GRADE 2 MATH: SINGING SONGS

UNIT OVERVIEW

A unit outline is not included in these materials. To support educators in determining how to integrate this task into their curriculum, a document that provides guidance around the use of this task is included in the Instructional Supports Section.

TASK DETAILS

Task Name: Singing Songs

Grade: 2

Subject: Mathematics

Depth of Knowledge: 3

Task Description: Students use the patterns of add five and add ten to demonstrate number sense to fifty-two and ninety-three, and apply comparison to determine an answer.

Standards:

2.NBT.2 Count within 1000; skip-count by 5s, 10s and 100s.

2.NBT.3 Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.

Standards for Mathematical Practice:

MP.1 Make sense of problems and persevere in solving them.
MP.3 Construct viable arguments and critique the reasoning of others.
MP.6 Attend to precision.

NYC Department of Education
Dennis M. Walcott, Chancellor

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The task and instructional supports in the following pages are designed to help educators understand and implement tasks that are embedded in Common Core-aligned curricula. While the focus for the 2011-2012 Instructional Expectations is on engaging students in Common Core-aligned culminating tasks, it is imperative that the tasks are embedded in units of study that are also aligned to the new standards. Rather than asking teachers to introduce a task into the semester without context, this work is intended to encourage analysis of student and teacher work to understand what alignment looks like. We have learned through this year's Common Core pilots that beginning with rigorous assessments drives significant shifts in curriculum and pedagogy. Universal Design for Learning (UDL) support is included to ensure multiple entry points for all learners, including students with disabilities and English language learners.

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Acknowledgements: The tasks were developed by the schools in the 2010-2011 NYC DOE Elementary School Performance Based Assessment Pilot, in collaboration with Exemplars, Inc. and Center for Assessment.

COMMON CORE-ALIGNED TASK
WITH INSTRUCTIONAL SUPPORTS

Mathematics

GRADE 2 MATH: SINGING SONGS PERFORMANCE TASK

NYC Department of Education
Dennis M. Walcott, Chancellor

Name_____

Singing Songs

Renee and Tyra love to sing songs.
Renee wants to sings fifty-two songs.
Renee wants to sing five songs every day until she sings a total of fifty-two songs.
Tyra wants to sing ninety-three songs.
Tyra wants to sing ten songs every day until she sings a total of ninety-three songs.
Does Renee or Tyra sing all her songs first?
Show all your mathematical thinking.

GRADE 2 MATH: SINGING SONGS
UNIVERSAL DESIGN FOR LEARNING (UDL) PRINCIPLES

NYC Department of Education
Dennis M. Walcott, Chancellor

Task Name ELA/Math Grade
Common Core Learning Standards/
Universal Design for Learning

The goal of using Common Core Learning Standards (CCLS) is to provide the highest academic standards to all of our students. Universal Design for Learning (UDL) is a set of principles that provides teachers with a structure to develop their instruction to meet the needs of a diversity of learners. UDL is a research-based framework that suggests each student learns in a unique manner. A one-size-fits-all approach is not effective to meet the diverse range of learners in our schools. By creating options for how instruction is presented, how students express their ideas, and how teachers can engage students in their learning, instruction can be customized and adjusted to meet individual student needs. In this manner, we can support our students to succeed in the CCLS.

Below are some ideas of how this Common Core Task is aligned with the three principles of UDL; providing options in representation, action/expression, and engagement. As UDL calls for multiple options, the possible list is endless. Please use this as a starting point. Think about your own group of students and assess whether these are options you can use.

REPRESENTATION: *The "what" of learning.* How does the task present information and content in different ways? How students gather facts and categorize what they see, hear, and read. How are they identifying letters, words, or an author's style?

In this task, teachers can…

- ✓ **Display information in a flexible format so that the following perceptual features can be varied** by highlighting, bolding or underlining number words, including the numerical representation of words, or color coding the operational words.

ACTION/EXPRESSION: *The "how" of learning.* How does the task differentiate the ways that students can express what they know? How do they plan and perform tasks? How do students organize and express their ideas?

In this task, teachers can…

- ✓ **Provide checklists and guides for note-taking** by providing a graphic organizer for students outlining the steps necessary to complete the problem.

ENGAGEMENT: *The "why" of learning.* How does the task stimulate interest and motivation for learning? How do students get engaged? How are they challenged, excited, or interested?

In this task, teachers can…

- ✓ **Invite personal response, evaluation and self-reflection to content and activities** by employing a self check on the top of the page where students indicate the level of challenge they found in solving the problem, allowing individual and group reflection and discussion on various ways to arrive at the correct mathematical answer.

Visit http://schools.nyc.gov/Academics/CommonCoreLibrary/default.htm to learn more information about UDL.

GRADE 2 MATH: SINGING SONGS
RUBRIC

The following section contains two rubrics that were used to score student work: a content rubric and a process rubric. The content rubric describes student performance according to the content standards in the CCLS. The process rubric describes student performance according to the National Council of Teachers of Mathematics (NCTM) process standards. Students were given a score based on their achievement on the CCLS content rubric and the process rubric. Given that the process rubric is not in the language of the Common Core's Mathematical Practices, we have also included a document that NCTM has posted regarding the relationship between the NCTM process standards and the Standards for Mathematical Practice.

CCSS Mathematics Content Standards Rubric

Students apply mathematical reasoning, knowledge, and skills in problems-solving situations and support their solutions using mathematical language and appropriate representations (data).

NOTE: Anchor papers illustrate how descriptors for each performance level are evidenced at each grade.

Grades K &1: Focus on measurement; comparing and ordering numbers; addition & subtraction

Gr K-1 CCSS Math Criteria by Strand	Novice	Apprentice	Practitioner	Expert (*work is exceeding grade level expectations*)
Number & Operations in Base Ten	Recognizes number symbols and names, but lacks counting sequence (K) Uses place value to show 10 or less (gr 1) A correct answer may be stated, but is not supported by student work (e.g., solves problems without applying properties of operations; copies numbers)	Some parts of problem correct and those parts supported by student work Represents and solves addition and subtraction using counting, models, visuals, manipulatives, number lines, sounds May apply commutative property	***Counts to compare: determines greater than/less than*** ***Represents, compares, and solves using addition and subtraction to 10 (K) or to 20 (gr 1)*** ***Composes/ decomposes (10s and ones)*** ***Minor computation flaws do not affect outcome of a correct solution***	All parts of problem correct, precise, and supported by student work Represents, compares, and solves using numbers greater than 20; uses place value to expand numbers (gr 1) Apply properties of operations - associative & commutative properties
Measurement	Still demonstrates limited number sense (e.g., difficulty estimating; representing quantities; recognizing measurement attributes) Tells time to the hour using a digital clock	Recognizes and uses 1 measureable attribute to compare or classify Tells time to hour, & half hour (gr 1) using a digital clock	***Describes & compares measurable attributes: compares 2 or 3 (gr 1) objects, classifies objects using more than 1 attribute*** ***Measures and compares lengths indirectly (gr 1)*** ***Tells time - digital and analog clocks (gr 1)***	Uses a variety of strategies to estimate, measure, and compare Measures and compares lengths of more than 2 objects and determines the difference in lengths

Grade 2: Focus on measurement; addition & subtraction

Gr 2 CCSS Math Criteria by Strand	Novice	Apprentice	Practitioner	Expert (*work is exceeding grade level expectations*)
Number & Operations in Base Ten	A correct answer may be stated, but is not supported by student work (e.g., copies numbers) Lacks understanding of place value (e.g., all digits have same value regardless of place)	Some parts of problem correct and those parts supported by student work Adds and subtracts correctly without regrouping	***Uses strategies, place value, & properties of operations to represent and solve addition and subtraction problems*** ***Minor computation flaws do not affect outcome of a correct solution***	All parts of problem correct, precise, and supported by student work Uses a variety of representations (e.g., concrete models, diagrams, equations)
Measurement	Still demonstrates limited number sense (e.g., difficulty estimating; representing or using measures/data)	Measures correctly, but may select the wrong tool, incorrect scale or representation (e.g., dollar and cents signs; line diagrams with	***Measures, compares, & estimates lengths, time, money*** ***Represents & interprets data; uses***	Uses a variety of strategies to estimate, measure, and compare

		unequal unit spacing)	***data to make predictions and support solutions***	

Grades 3 & 4: Focus on fractions; multiplication and division

Gr 3 and 4 CCSS Math Criteria	**Novice**	**Apprentice**	**Practitioner**	**Expert (*work is exceeding grade level expectations*)**
Number & Operations in Base Ten	Applies flawed strategies (e.g., attempts to form groups when multiplying, but does not use equal sized groups or repeated addition) Selects the incorrect operation to perform or major inaccuracies in computation lead to an incorrect solution Still demonstrates limited number sense (e.g., difficulty estimating; representing part-whole) A correct answer may be stated, but is not supported by student work	Some parts of problem correct and those parts supported by student work Uses additive reasoning to solve or interpret most problems May include limited explanations Uses visual models (number line, area, sets) to represent parts of whole	***Expresses whole numbers as fractions*** ***Generates equivalent fractions and explains why they are equivalent (e.g., using visual models- number line, area, sets; comparing to benchmarks)*** ***Uses addition, subtraction, and multiplication to solve problems with whole numbers, fractions (gr 3-4) and mixed numbers (gr 4)*** ***Minor computation flaws do not affect outcome of a correct solution***	All parts of problem correct, precise, and supported by student work Extends understanding of equivalence of fractions by identifying proper and improper fractions Interprets meaning of the products (gr 3-4) and remainder (gr 4) when dividing Uses a variety of strategies to solve problems
Operations & Algebraic Thinking			***Uses 4 operations in solving problems and explaining patterns using whole numbers*** ***Solves multi-step & word problems***	Uses multiple representations of the same problem (visual models, equations, decomposing fractions)

