

## Hopping Henry

Henry thinks it's fun to hop up the stairs. Henry stood at the bottom of some stairs. First he hopped up 1 step and stopped to rest. Then he hopped up 2 steps and stopped to rest. Then he hopped up 1 step and stopped to rest. Then he hopped up 2 steps and stopped to rest. Then he hopped up 1 step and stopped to rest. Henry continued hopping and resting in this way until he reached the top of the stairs. He said that he had stopped a total of 10 times to rest before reaching the top. How many steps were in the staircase?

## Hopping Henry

### Suggested Grade Span

Grades Pre K–2

### Grade(s) in Which Task Was Piloted

Grade

### Task

Henry thinks it's fun to hop up the stairs. Henry stood at the bottom of some stairs. First he hopped up 1 step and stopped to rest. Then he hopped up 2 steps and stopped to rest. Then he hopped up 1 step and stopped to rest. Then he hopped up 2 steps and stopped to rest. Then he hopped up 1 step and stopped to rest. Henry continued hopping and resting in this way until he reached the top of the stairs. He said that he had stopped a total of 10 times to rest before reaching the top. How many steps were in the staircase?

### Alternative Versions of Task

#### *More Accessible Version:*

Henry thinks it's fun to hop up the stairs. Henry stood at the bottom of some stairs. First he hopped up 1 step and stopped to rest. Then he hopped up 2 steps and stopped to rest. Then he hopped up 3 steps and stopped to rest. Then he hopped up 4 steps and stopped to rest. How many steps did Henry hop up in all?

#### *More Challenging Version:*

Henry thinks it's fun to hop up the stairs. Henry stood at the bottom of some stairs. First he hopped up 1 step and stopped to rest. Then he hopped up 2 steps and stopped to rest. Then he hopped up 4 steps and stopped to rest. Then he hopped up 8 steps and stopped to rest. Then he hopped up 16 steps and stopped to rest. Henry continued hopping and resting in this way until he reached the top of the stairs. He said that he had stopped a total of 10 times to rest before reaching the top. How many steps were in this very tall staircase?

## NCTM Content Standards and Evidence

### Algebra Standard for Grades Pre K–2

Instructional programs from Pre-Kindergarten through grade 12 should enable students to...

- Understand patterns, relations, and functions.
  - *NCTM Evidence:* Recognize, describe, and extend patterns such as sequences of sounds and shapes or simple numeric patterns and translate from one representation to another.

- **Exemplars Tasks Specific Evidence:** This task requires students to identify the 1-2-1-2 pattern, and to continue that pattern. The student must also keep track of the number of rests, for a total of 10 rests, and the number of stairs on which Henry hops.

### Time/Context/Qualifiers/Tip(s) From Piloting Teacher

This task is considered a short to medium task in that it took my students only one class period in which to complete it.

### Links

This task could coincide with similar activities experienced in physical education class.

### Common Strategies Used to Solve This Task

Most students will draw a staircase and label it with information presented in the task. From that they will reach a conclusion.

### Possible Solutions

*Original Version:*

Number of Hops	Rest Number	Step #
1	1	1
2	2	3
1	3	4
2	4	6
1	5	7
2	6	9
1	7	10
2	8	12
1	9	13
2	10	15

**More Accessible Version:**

$1 + 2 + 3 + 4 = 10$  steps

**More Challenging Version:**

Number of Hops	Rest #	Total
1	1	1
2	2	3
4	3	7
8	4	15
16	5	31
32	6	63
64	7	127
128	8	255
256	9	511
512	10	1023

Rules:

To determine the number of hops =  $2 \text{ (rest\#-1)}$

To determine the total number of hops =  $2 \text{ ( number of hops) - 1}$

**Task Specific Assessment Notes**

**General Notes:** This task assesses students' ability to find and extend patterns. The student must utilize problem solving strategies to keep track of the number of stops and the number of steps.

**Novice:** The novice will have little or no understanding of the task. Little or no understanding of the pattern, nor 10 rests will be demonstrated.

