Roger's Rabbits

Level: Elementary School

Version 10.28.13

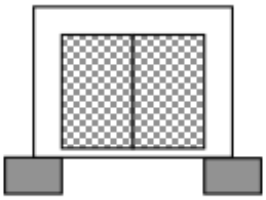
This task gives students the chance to:

- work with patterns
- work with tables

Table of Contents

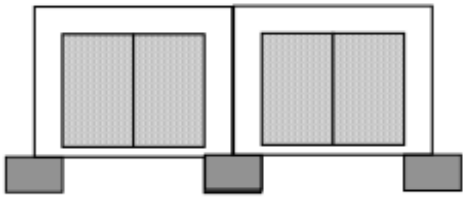
Name _____

Roger keeps pet rabbits. He keeps them in a row of rabbit hutches. The hutches are on blocks so that they don't get damp.



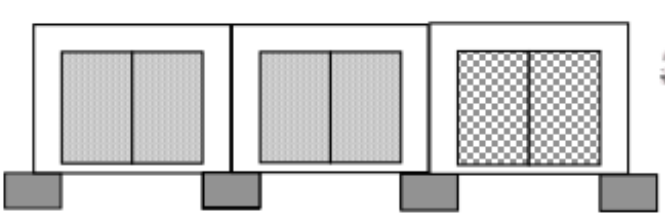
This is hutch #1.

It is for one rabbit.
It has 2 doors and 2 blocks.



This is hutch #2.

It is for two rabbits.
It has 4 doors and 3 blocks.



This is hutch #3.

It is for three rabbits.
It has 6 doors and 4 blocks.

1. Fill in the empty spaces in the table below.

Hutch	1	2	3
Number of doors			
Number of blocks			

2. Roger says: "To get the number of doors for a hutch, I take the hutch number and double it."

a. Does Roger's rule work for hutches #1, #2, and #3?

Use words, tables, diagrams, expressions, or equations to explain your answer.

b. According to Roger's rule, how many doors does hutch #12 have? _____

Explain how you figured this out.

_____

_____

3. Sara says: "To find the number of blocks for a hutch, I take the hutch number and add 1."

Does Sara's rule work for hutches #1, #2, and #3?

Use words, tables, diagrams, expressions, or equations to explain your answer.

ROGER'S RABBITS | ANNOTATIONS

Core Idea

Roger's Rabbits asks students to identify whether finite sequences of numbers follow given rules and to extend those sequences according to those rules. Note that a finite sequence such as 2, 4, 6 does not determine exactly one pattern. For example, it could be seen as part of a "multiples of 2" pattern and continued as 2, 4, 6, 8, . . . Or, it could be seen as part of a repeating pattern such as 2, 4, 6, 2, 4, 6, 2, 4, 6, . . .

Note that the two different kinds of shading on the doors do not have mathematical meaning.

Common Core State Standards for Mathematical Content
http://www.corestandards.org/Math/Content/4/OA

Grade 4, Operations and Algebraic Thinking
(p. 29)

Use the four operations with whole numbers to solve problems.

3. Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Gain familiarity with factors and multiples.

4. Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite.

Generate and analyze patterns.

With regard to this standard, the draft Operations and Algebraic Thinking Progression for the CCSS comments, "notice that the Standards do not require students to infer or guess the underlying rule for a pattern, but rather ask them to generate a pattern from a given rule and identify features of the given pattern."

Common Core State Standards for Mathematical Practice
http://www.corestandards.org/Math/Practice

SMP.1. Make sense of problems and persevere in solving them.	. . . Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships. . . . They can . . . identify correspondences between different approaches. . . .
SMP.3. Construct viable arguments and critique the reasoning of others.	Mathematically proficient students . . . justify their conclusions, communicate them to others, and respond to the arguments of others. . . .
SMP.6. Attend to precision.	Mathematically proficient students try to communicate precisely to others. . . . They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. . . .
SMP.7. Look for and make use of structure.	Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. . . .
SMP.8. Look for and express regularity in repeated reasoning.	Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts.

Common Core State Standards for ELA/Literacy (grade 4)
http://www.corestandards.org/ELA-Literacy/SL/4

Key Ideas and Details (p. 14) http://www.corestandards.org/ELA-Literacy/RI/4/1	1. Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.	. . . Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships. . . . They can . . . identify correspondences between different approaches. . . .