Grade 5: Focus on decimals; 4 operations

Gr 5 CCSS Math Criteria by Strand	**Novice**	**Apprentice**	**Practitioner**	**Expert (*work is exceeding grade level expectations*)**
Number & Operations in Base Ten	Consistently flawed understanding of decimals/place value Decimal representations not appropriate for task Incorrect computational strategies used or major inaccuracies in computation lead to an incorrect solution A correct answer may be stated, but is not supported by student work	Some parts of problem correct and those parts supported by student work (e.g., uses visual models to represent fractional or decimal parts of a whole) Mostly consistent understanding of place value and representation of decimals Displays some inaccuracies in computation	***Clear and consistent application of place value and representation of decimals (e.g., to the thousandths, using money concepts, rounding)*** ***Some minor flaws performing 4 operations with whole numbers and decimals to hundredths, but does not affect outcome of a correct solution***	All parts of problem correct, precise, and supported by student work Demonstrates higher order understanding of decimals and relating them to fractions, percents, or other abstract concepts beyond the scope of the specific task (e.g., explaining the solution or approach using alternative models)

Operations & Algebraic Thinking			***Writes and interprets numerical expressions*** ***Analyzes patterns and relationships***	Uses multiple representations of the same problem

Exemplars® Standards-Based Math Rubric*

	Problem Solving	Reasoning and Proof	Communication	Connections	Representation
Novice	No strategy is chosen, or a strategy is chosen that will not lead to a solution. Little or no evidence of engagement in the task present.	Arguments are made with no mathematical basis. No correct reasoning nor justification for reasoning is present.	No awareness of audience or purpose is communicated. or Little or no communication of an approach is evident or Everyday, familiar language is used to communicate ideas.	No connections are made.	No attempt is made to construct mathematical representations.
Apprentice	A partially correct strategy is chosen, or a correct strategy for only solving part of the task is chosen. Evidence of drawing on some previous knowledge is present, showing some relevant engagement in the task.	Arguments are made with some mathematical basis. Some correct reasoning or justification for reasoning is present with trial and error, or unsystematic trying of several cases.	Some awareness of audience or purpose is communicated, and may take place in the form of paraphrasing of the task. or Some communication of an approach is evident through verbal/written accounts and explanations, use of diagrams or objects, writing, and using mathematical symbols. or Some formal math language is used, and examples are provided to communicate ideas.	Some attempt to relate the task to other subjects or to own interests and experiences is made.	An attempt is made to construct mathematical representations to record and communicate problem solving.

*Based on revised NCTM standards.

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Exemplars® Standards-Based Math Rubric (cont.)*

	Problem Solving	Reasoning and Proof	Communication	Connections	Representation
Practitioner	A correct strategy is chosen based on mathematical situation in the task. Planning or monitoring of strategy is evident. Evidence of solidifying prior knowledge and applying it to the problem solving situation is present. Note: The practitioner must achieve a correct answer.	Arguments are constructed with adequate mathematical basis. A systematic approach and/or justification of correct reasoning is present. This may lead to... • clarification of the task. • exploration of mathematical phenomenon. • noting patterns, structures and regularities.	A sense of audience or purpose is communicated. and/or Communication of an approach is evident through a methodical, organized, coherent sequenced and labeled response. Formal math language is used throughout the solution to share and clarify ideas.	Mathematical connections or observations are recognized.	Appropriate and accurate mathematical representations are constructed and refined to solve problems or portray solutions.
Expert Work at this level is exceeding grade-level expectations	An efficient strategy is chosen and progress towards a solution is evaluated. Adjustments in strategy, if necessary, are made along the way, and / or alternative strategies are considered. Evidence of analyzing the situation in mathematical terms, and extending prior knowledge is present. Note: The expert must achieve a correct answer.	Deductive arguments are used to justify decisions and may result in formal proofs. Evidence is used to justify and support decisions made and conclusions reached. This may lead to... • testing and accepting or rejecting of a hypothesis or conjecture. • explanation of phenomenon. • generalizing and extending the solution to other cases.	A sense of audience and purpose is communicated. and/or Communication at the Practitioner level is achieved, and communication of argument is supported by mathematical properties. Precise math language and symbolic notation are used to consolidate math thinking and to communicate ideas.	Mathematical connections or observations are used to extend the solution.	Abstract or symbolic mathematical representations are constructed to analyze relationships, extend thinking, and clarify or interpret phenomenon.

*Based on revised NCTM standards.

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National Council of Teachers of Mathematics (NCTM) Process Standards and the Common Core State Standards for Mathematics

From ***NCTM Action on the Common Core State Standards for Mathematics***

by NCTM President J. Michael Shaughnessy

The preeminent message in both the NCTM *Principles and Standards for School Mathematics* (2000) and CCSSM is the importance of nurturing mathematical thinking and reasoning processes in our students. No bulleted list of specific content standards will hold together as a coherent, meaningful whole, or make any significant contribution to our students' growth in mathematics, without interweaving mathematical "practices." Mathematics curricula must show students the power of reasoning and sense making as they explore mathematical structures, of communication as they construct viable arguments, and of multiple representations as they engage in mathematical modeling. The close connections between the NCTM Process Standards and the CCSSM Standards for Mathematical Practice are represented in the chart below.

The upcoming NCTM publication, *Making it Happen*, will provide a deeper analysis of the connections between the NCTM Process Standards and detail the potential of the existing NCTM resources to interpret and implement CCSSM.

NCTM Process Standards and the CCSS Mathematical Practices

NCTM Process Standards	CCSS Standards for Mathematical Practice
Problem Solving	1. Make sense of problems and persevere in solving them. 5. Use appropriate tools strategically.
Reasoning and Proof	2. Reason abstractly and quantitatively. 3. Critique the reasoning of others. 8. Look for and express regularity in repeated reasoning
Communication	3. Construct viable arguments
Connections	6. Attend to precision. 7. Look for and make use of structure
Representations	4. Model with mathematics.

GRADE 2 MATH: SINGING SONGS
ANNOTATED STUDENT WORK

This section contains annotated student work at a range of score points, student summaries, and implications for instruction for each performance level. The annotated student work and student summaries demonstrate performance at different levels and show examples of student understandings and misunderstandings of the task that can be used with the implications for instruction to understand how to move students to the next performance level.

Grade 2 Math: Singing Songs
Annotated Student Work: Expert

This student is an Expert according to both the Exemplars Rubric and the CCSS Content Standards Rubric, both included in the supporting materials.

