities into an organized list or a table and determine whether they have all the possible rectangles. Students should be encouraged to answer questions such as, "Why was it helpful to use...?"

MP6
Students develop mathematical communication skills as they use clear and precise language in their discussions with others and in their own reasoning.

MP7

Students look closely to discover a pattern or structure. For instance, student use properties of operation (e.g., commutative and distributive properties) as strategies to multiply and divide. Teachers might ask, "What do you notice when…" or "How do you know if something is a pattern?"

MP8
Students notice repetitive actions in computations and they look for "shortcut" methods. For instance, students may use the distributive property as a strategy to work with products of numbers they do know to solve products they do not know. For example, to find the product of 7 x 8, students might decompose 7 into 5 and 2 and then multiply 5 x 8 and 2 x 8 to arrive at 40 = 16 or 56. Third grade students continually evaluate their work by asking themselves, "Does this make sense?" Student should be encouraged to answer questions, such as "What is happening in this situation?" or "What predictions or generalizations can this pattern support?"

DOK Level: 3

Use concepts to solve non-routine problems

Explain, generalize, or connect ideas using supporting evidence

Explain thinking when more than one response is possible

Explain phenomena in terms of concepts

Use & show reasoning, planning, and evidence

Cite evidence and develop a logical argument for concepts or solutions

Describe, compare, and contrast solution methods

Verify reasonableness of results

Develop a scientific/mathematical model for a complex situation

Enduring Understandings

Students recognize multiplication as finding the total number of objects in a certain number of equal-sized groups through the use of arrays modeled in different ways.

Materials Needed

Chart paper, paper, pencils, graph paper, dot paper, tiles, counters

Set-Up Phase

Solving the task prior to the lesson is critical so that you become familiar with strategies students may use and consider the misconceptions students may have or errors they might make. This will allow you to better understand students' thinking and prepare for questions they may have or that you might ask and the sequence of solution paths you might want to share out with the group.
It is important that students have access to solving the task from the beginning. The following strategies can be useful in providing such access:

- strategically pairing students who complement each other
- providing manipulatives or other concrete materials
- identifying and discussing vocabulary terms that may cause confusion
- posting vocabulary terms on a word wall, including the definition and, when possible, a drawing or diagram

It is important not to "teach" the terms prior to the lesson.
Instead, use the word wall as a tool to assist students if and when they encounter difficulty with a term

Review the Content Objective with Students:
Participants will solve a problem in two or more ways by using words, pictures, number sentences, and/or models to explain their thinking.

Review the Language Objective(s):
Students will justify and defend their thinking using *complex sentences* (because, since, therefore).

Students will compare and contrast solutions using math academic vocabulary and complete sentences.

Introduce the Communication Guide:

To justify and defend:
I know _____ because _____.
Since _____, therefore_____.
First I _____because_____. Then I _____, given that _____.

To contrast:
The difference between _____ and _____ is_____.

To compare:

A similarity between _____ and _____ is _____.

Explore Phase

Allow students the opportunity to work independently for about 5 minutes. Circulate to determine students' level of understanding and ask questions to focus, assess and advance their level of understanding. (**These may be used throughout the TTLP lesson and depending on the student work they may serve a different purpose.)**

Give students the opportunity to work in partners or in groups. Circulate to determine students' level of understanding. Ask questions to focus, assess, and advance students thinking.

Determine the sequence of students that will share their work. Talk to the students about their share out.

Possible Student Strategies	**Focusing Questions**	**Assessing Questions**	**Advancing Questions**
Can't get started	What information do you know? What information are you trying to find? How might you represent the chorus members?		
Writes equations		How do you know your multiplication sentence matches the chorus set up?	
Draws arrays		How do you know that your drawing is	How are your array and multiplication

Possible Student Strategies	Focusing Questions	Assessing Questions	Advancing Questions
		accurate? Why did you draw an array?	sentence related? How might you explain the set up with a number sentence?
Only shows one way			How else would you show a completely different set up?
Has two arrays			Are those the only two set ups that are possible?
Can't get started on the second part	What's the relationship between the different set ups? What number sentence would represent the original set up with the new set up? How many ways can you show it?	When the 16 chorus members are added, do all the set ups work? Why?	