---

## Exemplars

---

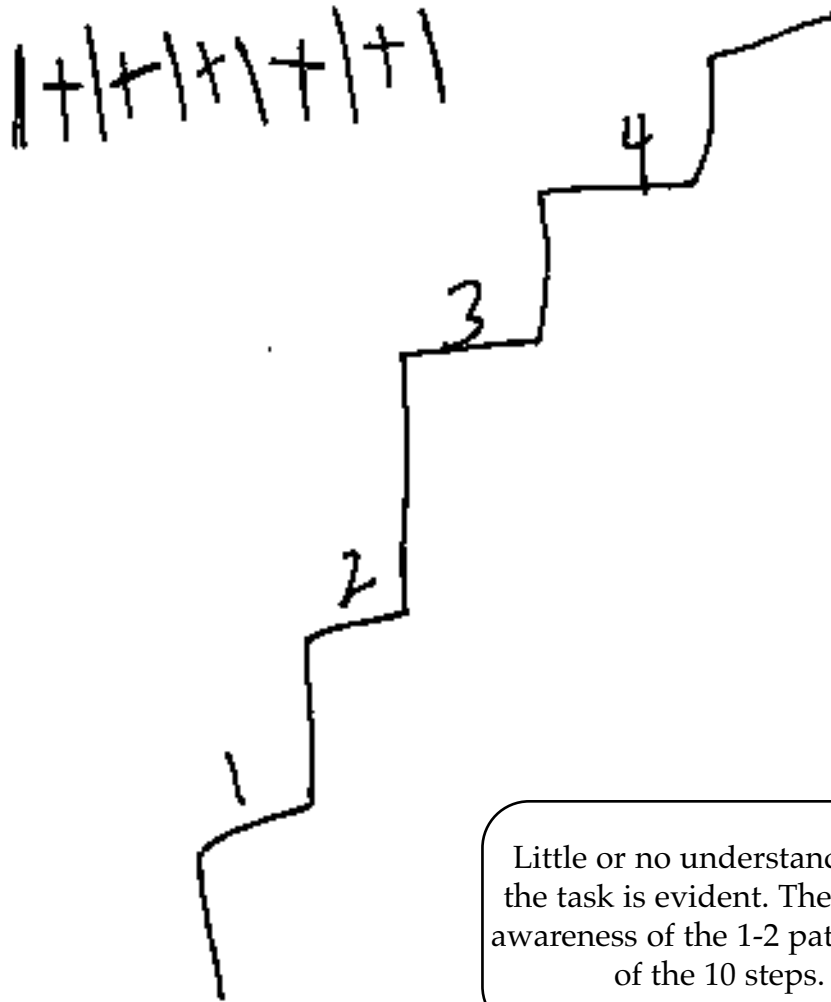
**Apprentice:** The apprentice will demonstrate partial understanding of the task. The apprentice may be able to identify and extend the pattern, but will not find a conclusion for 10 rests. Or the apprentice may make an error in the pattern resulting in an incorrect solution.

**Practitioner:** A correct and complete solution will be achieved utilizing math language and representations to communicate.

**Expert:** The expert will have a correct solution, and will go beyond the task requirements by verifying the solution, making relevant observations, or by experimenting with how changing the pattern or the number of rests will affect the solution.

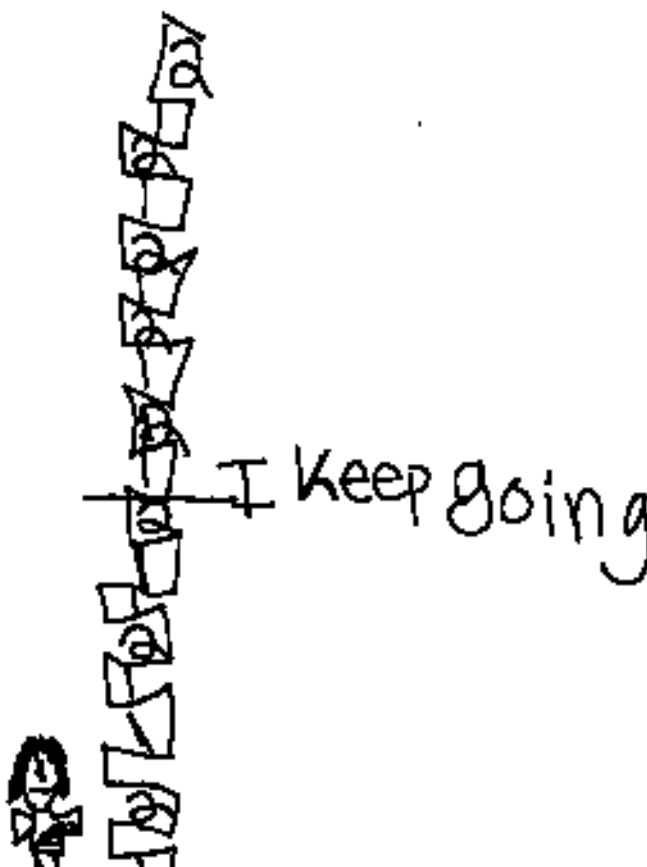
### Author

This task was written by **Deb Armitage**, Pre K–8 Mathematics Assessment Consultant at the Vermont Department of Education. The task was piloted by teachers and students in Vermont.