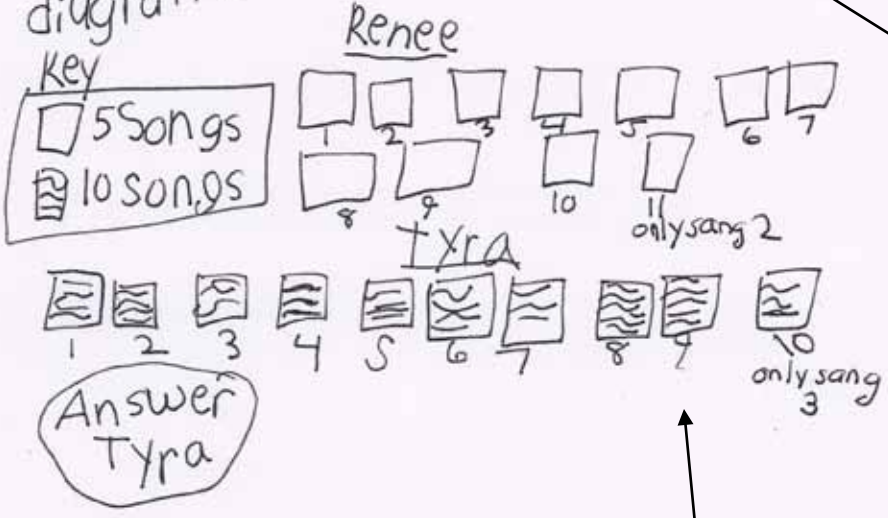
Expert, Student 1 Grade 2

Name_____

Singing Songs

Renee and Tyra love to sing songs.
Renee wants to sings fifty-two songs.
Renee wants to sing five songs every day until she sings a total of fifty-two songs.
Tyra wants to sing ninety-three songs.
Tyra wants to sing ten songs every day until she sings a total of ninety-three songs.
Does Renee or Tyra sing all her songs first?
Show all your mathematical thinking.

I have to Know if Renee or Tyra sing all the songs first. I will do a diagram.



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The student creates a diagram with an accurate key. Although the student keeps track of the days, there is no indication of the total songs and no evidence of how the student reached this conclusion.

The student demonstrates understanding that on day 10 for Tyra she "only sang 3" and on day 11 for Renee she "only sang 2."

Grade 2 Math: Singing Songs
Annotated Student Work: Expert

The student creates one table the clearly demonstrates he/she knows how to skip count and helps to interpret the diagram on the previous page.

I canput all the songs on a table

Songs

day	Renees songs	Tyra Songs
1	5	10
2	10	20
3	15	30
4	20	40
5	25	50
6	30	60
7	35	70
8	40	80
9	45	90
10	50	100
11	55	

It is Tyra again
I am right on
my answer two
ways

Patterns

day add 1-odd
Renee add 5 songs-odd even
Tyra add 10 songs-even
They are multiples onle
Renne sings $\frac{1}{2}$ of
Tyra songs 5+5=10

52 is about $\frac{1}{2}$ 93

$$\begin{array}{r} 93 \\ -52 \\ \hline 41 \end{array}$$

$$\begin{array}{r} 52 \\ 93 \\ \hline 145 \end{array}$$ - total songs

Renee needs 1 more
day then Tyra
11 days is 1 week
and 4 days
Renee can sing 3 more
songs on day 11
Tyra can sing 7 more
songs. That is 155
songs.

The student clearly communicates a solution pathway. We are able to know how this student used skip counting to solve and that he/she can write 2- and 3-digit numbers, as well as accurately add and subtract them.

$$\begin{array}{r} 55 \\ -52 \\ \hline 3 \end{array} \qquad \begin{array}{r} 100 \\ -93 \\ \hline 7 \end{array}$$

$$\begin{array}{r} 145 \\ +10 \\ \hline 155 \end{array}$$

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The use of the table seems to have allowed this student to reflect on number relationships not apparent in the diagram. “Renne sings ½ of Tyra songs. 5 + 5 = 10”

The student interprets her/his mathematical results in the context of the situation and reflects. The student verifies that the answer is correct by creating a table to show the multiples of five and ten and stating, “It is Tyra again. I am right on my answer two ways.” The student makes many interesting mathematical connections such as some observations about adding odds and evens.

Grade 2 Math: Singing Songs
Annotated Student Work: Expert

Expert – Student 1 Summary

Achievement Level: Student 1 is an Expert according to both the Exemplars Process Rubric and the CCSS Content Standards Rubric, both of which are included in the supporting materials. The table below provides a rationale for the student's performance level in each of the criteria identified in the Exemplars Process Rubric.

Criteria and Performance Level	Rationale
Problem Solving Expert	The student designs a pathway to solve the problem beginning with a diagram with a key which provides all the information needed to solve the problem. The student progresses to model the task more efficiently in one table – coordinating the day, Renee's songs, and Tyra's songs. The table allows the student to recognize the pattern of odd and even numbers and the relationship that every day "Renee sings ½ of Tyra's songs."
Reasoning and Proof Expert	The student skip counts, understanding the bundling of fives and tens, and keeps track of the days and the number of songs for each girl, and compares the number of skip counts (days) to reach a solution. The student does not use place value to determine the number of days Tyra sings (90 is nine tens, and 2 more would be eleven days) and makes no connection to place value in the solution.
Communication Expert	The student creates a diagram and then a table which are clearly labeled and easy to follow in order to evaluate the effectiveness of the solution pathway. The student uses mathematical language appropriately (odd, even, half, ½, multiples). The student uses the context of the problem to communicate the mathematical ideas ("Renee can sing 3 more songs on day 11 and Tyra can sing 7 more songs."), clarifying the referents.

Connections Expert	The student notices mathematically relevant patterns, commenting on the patterns of adding odds and evens in the chart. We do not know whether this student studied patterns of adding odds and evens and used this knowledge or whether these observations make a good beginning place for a study that leads to generalizing about adding odd and even numbers. The student does not make a connection to place value in this solution.
Representation Expert	The student begins with an accurate, labeled diagram which is sufficient to solve the problem. The student then creates a table. It seems as if the student creates the table as a way of checking, but the creation of the table invites the student to recognize some patterns and make mathematically interesting observations and connections.

Instructional Implications: Singing Songs, 2

Achievement Level: Expert

The following is a list of instructional implications that you may want to consider for students performing at the Expert level. In addition, you may want to consult the suggestions for the Practitioner level.

- Students must be fluent in counting to 1000, counting by 100s and understanding the relative magnitude of three-digit numbers.
- Investigate the notion of ½. Where is it coming from in this problem? Which representations allow us to see it? How might knowing that predict the correct solution? Is there something in the written problem that might have helped us predict this? How does that work? Will it always work that way? How do you know?
- Investigate odd and even numbers. Can we predict whether all numbers will be even, or odd, or even and odd, based on the number we choose to skip count by (e.g. skip counting by 3, skip counting by 2). How do you know? Could you prove it to someone else?
- How many songs would Tyree have sung by the end of the 20th day if she continued this way? How do you know? Could you predict the number of songs she would have sung at the end of any day? Can you do the same for Renee?
- What might be interesting about this to put on a graph? Try it and let's talk about it.

Grade 2 Math: Singing Songs
Annotated Student Work: Practitioner

This student is a Practitioner according to both the Exemplars Rubric and the CCSS Content Standards Rubric, (both included in the supporting materials).

Practitioner, Student 1 Grade 2

Name_____

Singing Songs

Renee and Tyra love to sing songs.
Renee wants to sings fifty-two songs.
Renee wants to sing five songs every day until she sings a total of fifty-two songs.
Tyra wants to sing ninety-three songs.
Tyra wants to sing ten songs every day until she sings a total of ninety-three songs.
Does Renee or Tyra sing all her songs first?
Show all your mathematical thinking.

I have to find out if Renee or Tyra sing all her Songs First I will make a table

Days	Tyra Songs
1	10
2	20
	30
3	40
4	50
5	60
6	70
7	80
8	90
9	
10	93

Renee songs	Days
5	1
10	2
15	3
20	4
25	5
30	6
35	7
40	8
45	9
50	10
52	11

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The student is able to makes sense of the problem and persevere to in finding regularity (patterns) and reason quantitatively. The student uses patterns and compares the appropriate quantities in order to reach a mathematically correct solution.

The student communicates using mathematically correct terms- first, table, pattern. He/she writes two-digit numbers. The solution is clear and gives us an opportunity to evaluate this student's justification for his/her answer.

The student demonstrates understanding of skip counting, counting accurately by 5s and 10s and demonstrating understanding that the last day would include songs 91, 92, and 93 for Tyra and 51 and 52 for Renee.

The student creates two coherent tables to show the quantities of songs being sung each day by each girl.

Grade 2 Math: Singing Songs
Annotated Student Work: Practitioner

Tyra Finishs First

connections

patterns
I count By 5 under
Renee Songs to Day 10
and I count By 10
under Tyra Songs to Day 9

The student looks for and expresses regularity by naming the patterns used in solving the problem, but does not connect beyond this problem.

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Grade 2 Math: Singing Songs
Annotated Student Work: Practitioner

Practitioner – Student 1 Summary

Achievement Level: Student 1 is a Practitioner according to both the Exemplars Process Rubric and the CCSS Content Standards Rubric, (both of which are included in the supporting materials). The table below provides a rationale for the student's performance level in each of the criteria identified in the Exemplars Process Rubric.