Share, Discuss, and Analyze Phase

Have students share out their work in the specific sequence that matches your mathematical goal. Have the students ask questions of one another through the use of talk moves. Have students use the communication guide, if needed, to justify their solution paths.

Application
Create a new problem for the chorus teacher to solve, for example: how might the solutions be different if the total number of chorus members is a different number? An odd number?

Summary
Students make connections between arrays and how they are used for multiplication and division. Students make connections to commutative properties of multiplication. Students make connections to associative properties of multiplication.

Quick-Write
Create a prompt for the students to capture their understanding of this problem in their math journal, for example: What is the difference on the stage between seven rows of eight members and eight rows of seven members? What is the same? What about two rows of 28 and 28 rows of two? How might that reasoning be applied to any multiplication problem?

Chorus Line-up Task

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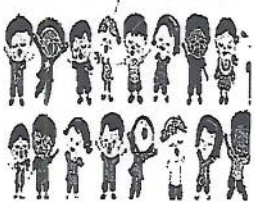
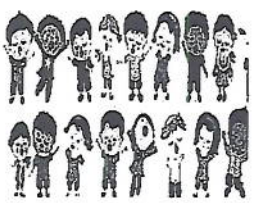
The honors chorus is joining the school chorus. They have 16 members. Explain how you included the 16 honors chorus members using numbers, pictures, words and/or models.

[redacted]



Chorus Line-up

Low



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Show at least two ways she can organize the chorus members and describe the set-up. Use numbers, pictures, words and/or models to explain your thinking.

7 10

14 10

2 10

28 10

35

42

40

56 10

10 in each row

56 +16 72

56 +56 112

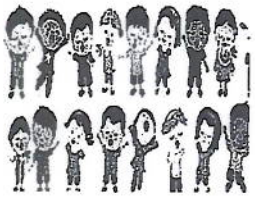
56 +0 56

56 +56 112

The honor chorus has decided to perform with the school chorus. They have 16 members. How can you include them into the performance without changing the number of rows in your two set-ups? Explain how you included the 16 honor chorus members into your set-up using numbers, pictures, words and/or models.

Middle [redacted]

Chorus Line-up



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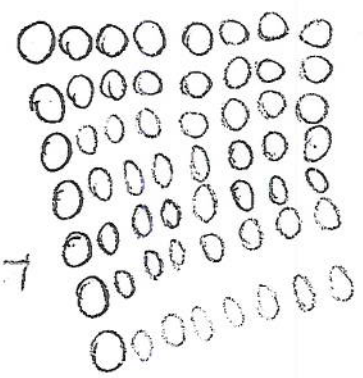
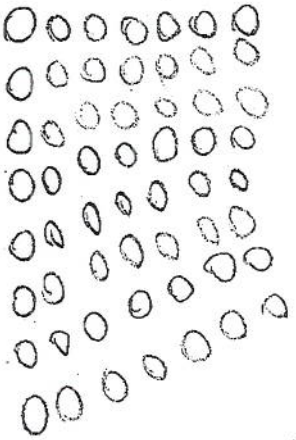


56 ÷ 8 = 7

8 × 7 = 56



I have 8 rows. 7 are in each of them

I have 7 rows. 8 are in each of them.