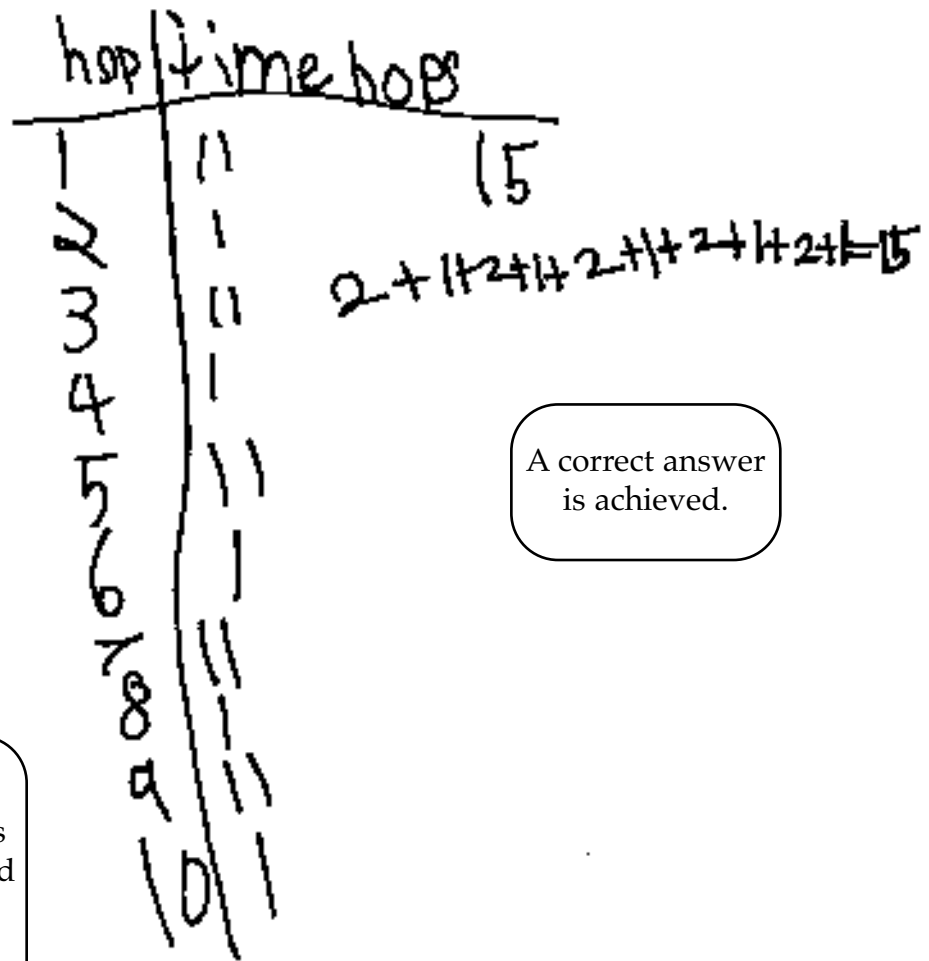
Little or no understanding of the task is evident. There is no awareness of the 1-2 pattern nor of the 10 steps.

Apprentice



A partial solution is achieved. The student identifies and extends the pattern but does not find the total after 10 steps. When the student “keeps going” the pattern is extended incorrectly.

Practitioner



A correct answer is achieved.

All work is shown. The representation is used as a strategy and to communicate the solution.

# Exemplars

The solution is correct.  
All work is labeled.

Expert

Math language and sophisticated representations are used to communicate the solution.

Way

jumps	Henry's Hops	Stairs	times
1	2	1	1
1	3	2	2
2	5	3	3
1	6	4	4
2	8	5	5
1	9	6	6
2	11	7	7
1	12	8	8
2	14	9	9
1	15	10	10

15 in all jumps he did  
The pattern is 2, 1, 2, 1, 2, 1  
if he did 2 more times it's 18 stairs  
if the pattern was 3, 1, 3, 1 it would be 20 jumps in 16 times



Way 1 is 15  
Way 2 is 15  
His right 15  
33 33 3 1111  
5 = 20

The student identifies the pattern and makes a relevant comment about if the pattern were extended.

The student comments on how the solution would change as the pattern changed.