Criteria and Performance Level	Rationale
Problem Solving Practitioner	Student creates two tables that are a clear pathway to solving the problem. The student demonstrates knowledge of skip counting, understanding that the pattern can break the last day because the 93rd song or the 52nd song would be sung among the last batch. The student accurately compares the quantities of skip counts to reach a reasonable conclusion. The student does not demonstrate knowledge of place value, instead skip counting by 10s to get to 90.
Reasoning and Proof Practitioner	Student demonstrates appropriate mathematical reasoning to solve the problem.
Communication Practitioner	Student's table is clear and allows access into student's thinking about this problem, allowing others to evaluate the effectiveness of the argument and solution.
Connections Practitioner	Student looks for connections, but merely reiterates her solution pathway. She does not connect skip counting by 10s to place value. This would be the most relevant connection for 2nd graders to be making.
Representation Practitioner	The student creates an accurate representation which leads to a valid mathematical conclusion.

Grade 2 Math: Singing Songs
Annotated Student Work: Practitioner

This student is a Practitioner according to both the Exemplars Rubric and the CCSS Content Standards Rubric, (both included in the supporting materials).

Practitioner, Student 3 Grade 2

Name_____

Singing Songs

Renee and Tyra love to sing songs.
Renee wants to sings fifty-two songs.
Renee wants to sing five songs every day until she sings a total of fifty-two songs.
Tyra wants to sing ninety-three songs.
Tyra wants to sing ten songs every day until she sings a total of ninety-three songs.
Does Renee or Tyra sing all her songs first?
Show all your mathematical thinking.

I must find who will sing all songs first.
I will do a table.

Key
d days
s Songs

answer
Tyra

Renee d	s
1	5
2	10
3	15
4	20
5	25
6	30
7	35
8	40
9	45
10	50
11	55

Tyra d	s
1	10
2	20
3	30
4	40
5	50
6	60
7	70
8	80
9	90
10	100

Renee has 3 exter songs on +5 pattern
Trya has 7 exter songs on +10 pattern
Tyra always sings even number of songs
Renee goes 1 more day and both go more than 1 week
Thats all I See

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The student makes sense of the problem and designs a clear pathway to solution. The student creates two tables, one for Renee and one for Tyra, which coordinate days and total number of songs sung.

The student uses precise mathematical terms-, first, table, key, pattern, even number, more, week. There is a clear justification for the solution and others can evaluate the effectiveness of this argument.

The student demonstrates understanding of skip counting. The student writes 2-digit numbers.

The student interprets her/his mathematical results showing understanding that when skip counting, 3 is included in a bundle of 10 and 2 is included in a bundle of 5.

The student is able to attend to the relationship between the number of days it takes to sing all the songs in order to solve the problem.

Grade 2 Math: Singing Songs
Annotated Student Work: Practitioner

Practitioner – Student 2 Summary

Achievement Level: Student 3 is a Practitioner according to both the Exemplars Process Rubric and the CCSS Content Standards Rubric, (both of which are included in the supporting materials). The table below provides a rationale for the student's performance level in each of the criteria identified in the Exemplars Process Rubric.

Criteria and Performance Level	Rationale
Problem Solving Practitioner	The student's strategy of using a table to indicate Renee sings fifty-two songs in eleven days, Tyra sings ninety-three songs in ten days, and comparing the total days to determine that Tyra sings all her songs first, works to solve the problem. The student's answer, "Tyra," is correct.
Reasoning and Proof Practitioner	The student creates two accurate tables, uses skip counting to achieve the solution, keeps track of both days and number of songs, and compares the number of skip counts to find a mathematically valid solution. The student does not write the numeric 52 or 93 and makes no reference to place value (nine tens is 90, 92 is nine days plus 2 more songs).
Communication Practitioner	The student's written solution provides access into the thinking that solved the problem, allows others to evaluate the argument. The student uses mathematically appropriate vocabulary (pattern, even) correctly. The language of "Renee has 3 extra songs of +5 pattern Tyra has 7 extra songs on +10 pattern" could be recontextualized (MP 2) and brought back to the context of the problem to clarify, e.g. "Renee could sing three extra songs on the last day and Tyra could sing 7 extra songs on the last day."
Connections Practitioner	The student notices some mathematically interesting and relevant patterns ("Tyree always sings even number of songs" might lead to a generalization that when counting by ten, the numbers are all even, which leads to the idea that all factors of 10 are factors of 2 in later years). The student does not make a connection to the place value of the number 93 (see RP above).
Representation Practitioner	The student's tables are appropriate to the problem and accurate. Each column is correctly labeled and a key defines the d and s. All the entered data is correct.

Instructional Implications: Singing Songs, 2

Student Achievement Level: Practitioner

See all of Novice and Apprentice Implications. These students understand skip counting, but their understanding of place value needs further assessment. In addition:

- Extend work on place value to 3-digit numbers. This is the thrust of 2nd grade standards.
- Through journaling and regular written reflections, encourage students to use precise mathematical language, to refer back to the context of the problem in their explanations.
- Work with students on looking at the representations and models they are using for ease of use and reading and to determine which ones more readily display patterns and regularity in a solution. E.g. although Practitioner, Student 2 uses a diagram that appears to have been fun to construct and solves this problem, a table would have displayed the regularity in the counting by 10 and counting by 5 numbers, the relationship between the two counts.
- Encourage students to look for connections that make them want to explore further. The total and difference of the two girls' songs is an end. Odd/even numbers, the patterns of the multiples, halves, the leftovers at the end of the count can all lead to investigations that will interest students and propel mathematical understanding forward.

Grade 2 Math: Singing Songs
Annotated Student Work: Apprentice

This student is an Apprentice according to both the Exemplars Rubric and the CCSS Content Standards Rubric, (both included in the supporting materials).

Apprentice, Student 1 Grade 2

Name_____

Singing Songs

Renee and Tyra love to sing songs.
Renee wants to sings fifty-two songs.
Renee wants to sing five songs every day until she sings fifty-two songs.
Tyra wants to sing ninety-three songs.
Tyra wants to sing ten songs every day until she sings a total of ninety-three songs.
Does Renee or Tyra sing all her songs first?
Show all your mathematical thinking.

I have to find out who is going to end first.
I will make a table.

Renee

days	Songs
1	5
2	10
3	15
4	20
5	25
6	30
7	35
8	40
9	45
10	50
11	51
12	52

Tyra

days	Songs
1	10
2	20
3	30
4	40
5	50
6	60
7	70
8	80
9	90
10	91
11	92
12	93

A
They both end on day 12

page 1 of 1

The student correctly makes a plan and follows that pathway. The student uses a table to find the amount of songs each girl sings to fifty and ninety songs. The student's understanding of skip counting breaks down when looking for numbers inside the bundled counting.

The student uses some precise mathematical language (e.g., first, table) and is precise in finding sums by adding 5s, 10s and 1s in the chart.

The student counts by fives to fifty and tens to ninety. The student does not understand that fifty-one is part of the next set of five for fifty-five and that ninety-one is part of the next set ten for one hundred (2.NBT 3).

The student's communication of thinking is clear allowing us to evaluate the argument and recognize the conceptual flaw in his/her thinking.

The student uses two tables to justify the conclusion in an organized way.

Grade 2 Math: Singing Songs
Annotated Student Work: Apprentice

Apprentice – Student 1 Summary

Achievement Level: Student 1 is an Apprentice according to both the Exemplars Process Rubric and the CCSS Content Standards Rubric, both of which are included in the supporting materials. The table below provides a rationale for the student's performance level in each of the criteria identified in the Exemplars Process Rubric.

Criteria and Performance Level	Rationale
Problem Solving Apprentice	The student correctly constructs a table and correctly counts by 5s and 10s. The student is able to count by 5s to 50 and by 10s to 90. There is a breakdown of understanding of what it means to count by a number, e.g., 1 2 3 4 **5** 6 7 8 9 **10** 11 12 13 14 **15**…**50** 51 52 53 54 55. This is very much connected to understanding that we can compose a unit of 10 from ten ones and can decompose 1 ten into ten ones, in this case, **90** 91 92 93 94 95 96 97 98 99 **100**. The student does not recognize that when he/she says 55, that number includes 52 and when she/he says 100, that includes 92.
Reasoning and Proof Apprentice	Conclusion is correct based on flawed reasoning. Students understands task, but has a conceptual breakdown in skip counting.
Communication Practitioner	Student precisely labels. Solution communicates chosen pathway clearly, allowing us insight into student's mathematical thinking in order to evaluate the flawed argument.
Connections Novice	Student fails to connect skip counting by 10 to the place value in the number 92. By end of first grade we want students to recognize that 92 is nine 10s and 2 more. If we count by 10s nine times, we will get to 90.
Representation Apprentice	Student uses a table to compare the two quantities, accurately labels and enters solution path. Conceptual flaw in student reasoning prevents him/her from reaching correct solution to problem.