Craft and Structure (p. 14) http://www.corestandards.org/ELA-Literacy/RI/4/4	4. Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a grade 4 topic or subject area.	Mathematically proficient students . . . justify their conclusions, communicate them to others, and respond to the arguments of others. . . .
Integration of Knowledge and Ideas (p. 14) http://www.corestandards.org/ELA-Literacy/RI/4/7	7. Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.	Mathematically proficient students try to communicate precisely to others. . . . They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. . . .
Speaking and Listening (p. 24) http://www.corestandards.org/ELA-Literacy/SL/4/2	2. Paraphrase portions of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.	Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. . . .

Suggestions

Before students attempt Question 1, teachers might:

1. Read the problem as a class.
2. Think, Talk, Share: Have the students talk in pairs to discuss the meaning of the task:
   - Have students look at the pictures and describe a hutch.
   - Negotiate for meaning as students come to common understandings or agreements regarding the use of formal and informal mathematical language. For example, students may need to agree on the following:

     What constitutes a hutch? Is it a singular space or multiple spaces? Although an illustration is provided, students may consider each pair of doors as one hutch, when actually each row is considered one hutch.
3. Ask students to write down three things they agree on, using words, phrases, pictures and/or diagrams on poster-sized paper. Put these up in front of the room. Have a reporter from each group to read their agreements.
4. Show the pictures without the words and ask students to describe what they see to each other.

   Ask students:

   - "What did we notice about hutch #1?"
   - "Hutch number 1 has two blocks, hutch #2 has three blocks. Why does it *not* have four blocks?"
   - "Tell me something you notice about hutch #3." Have students begin with "I/We notice . . . "; "We think . . . "; or "I see . . . "
   - Write responses on chart paper and post.

1. Fill in the empty spaces in the table below.

Hutch	1	2	3
Number of doors			
Number of blocks			

To assist students in completing the table:

1. Have each student complete the table independently, then share the results with a peer.*
2. Ask students to explain how they came to their particular results and to adjust their responses based on the new information, if necessary. This allows for more talk, justification, and peer teaching and learning. This also encourages peer-to-peer teaching and learning as well as peer monitoring.
3. Ask students to describe any patterns they see in the table to another student. This is an opportunity for them to use words, the table (possibly augmented by more rows or columns, or annotations), diagrams, expressions, or equations in describing any regularities that they see. In particular, this is an opportunity to see repeated calculations, e.g., repeatedly adding 1 to get the number of blocks for the next hutch or repeatedly adding 2 to get the number of doors for the next hutch.

*In many cases ELLs are reassured by the illustrations that support their response and depend on them when they are uncertain about the language. Often they receive lower scores for the language expression rather than the mathematical understanding. In these cases, teachers might give two scores —one for writing and another for mathematics.

2. Roger says: "To get the number of doors for a hutch, I take the hutch number and double it."

   a. Does Roger's rule work for hutches #1, #2, and #3? Use words, tables, diagrams, expressions, or equations to explain your answer.

   b. According to Roger's rule, how many doors does hutch #12 have?

   Explain how you figured this out.

   Students are being asked to compare the result of applying

Roger's rule for 1, 2, and 3 with the entries that they made in their tables. Second, they are asked to apply the rule to a hutch whose picture is not shown. To help clarify the rule consider the following:

1. Ask a volunteer to re-read Roger's rule aloud to the class.
2. Have students work in pairs and share ideas about how they can show how they answered the question.
3. Allow students to build or illustrate the hutches/doors/rabbits as they figure out how many of each will be needed for hutch #12. This is especially helpful for ELLs.*

To assist students having difficulty with this task, use patterned language that supports the correct results.
For example:

> According to Sara's rule, hutch number four has five blocks,
>
> According to Sara's rule, hutch number five has six blocks,
>
> According to Sara's rule, hutch number six has _____ ? The whole class should respond, "Seven blocks."

Or, for a second example:

> "I agree with _____'s response because _____."
>
> "I disagree with _____'s response because _____."

Here there is less scaffolding, which allows students with more advanced fluencies and mathematics understanding to do the "heavy lifting" in the task.