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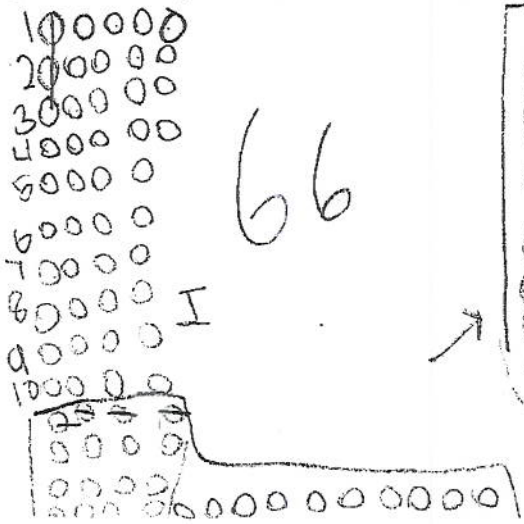


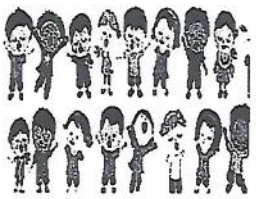
66

I

I have 8 rows, 9 are in each of them

8 + 9 = 72

High



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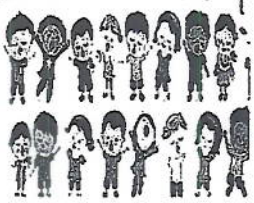

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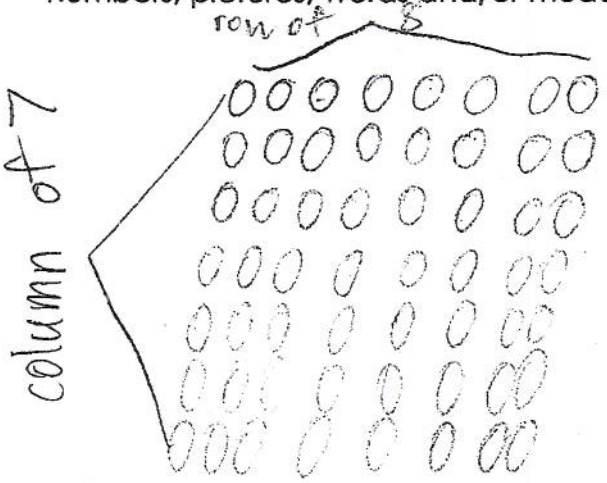
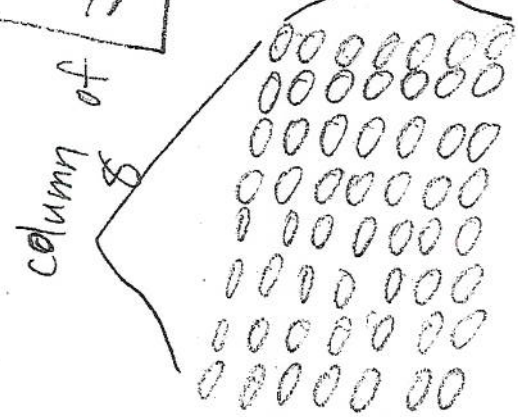


I know that $8 \times 7 = 56$ ($56 \div 7 = 8$) so I can organize the chorus members by putting them in rows of 8 and columns of 7.



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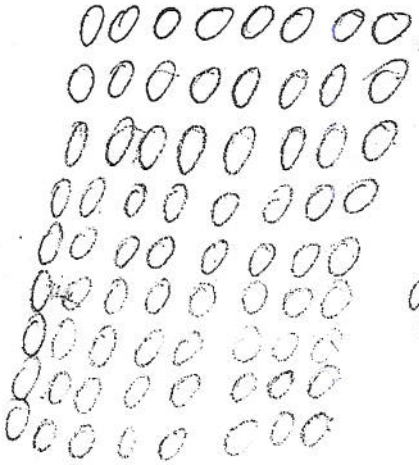

$9 \times 8 = 72$

$$\begin{array}{r} {\scriptstyle 1\ 1} \\ 56 \\ +\ 16 \\ \hline 72 \end{array}$$

I can include the 16 honor chorus members into my set-up by adding 2 more rows of 8.