Grade 2 Math: Singing Songs
Annotated Student Work: Apprentice

This student is an Apprentice according to both the Exemplars Rubric and the CCSS Content Standards Rubric, (both included in the supporting materials).

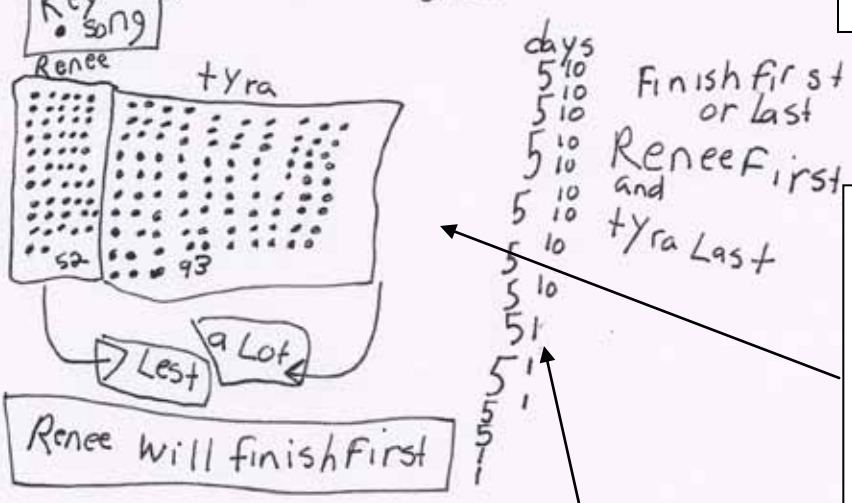
Apprentice, Student 2 Grade 2

Name_____

Singing Songs

Renee and Tyra love to sing songs.
Renee wants to sings fifty-two songs.
Renee wants to sing five songs every day until she sings a total of fifty-two songs.
Tyra wants to sing ninety-three songs.
Tyra wants to sing ten songs every day until she sings a total of ninety-three songs.
Does Renee or Tyra sing all her songs first?
Show all your mathematical thinking.

I have to find out who finish first
Im going to do a diagram.



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The student uses the precise mathematical language (e.g., first, diagram, key, "Lest"). The student justifies thinking so that we can evaluate the argument.

The student makes sense of the problem to correctly represent fifty-two and ninety-three individual songs. The student also uses ten 5s, two 1s, and nine 10s, three 1s. To find an answer, the student relied on which number is less (52) and which was a lot (92 ignoring the number of counts of 5.

The student creates a diagram and a list to help solve this problem. Although both representations use 5s and 10s, the student does not make use of that structure in finding her/his answer to the problem, relying instead on the relative size of 52 and 93.

The student models the entire situation in her/his representation, but does not know which number relationships provide the answer to the question.

The student makes two lists, one of ten 5s and two 1s, the other of nine 10s and three 1s. There is no indication of how the student kept track of the count (5, 10, 15 or 5 +5 +5) or that the student knows how to skip count

Grade 2 Math: Singing Songs
Annotated Student Work: Apprentice

Apprentice – Student 2 Summary

Achievement Level: Student 2 is an Apprentice according to both the Exemplars Process Rubric and the CCSS Content Standards Rubric, both of which are included in the supporting materials. The table below provides a rationale for the student's performance level in each of the criteria identified in the Exemplars Process Rubric.

Criteria and Performance Level	Rationale
Problem Solving Apprentice	Student makes a diagram, accurately organizing Renee's songs in groups of 5 and Tyra's songs in groups of ten. She accurately ends at 52 for Renee and 93 for Tyree. She labels Renee "lest" and Tyree "a Lot". She makes two columns of numbers, one of ten 5s, two 1s; the other of nine 10s and three 1s. Her conclusion is Renee first, Tyree last. This may be based on the fact that 52 is less than 93. Although she writes columns of 5s and 10s, she does not skip count. She loses track of the purpose of counting 5s and 10s in her solution pathway.
Reasoning and Proof Apprentice	The student's reasoning is flawed. She chooses a pathway that will allow her to reach a correct solution, but she does not count up the number of 5s or the number of 10s in her representations. She bases her conclusion solely on comparing the magnitude of 52 and 93.
Communication Practitioner	The student creates a solution that allows us insight into thinking and giving us an opportunity to evaluate the argument. The student uses some precise mathematical language and representations that clearly represent the thinking.
Connections Novice	The student does not make a connection between the place value of 93 and counting by 10s.
Representation Practitioner	The student creates a representation that will allow her to solve the problem, but loses track of what she is comparing (the number of skip counts versus the total number of songs).

Instructional Implications: Singing Songs, 2

Student Achievement Levels: Novice and Apprentice

The following is a list of instructional implications that you may want to consider for students performing at the Novice and Apprentice level.

- Encourage students to listen to and visualize the action in the problem. Encourage them to model the action with manipulatives (including drawings) that help them understand the action. Tables and diagrams with keys may be too complex for students at this level, distracting from the number relationships. At this point, students may need to start by drawing out all objects, then group objects, then compare, referring back to the problem at each step of the way.
- Use appropriate mathematical language at all times. Encourage your students to do the same. This problem has very little academic language in it (total, first), but other language can be tricky (until, the written words for numbers). Students should understand the language of the problem before they begin.
- Investigate counting by 5s and 10s with objects, exploring where the 1 group is and where the 5 (or 10) objects are in each group. Develop skip counting based on this model.
- Use many models that encourage understanding 1 ten as a unit of ten ones: ten frames, number lines, one hundred charts, rekenrek (number rack). Counting money is not a good model for these students. They cannot see the 10 cents in a dime or the 5 cents in a nickel. This requires many experiences and cannot be limited to one, two or even five lessons.
- Use tens and ones language along with standard language to name two-digit numbers (*fifty-two* and *five tens and two ones*).
- Play games where students compare two-digit numbers, leading to the generalization that the number of tens is the best indicator of relative size.
- Engage in choral skip counting whenever possible: when lining up or transitioning in the classroom. Occasionally give a target number, for example when counting by 10s, 78. Ask in whose count the number 78 belongs. (The discussion will probably be whether the person who said 70 or the person who said 80. Students justify their reasoning.)
- Share student work such as Apprentice, Student 2. All students can understand how this student represented each song, organizing into groups of five or ten. The students will discuss what this student could do next to make the response more clear.

Grade 2 Math: Singing Songs
Annotated Student Work: Novice

This student is a Novice according to both the Exemplars Rubric and the CCSS Content Standards Rubric, both included in the supporting materials.

Novice, Student 1 Grade 2

Name_____

Singing Songs

Renee and Tyra love to sing songs.
Renee wants to sings fifty-two songs.
Renee wants to sing five songs every day until she sings a total of fifty-two songs.
Tyra wants to sing ninety-three songs.
Tyra wants to sing ten songs every day until she sings a total of ninety-three songs.
Does Renee or Tyra sing all her songs first?
Show all your mathematical thinking.

I need to find out if Renee or Tyra finish first.

Renee	Tyra
1	1
2	2
3	3
4	4
5	5
	6
	7
	8
	9
	10

I think that Renee sings her songs first because her number is less

Renee will sing first.

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The student understands the relative magnitude of 5 and 10, but does not use either counting by five's and ten's or comparison to arrive at a correct answer.

The student shows no work to demonstrate understanding of how to read and write numbers for fifty-two songs and ninety-three songs.

The student uses one precise mathematical word: first.

The student attempts to model the mathematics by comparing 5 and 10 in two lists. We are left to wonder if this student knows the relative magnitude of 5 and 10 without writing all the numbers out.

The student chooses a pathway which does not address large areas of this problem. The written work makes the student pathway clear so that we can evaluate the argument.

Grade 2 Math: Singing Songs
Annotated Student Work: Novice

Novice – Student 1 Summary

Achievement Level: Student 1 is a Novice according to both the Exemplars Process Rubric and the CCSS Content Standards Rubric, both of which are included in the supporting materials. The table below provides a rationale for the student's performance level in each of the criteria identified in the Exemplars Process Rubric.