*Note that according to the CCSS, "Drawings need not show details, but should show the mathematics in the problem. (This applies wherever drawings are mentioned in the Standards.)"

Language of Mathematics Task | Mathematically Speaking

Adapted from R. Santa Cruz (2012) for the Understanding Language Project

This Language of Mathematics task is provided as a resource to be used, revised, and combined to fit a variety of lesson plans. The overall goals are to minimize direct instruction and introduction by the teacher, and instead provide structure so that the students can grapple with the questions themselves. Students first work alone, then in pairs or small groups, and finally in a whole class discussion while always focusing on their mathematical reasoning. This cycle provides ELLs with the opportunity and time to think, practice speaking in pairs or small groups, and thus be better prepared to participate in a whole class discussion or a presentation of their reasoning. Students should be encouraged to describe not only *what* they are doing but also, more importantly, *why* they are doing it. Teacher questions and whole class discussions should focus on describing, refining, and comparing students' mathematical reasoning.

As students work on Roger's Rabbits, they will use a variety of words to talk about their reasoning.

To encourage the use of relevant mathematical vocabulary, phrases, or statements, model using these throughout the lesson.

A partial list of vocabulary words and phrases that may be used in this task is below.

General	Mathematical	Statements
Table	Pattern	Twice as many . . .
Hutch	Extend	One more than . . .
Explain	Number	One less than . . .
Increase	Double	
Blocks	Twice	
	Rule or Rules	
	Multiply	

Note that words like *table*, *blocks*, and *rule/rules* have multiple meanings. Check to see if students understand their meanings in this context. It is not necessary to use all the words, but attempt to use as many of the mathematical terms as possible.

Structure of the activity

1. After students have completed Roger's Rabbits, assign partners and have them discuss how they solved the problems by doing the Mathematically Speaking task.
2. After the discussions, ask the students to create a class poster of words and phrases that they listed on their Mathematically Speaking charts. The class poster need not look like the example shown here and may include words, phrases, diagrams, expressions, and equations.
3. Note that it is not necessary to use all the words in one session. If the students leave out critical words such as *extend* or *increase*, add the words to the list as the lesson progresses.

Keep this poster on display to provide students with visual cues, connections to similar tasks, and reminders to use the vocabulary.

Words & Phrases Used by Student Groups

- more than
- pattern
- number
- explain
- double
- twice

This type of poster might be useful if it listed synonyms, e.g., "twice," "two times as many," and associated terms, e.g., "double."

Mathematically Speaking

Date _____

Partner Names _____ & _____

1. Solve the problem individually. Show your work. If needed, use the back of the page.
2. Explain your thinking, strategies, and solution to your partner. Use the target words in your explanation.
3. Listen to your partner's explanation, and make a tally for each time he or she uses the target vocabulary.

Explain how you solved the problem.	Explain how you solved the problem.
Problem 1	Problem 2

Vocabulary Words	Tally: How many times used
Example: **rabbit(s)**	IIII II
blocks	
increase	
next	
pattern	
rule(s)	
table	
think	
+ twice as many	

Vocabulary Words	Tally: How many times used
Example: **each**	III
double	
extend	
multiply	
number	
plus	
+ one more than	

If you found other helpful words, list them here:

Mathematically Speaking

Date _____

Partner Names _____ & _____

1. Solve the problem individually. Show your work. If needed, use the back of the page.
2. Explain your thinking, strategies, and solution to your partner. Use the target words in your explanation.
3. Listen to your partner's explanation, and make a tally for each time he or she uses the target vocabulary.

Explain how you solved the problem.	Explain how you solved the problem.
Problem 1	Problem 2

Vocabulary Words	Tally: How many times used
Example: rabbit(s)	IIII II
+ twice as many	

Vocabulary Words	Tally: How many times used
Example: each	III
+ one more than	

If you found other helpful words, list them here:

_____

Understanding Language

Language, Literacy, and Learning in the Content Areas

Understanding Language aims to enrich academic content and language development for English Language Learners (ELLs) by making explicit the language and literacy required to meet the Common Core State Standards (CCSS) and Next Generation Science Standards (NGSS).

http://ell.stanford.edu