Criteria and Performance Level	Rationale
Problem Solving Novice	Although the student attempts to organize data onto a table to solve the problem, the student is not attending to all of the number relationships in this problem, ignoring counting by fives with a total of 52 songs for Renee and counting by tens with a total of 93 songs for Tyra. The student understands that there is some comparison, but compares 5 and 10.
Reasoning and Proof Novice	The student's conclusion that Renee will complete singing her songs first based on flawed reasoning and lack of understanding of the mathematical relationships.
Communication Apprentice	This student uses two relevant mathematical words: first and less. The student only understood less in terms of number of total songs.
Connections Novice	The student solves the problem and stops without making a mathematically relevant connection.
Representation Apprentice	Attempts a table which potentially addresses the task, but is irrelevant for the student's solution path (10>5).

GRADE 2 MATH: SINGING SONGS INSTRUCTIONAL SUPPORTS

The following section includes a document that provides general guidance on administration of Singing Songs to support teachers in integrating it into their curriculum. Additionally, other related tasks, assessing similar concepts, are included that teachers can use as appropriate.

P/S	R/P	Com	Con	Rep	Ach/Level

Name_____

Earning a Box of Markers

Kobe is helping to wash the lunch room tables to earn points to get a box of markers at the school store. Every day Kobe washes ten tables and earns one hundred points. Kobe needs one thousand points to earn the box of markers. How many tables does Kobe wash before he earns his box of markers? Show all your mathematical thinking.

Preliminary Planning Sheet for a Mathematics Portfolio Piece/Task

(2)

Title of Task: Earning a Box of Markers

Content Strand(s) Addressed: Number+Operations in Base Ten

State Standard(s) Addressed: _____

Program Link: _____

Common Core Standard(s): 2 NBT 1, 2

Underlying Mathematical Concepts

Counting by 10 to 100
counting by 100 to 1,000
10 tables per day
100 points per 10 tables

Problem Solving Strategies/Representation

model (manipulatives)
diagram/key
table
number line

Mathematical Language

model
diagram/key
table
number line
pattern
equal
per
odd/even
more/less than
week / day
total
amount
sum

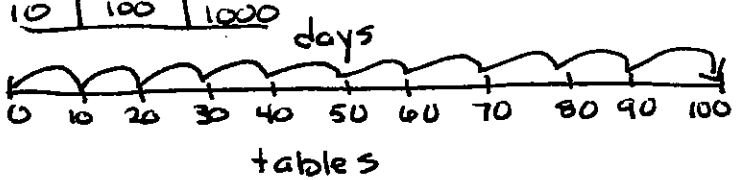
Answer
100 tables

Possible Solution(s)

day	total tables	total points
1	10	100
2	20	200
3	30	300
4	40	400
5	50	500
6	60	600
7	70	700
8	80	800
9	90	900
10	100	1000

Key
□ - ten tables
X - 100 points

[X] [X] [X] [X] [X] = 50 □ 500 X
[X] [X] [X] [X] [X] = 50 □ 500 X
50 + 50 = 100 □
500 + 500 = 1000 X



Connections

- patterns day + 1
  tables + 10
  points + 100
- tables + points are all even numbers
- Kobe gets his markers in 2 weeks if school is in session 5 days each week
- Continue table for more table/points
- relate to a similar problem and state math

Related Tasks

See Resource Binder

- Solve 2 ways to verify link math
- washes an equal amount of tables each day
- Discuss 1, 10, 100, etc

P/S	R/P	Com	Con	Rep	Ach/Level

Name_____

Pumpkin Seeds

Eight students each have a pumpkin to clean out the inside. The teacher tells each student to save one hundred pumpkin seeds so they can toast them for a snack. Each student counts one hundred seeds. The students want to have a total of one thousand seeds. How many more pumpkin seeds do they need to find in the pumpkins? Show all your mathematical thinking.

Preliminary Planning Sheet for a Mathematics Portfolio Piece/Task

(2)

Title of Task Pumpkin Seeds

Content Strand(s) Addressed Number + Operations in Base 10

State Standard(s) Addressed

Program Link

Common Core Standard(s) 2 NBT 1, 2

Underlying Mathematical Concepts

number sense to 1,000
addition
100 to 1 (100 seeds to 1 student)

Problem Solving Strategies/Representation

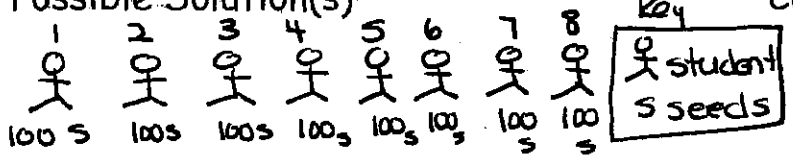
model (manipulatives)
diagram/key
table
graph
numberline

Mathematical Language

model
diagram
key
table
graph
numberline
per
total
sum
amount
rule
100*S=T
odd/even
more/less/than
multiple
equal

Answer
200 seeds

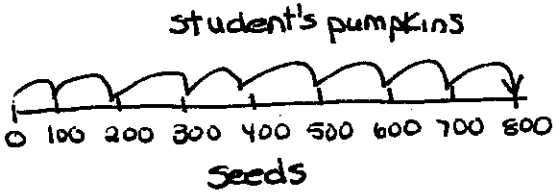
Possible Solution(s)



100+100+100+100+100+100+100+100 = 800 s
1000 - 800 = 200 s

Student	total seeds
1	100
2	200
3	300
4	400
5	500
6	600
7	700
8	800

or graph pattern



rule
100 * S = T
100 * 5 = 500
100 * 8 = 800
100 * 10 = 1000

Key
s student
T total seeds

Connections

- pattern s student + 1 odd/even seeds + 100 - even multiples
- add more students or seeds
- solve more than 1 way to verify
- relate to a similar problem and state math
- each student has an equal amount of seeds
- 8 students = 800 seeds
  explain 8-800
  7-700 etc

Related Tasks

See Resource Binder

P/S	R/P	Com	Con	Rep	Ach/Level

Name_____

A lot of Pages

Mr. Linton is reading a book that is nine hundred pages long. Mr. Linton will read one hundred pages every day until his finishes the book. Mr. Linton thinks it will take seven days to finish his book. Is Mr. Linton correct? Show all your mathematical thinking.

Preliminary Planning Sheet for a Mathematics Portfolio Piece/Task

(2)

Title of Task: A lot of Pages

Content Strand(s) Addressed: Number + Operations in Base ten

State Standard(s) Addressed:

Program Link:

Common Core Standard(s): 2 NBT 1,2

Underlying Mathematical Concepts

- number sense to 100
- counting by 100
- comparison
- writing hundreds
- 100 to 1 (100 pages to 1 day)

Problem Solving Strategies/Representation

- model (manipulatives)
- diagram/key
- number line
- Table
- bar graph

Mathematical Language

- model
- diagram
- key
- numberline
- Table
- bargraph
- pattern
- per
- day, week, month
- one-half, ½
- sum
- total
- odd/even
- equal
- multiples
- rule
- 100*d=p
- total
- variable

Answer NO

Possible Solution(s)

Reading a Book

day	1	2	3	4	5	6	7	8	9
total pages	100	200	300	400	500	600	700	800	900

Reading

day	pages	total pages
1	100	100
2	100	200
3	100	300
4	100	400
5	100	500
6	100	600
7	100	700
8	100	800
9	100	900

Rule

Key
d day
p pages

100*d=p
100*2=200
100*9=900
100*10=1,000
100×8=800

Connections

- Read an equal amount of pages each day
- It doesn't take a week, it takes 9 days to read the book
- patterns - day +1 odd/even
  pages + 100 - even multiples
- use rule to find pages read for any number of days
- Solve more than one way to verify
- Relate to a similar problem and state math. It would take 18 days if he reads 50 pages per day
  50 is ½ of 100

Related Tasks

See Resource Binder

- Discuss 1, 100
  2, 200
  3, 300
  etc

P/S	R/P	Com	Con	Rep	Ach/Level

Name_____

Picking Apples

Vincent has a job picking apples for his uncle. Vincent earns five dollars for every ten baskets of apples he picks. Vincent works seven days for his uncle. Vincent picks ten baskets of apples every day. How much money does Vincent earn picking apples? Show all your mathematical thinking.

Preliminary Planning Sheet for a Mathematics Portfolio Piece/Task

②

Title of Task Picking Apples

Content Strand(s) Addressed Number+Operations in Base Ten

State Standard(s) Addressed

Program Link

Common Core Standard(s) 2 NBT 1,2

Underlying Mathematical Concepts

money notation

number sense to 70

addition/multiplication

10 to $5.00 (10 baskets to $5.00)

Problem Solving Strategies/Representation

model (manipulatives)

diagram/key

table

number line

graph

Mathematical Language

model	rule
diagram	variable
key	10*d=b
table	10*d=m
numberline	week
graph	day
per	money
total	odd/even
money notation	sum
$.	
pattern	

Answer $35.00

Possible Solution(s)

day	total baskets	total money
1	10	$5.00
2	20	$10.00
3	30	$15.00
4	40	$20.00
5	50	$25.00
6	60	$30.00
7	70	$35.00

or graph table

Key

d-day
b-baskets
m-money

10*d=b
10*2=20
10*7=70
5*d=m
5*3=$15.00
5*6=$30.00
5*100=$50,00

days

10 20 30 40 50 60 70

baskets

Connections

- Patterns day+1 - odd/even
  total baskets +10 - all even
  total money+$5.00
- 7 days is a week
- continue table to two weeks
- Relate to a similar problem and state math
- Verify by solving more than one way
- generalize and apply rules
  10*d=b or 5*d=m
- Discuss 1-10
  2-20
  3-30 ....

Related Tasks

See Resource Binder

- graph baskets/money

P/S	R/P	Com	Con	Rep	Ach/Level

Name_____

Bookmarks

Main Street School is having a craft sale to raise money for the library. Omari is making bookmarks to sell at the craft sale. Omari makes ten bookmarks each day for ten days. How many bookmarks does Omari make? Omari sells each bookmark at the craft sale for one dollar. How much money does Omari earn at the craft sale? Show all your mathematical thinking.

Preliminary Planning Sheet for a Mathematics Portfolio Piece/Task

②

Title of Task Bookmarks

Content Strand(s) Addressed Number + Operations in Base Ten

State Standard(s) Addressed

Program Link

Common Core Standard(s) 2 NBT 1,2

Underlying Mathematical Concepts

number sense to 100
adding by 10 or sets of 10
money notation
adding by $10.00
10 to 1 (10 bookmarks to 1 day)

Problem Solving Strategies/Representation

model (manipulatives)
diagram/key
table
tally chart
number line
graph

Mathematical Language

model
diagram
key
table
tally chart
number line
graph
pattern
odd/even
day
week...
more than

amount
money notation
$
sum
equal
dollar
dime
quarter
nickel
penny
total
per
½ one-half

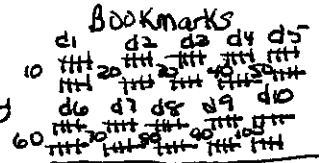
multiples
money

Answer
100 bookmarks
$100.00

Possible Solution(s)

day	total bookmarks	total money
1	10	$10.00
2	20	$20.00
3	30	$30.00
4	40	$40.00
5	50	$50.00
6	60	$60.00
7	70	$70.00
8	80	$80.00
9	90	$90.00
10	100	$100.00

Bookmarks



Key 1-bookmark
d-day

day	bookmarks
1	10
2	10
3	10
4	10
5	10
6	10
7	10
8	10
9	10
10	10

10 10's = 100
$100.00

|||| |||| = 10
$1.00
$1.00
$1.00
$1.00
$1.00
$1.00
$1.00
$1.00
$1.00
$1.00
$10.00

rule
10 * d = b $10.00 * d = m

Key d-day b-bookmark
m money

Connections

- patterns day + 1
  bookmarks + 10 - all even multiples
  money + $10.00
- made bookmarks for 1 week and 3 day
- made an equal amount each day
- Did not earn $10.00 each day but $100.00 at the craft sale
- Solve more than 1 way to verify
- Relate to a similar problem and state math.
- $1.00 is 4 quarters, 10 dimes...
- If made 20 a day it would take ½ the days to make 100

Related Tasks

See Resource Binder

- Discuss 1 - 10
  2 - 20
  9 - 90 ...
- graph linear patterns

P/S	R/P	Com	Con	Rep	Ach/Level

Name_____

Reading

Nina loves to read. Nina is reading a book that is one hundred forty pages long. Nina decides to read ten pages every day until she finishes her book. Nina starts reading her book on Saturday. On what day of the week will Nina finish reading her book? Show all your mathematical thinking.

Preliminary Planning Sheet for a Mathematics Portfolio Piece/Task

(2)

Title of Task Reading

Content Strand(s) Addressed Number + Operations in Base 10

State Standard(s) Addressed

Program Link

Common Core Standard(s) 2 NBT 1,2

Underlying Mathematical Concepts

number sense to 140
writing 3 digit numbers
adding/multiplying
days of the week

Problem Solving Strategies/Representation

model
diagram/key
table
tally chart
number line
bar graph

Mathematical Language

model
diagram
table
tally chart
number line
bar graph
pattern
per
day
Sat. Sun. Mon...
week
month

sum
total
equal
double
multiple
odd/even
graph

Answer
Friday

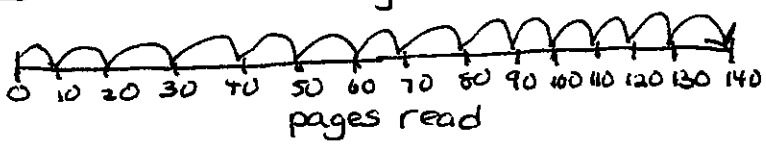
Possible Solution(s)

day	Reading pages total
Sat.	10
Sun.	20
Mon.	30
Tues.	40
Wed.	50
Thur.	60
Fri.	70
Sat	80
Sun.	90
mon	100
Tues.	110
Wed.	120
Thur.	130
Fri	140

Key
☐ 10 pages

Sat. Sun.
☐ 10 ☐ 20
Mon. Tues. Wed. Thurs.
☐ 30 ☐ 40 ☐ 50 ☐ 60
Fri. Sat. Sun. Mon.
☐ 70 ☐ 80 ☐ 90 ☐ 100
Tues. Wed. Thurs. Fri.
☐ 110 ☐ 120 ☐ 130 ☐ 140

Reading a Book
Days



Connections

- Read an equal amount each day
- Read for 2 weeks
- patterns - pages +10 - even multiples
- Solve more than 1 way to verify
- Relate to a similar problem and state math
- continue for 3 week, a month
- If only reads 5 pages it would take double the time or 4 weeks - approx. one month
- graph linear pattern

Related Tasks

See Resource Binder

P/S	R/P	Com	Con	Rep	Ach/Level

Name_____

Decade, Score, and Century

Jason learns that ten years is called a decade. Jason learns that twenty years is called a score. Jason learns that one hundred years is called a century. Jason finds two different ways to total a century using decades and scores. What could Jason's two different ways look like? Show all your mathematical thinking.

Preliminary Planning Sheet for a Mathematics Portfolio Piece/Task

②

Title of Task Decade, Score, and Century

Content Strand(s) Addressed Number + Operations in Base Ten

State Standard(s) Addressed

Program Link

Common Core Standard(s) NBT 1, 2

Underlying Mathematical Concepts

multiples of 10, 20, 100
number sense to 100
addition
comparison

Problem Solving Strategies/Representation

model (manipulatives)
table
organized list
diagram/key

Mathematical Language

model
table
organized list
diagram
key
decade
score
century
pattern
$\frac{1}{2}$, one half
combinations
odd/even
multiples
equal
more/less than

Answer - more than 1 example
8 decades, 1 score
4 decades, 3 scores

Possible Solution(s)

Years

order how many	decade	score
1	10	20
2	20	40
3	30	60
4	40	80
5	50	100
6	60	–
7	70	–
8	80	–
9	90	–
10	100	–

Connections

- Find additional combinations for a century
- patterns - all even numbers
  decade +10
  score + 20
- patterns are multiples of 10 and 20
- Relate to a similar problem and state math
- A decade is $\frac{1}{2}$ a score
- It takes 10 decades to equal one century
- Discuss 1-10
  2-20
  9-90 ...

Related Tasks

See Resource Binder

- need 5 more for decade than score in order column

P/S	R/P	Com	Con	Rep	Ach/Level

Name_____

Reading Books

Carl is reading a book with one thirty-seven pages. Carl reads five pages every day. Jamal is reading a book with ninety-two pages. Jamal reads ten pages every day. Carl thinks he will finish reading his book first. Jamal thinks he will finish his book first. Who is correct? Show all your mathematical thinking.

Preliminary Planning Sheet for a Mathematics Portfolio Piece/Task ②

Title of Task Reading Books

Content Strand(s) Addressed Number+Operations in Base10

State Standard(s) Addressed

Program Link

Common Core Standard(s) 2 NBT 1, 2

Underlying Mathematical Concepts

number sense to 100

addition with 5, 10

comparison

Problem Solving Strategies/Representation

model (manipulatives)

diagram / Key

table

number line

graph

Mathematical Language

model	sum
diagram	total
Key	amount
numberline	equal
table	multiples
graph	rule
more/less/than	variable
per	5*d=c
pattern	10*d=j
½, one half	> <
day, week, month	

Possible Solution(s)

day	Carl's total pages	Jamal's total pages
1	5	10
2	10	20
3	15	30
4	20	40
5	25	50
6	30	60
7	35	70
8	40	80
9	—	90
10	—	100

8 < 10

Answer Carl is correct

Carl

day	pages	total pages
1	5	5
2	5	10
3	5	15
4	5	20
5	5	25
6	5	30
7	5	35
8	5	40

Jamal

day	pages	total pages
1	10	10
2	10	20
3	10	30
4	10	40
5	10	50
6	10	60
7	10	70
8	10	80
9	10	90
10	10	100

Connections

- Carl reads ½ Jamal's pages 10-5=5
- Carl didn't need 3 pages on day 8
- Jamal didn't need 8 pages on day 10
- Carl reads 2 less days than Jamal
- patterns day+1
  Carl's pages +5
  Jamal's pages +10
- find rules 5*d=C 10*d=J
- Solve more than 1 way to verify
- They read a total of 37+92=129 pages
- Jamal read 92-37 = 55 pages more than Carl

Related Tasks

See Resource Binder

- graph each boys pages
- each read an equal amount each day 5, 10
- Relate to a similar problem and state math

P/S	R/P	Com	Con	Rep	AC/LV

Name_____

Collecting Rocks

Sara wants to collect 19 rocks to put around her garden Sara will collect 4 rocks every day. Amy wants to collect 27 rocks to put around her garden. Amy will collect 5 rocks every day. Sara thinks she will collect all her rocks before Amy collects all her rocks. Is Sara correct? Show all your mathematical thinking.

Preliminary Planning Sheet for a Mathematics Portfolio Piece/Task

(2)

Title of Task Collecting Rocks

Content Strand(s) Addressed Number + Operations Base Ten

State Standard(s) Addressed

Program Link

Common Core Standard(s) NBT 1, 2

Underlying Mathematical Concepts

numbersense to 27/30
counting by 4 and 5
addition/countingon
comparison

Problem Solving Strategies/Representation

model (manipulatives)
diagram/key
tally chart
table
graph

Mathematical Language

model
diagram
key
tallychart
table
pattern
morelless than
per
oddleven
day, week, month
total
sum
amount
multiples
rule
variables
4·d = 5
5·d = A
graph
axis

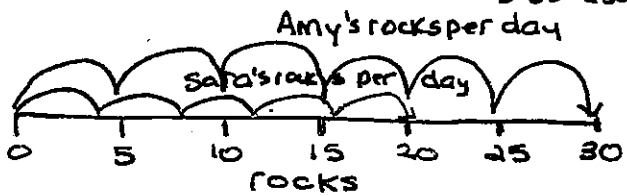
Possible Solution(s)

Answer
Sara is Correct

day	Sara's totalrocks	Amy's total rocks
1	4	5
2	8	10
3	12	15
4	16	20
5	20	25
6	—	30

Key
d day
s sarab rocks
a amy's rocks

rules
4·d=S
4·2=8
4·5=20
4·10=40
5·d=a
5·3=15
5·50=250

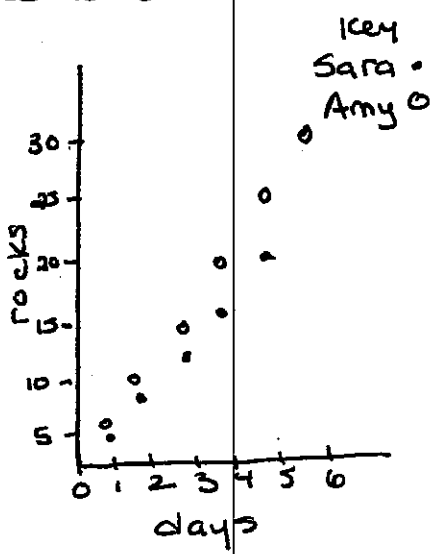


Connections

- Patterns day +1
  Sara's rocks +4 - all even multiples
  Amy's rocks + 5 - odd/even multiples
- Amy has to look 1 more day than Sara
- Sara finds 1 more rock than needed on day 5
- Amy finds 3 more rocks than needed on day 6
- Both took less than a week to find their rocks
- Need a total of 19+27 = 46 rocks
- Solve more than 1 way to verify
- Relate to another problem and state math

Related Tasks

See Resource Binder



P/S	R/P	Com	Con	Rep	AC/LV

Name_____

Reading about Motorcycles

Steve is interested in motorcycles. Steve is reading a book about the types of motorcycles made over the past three decades. The first day Steve reads 10 pages in 5 minutes. The second day Steve reads 20 pages in 10 minutes. The third day Steve reads 30 pages in 15 minutes. If this pattern continues how many pages does Steve read on the ninth day? How many minutes does Steve read on the ninth day? Show all your mathematical thinking.

Preliminary Planning Sheet for a Mathematics Portfolio Piece/Task

②

Title of Task Reading About Motorcycles

Content Strand(s) Addressed

State Standard(s) Addressed

Program Link

Common Core Standard(s)

Underlying Mathematical Concepts

number sense to 90
ordinal numbers
+5, +10
addition

Problem Solving Strategies/Representation

diagram/key
models (clocks)
table
graph
number line

Mathematical Language

model
diagram
key
table
graph
number line
pattern
per
day, week, month
odd/even
decade
minutes
hour
rule
10. d=p
5·d=m
variables
more/less/than
multiples
input
output
ordinal numbers
1st, 2nd, 3rd

Answer
90 pages
45 min.

Possible Solution(s)

Reading

day	pages	minutes
1	10	5
2	20	10
3	30	15
4	40	20
5	50	25
6	60	30
7	70	35
8	80	40
9	90	45

Key
d day
p pages
m minutes

Rules

10·d=p
5·d=m

10·4=40
10·9=90
10·50=500

5·3=15
5·9=45
5·11=55
5·20=100

Connections

- patterns day +1 odd/even
  pages +10 -even multiples
  min. +5 -odd/even multiples
- Read 450 total pages
- Read 225 total min -which is 3 hours, 45 minutes
- A decade is 10 years
- generalize and use rules 10·d=p, 5·d=m
- Reads for 1 week, 2 days
- graph linear function
- Relate to a similar problem and state math

Related Tasks

See Resource Binder

P/S	R/P	Com	Con	Rep	Ach/Level

Name_____

Reading Aloud

Mrs. Jackson loves to read chapter books out loud to her children. Mrs. Jackson reads a chapter book that has one hundred twenty pages. If Mrs. Jackson reads ten pages every day out loud to her children when will she finish reading the book? Show all your mathematical thinking.

Preliminary Planning Sheet for a Mathematics Portfolio Piece/Task

(2)

Title of Task Reading Aloud

Content Strand(s) Addressed Number+Operations in Base 10

State Standard(s) Addressed

Program Link

Common Core Standard(s) 2.NBT 1, 2

Underlying Mathematical Concepts

number sense to 120
addition/multiplication
10 to 1 (10 pages to 1 day)

Problem Solving Strategies/Representation

model (manipulatives)
diagram
key
graph
tally
number line
bargraph

Mathematical Language

graph
Model
diagram
table
tally
number line
bargraph
pattern
per
day
odd/even
rule
10·d = p

variable
more
double
axis
total
dozen
equal
sum
product

55

Answer
day 12

Possible Solution(s)

Reading Pages

day	1	2	3	4	5	6	7	8	9	10	11	12
pages	10	20	30	40	50	60	70	80	90	100	110	120

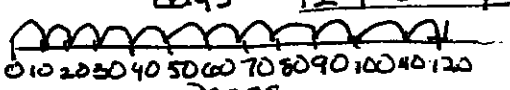
rule
10·d=p
Key d-day
p-pages

10·2=20
10·5=50
10·10=100

day	pages	total pages
1	10	10
2	10	20
3	10	30
4	10	40
5	10	50
6	10	60
7	10	70
8	10	80
9	10	90
10	10	100
11	10	110
12	10	120

or
graph
table
on graph
paper

Reading days



Connections

- patterns day +1 odd/even
  pages +10 even
- she reads aloud for 1 dozen days
- generalize rule and apply to other days 10·d = p
- Relate to a similar problem and state math
- continue table for more pages
- If read 20 pages per day it will take only 6 days - double the pages
- solve more than 1 way to verify

Related Tasks

See Resource Binder

- Reads an equal amount of pages each day
- discuss 1, 10
  2, 20
  etc.