Magic Age Rings

Grades: 2-4

Math: To apply rules (e.g., add 5) to numbers. Write number sentences to represent pattern. Combine various arithmetic operations to solve complex problems.

Task: This task asks students to imagine they are wearing magic rings that change their age. A blue ring doubles one's age, a green ring adds five years, and a yellow ring takes two years away from one's age. Students calculate the effects of wearing different rings and answer questions about this imaginary situation. You may wish to extend this task by posing some of these challenges to your students:

- Make up your own question about these magic rings. Work out the answer. Ask someone else to answer your question.
- Are there any ages that are impossible to produce with the rings?
- Invent different types of rings that also change your age. What would be the most useful set of rings to have if you want to increase your age?

Investigate what happens when you put two rings in a different order (blue first, then green, or green first, then blue). For which combinations of rings does order matter? Are there combinations in which order doesn’t make any difference? Why is this?

Expectation: Most fourth graders should be able to tackle the mathematics of this task. It assumes that students have had prior opportunities to explore the ways addition, subtraction, multiplication, and division relate to each other. The task also assumes that students have some understanding of the significance of order of operations and that they know the meaning of doubling a quantity. Students may discuss the task in pairs, but each student should complete an individual written response.
You are ten years old and as a birthday present you have been given three boxes of magic rings.

With great care you slip one of the green rings onto the little finger of your left hand. At once you start to grow and, within seconds, the magic has worked—you are 15 years old. Discuss this with your partner. What does it mean to “double” your age?

1. Complete the table.

<table>
<thead>
<tr>
<th>Imagine that you are . . .</th>
<th>Rings you wear</th>
<th>Age you become</th>
<th>Number sentences to explain this</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 years old</td>
<td>Green</td>
<td>15</td>
<td>10 + 5 = 15</td>
</tr>
<tr>
<td>10 years old</td>
<td>Blue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 years old</td>
<td>Yellow</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 10 years old             | Green and then blue | 30             | 10 + 5 = 15  
15 + 15 = 30             |
| 10 years old             | Green and then yellow | 13            | 10 + 5 = 15  
15 – 2 = 13              |
| 10 years old             | Green and another green |                 |                                 |
| 10 years old             | Yellow and then blue |                 |                                 |
| 10 years old             | Yellow and another yellow |             |                                 |
2. Use your imagination. Choose to be any age and wear any combination of rings. Complete the table.

<table>
<thead>
<tr>
<th>Imagine that you are . . .</th>
<th>Rings you wear</th>
<th>Age you become</th>
<th>Number sentences to explain this</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Latosha is 11 years old. She puts on three blue rings. How old is she now? Explain your answer.

4. Margaux is 10 years old, but she wants to be 18. What rings should she put on to change her age to 18 years? Explain your answer.

5. Lloyd is 9 years old. He has a blue ring and a green ring. He wants to wear both rings. Will it make any difference to his age which ring he puts on first? Explain your answer.

6. Jessica is wearing a yellow ring and she tells you she is 13 years old. She takes off the yellow ring and she is back to her real age. What is her real age? Explain your answer.

7. Rashad is wearing three rings and is 12 years old. First he takes off a yellow ring, then a blue ring, and finally a green ring. He is back to his real age. How old is he? Explain your answer.
Magic Age Rings: Sample Solution

1. Imagine that you are . . . | Rings you wear | Age you become | Number sentences to explain this
--- | --- | --- | ---
10 years old | Green | 15 | \(10 + 5 = 15\)
10 years old | Blue | 20 | \(10 + 10 = 20\)
10 years old | Yellow | 8 | \(10 - 2 = 8\)
10 years old | Green and then blue | 30 | \(10 + 5 = 15\), \(15 + 15 = 30\)
10 years old | Green and then yellow | 13 | \(10 + 5 = 15\), \(15 - 2 = 13\)
10 years old | Green and another green | 20 | \(10 + 15 = 25\), \(15 + 5 = 20\)
10 years old | Yellow and then blue | 16 | \(10 - 2 = 8\), \(8 + 8 = 16\)
10 years old | Yellow and then yellow | 6 | \(10 - 2 = 8\), \(8 - 2 = 6\)

*Other number sentences may also be correct. For example, doubling may be shown as “\(\times 2\).”

2. There is no reason students should not complete this table with examples that use three or more rings—for example, “Blue, then green, then yellow.”

3. Latosha will be 88 years old. \(11 \times 2 = 22\), \(22 \times 2 = 44\), \(44 \times 2 = 88\)

4. Margaux could put on a blue ring and then a yellow ring. \(10 \times 2 = 20\), \(20 - 2 = 18\). Or she could put on two green rings and then a yellow ring. \(10 + 5 = 15\), \(15 + 5 = 20\), \(20 - 2 = 18\). There are other solutions.

5. It does make a difference which ring Lloyd puts on first. If he puts on the blue ring first, his age becomes 23 years. \(9 \times 2 = 18\), \(18 + 5 = 23\). But if he puts on the green ring first, he becomes 28 years old. \(9 + 5 = 14\), \(14 \times 2 = 28\)

6. Jessica’s real age is 15 years. A yellow ring takes 2 years off your age. So removing a yellow ring will do the opposite. It will make Jessica two years older. \(13 + 2 = 15\)

7. Rashad’s real age is 2 years. \(12 + 2 = 14\), \(14 + 2 = 16\), \(7 - 5 = 2\). This last question is difficult as it really demands some understanding of inverse operations.
Rubric

Characterizing Performance

This section offers a characterization of student responses and provides indications of the ways the students were successful or unsuccessful in engaging with and completing the task. The descriptions are keyed to the Core Elements of Performance. Our global descriptions of student work range from “The student needs significant instruction” to “The student's work meets the essential demands of the task.”

The characterization of student responses for this task is based on these Core Elements of Performance:

1. Apply simple functions in a problem-solving situation.
2. Use combinations of various arithmetic operations to solve problems.
3. Demonstrate understanding of what effect reversing the order of operations has on a problem.
4. Use doubling and an understanding of inverse operations to solve complex problems.
5. Explain how answers are decided.

Descriptions of Student Work

The student needs significant instruction. These papers show evidence of some limited success in one or two of the core elements of performance, most commonly in the first and second.

The student needs some instruction. These papers provide evidence of ability in the first two core elements, both in the tables and in some of the problems. There may be some limited evidence of performance in the last three core elements: this evidence, however, is weak and inconsistent. This level of work will show the ability to apply simple functions and to combine various arithmetic operations not just in the table but also in some of the problems 3 through 7. Generally, there will not be evidence of an ability to work with inverse operations, or to double numbers correctly or consistently. The paper will not provide evidence of understanding the importance of order of operations. Explanations will be limited and/or weak.

The student's work needs to be revised. There will be evidence of ability to perform in at least four out of five of the core elements of performance. There may be some inconsistency in one or two core elements (for example, the response may correctly show doubling in the table, but incorrectly solve problem 3, or correctly solve problem 5, but make a mistake in order of operations in the table). The answers may be all correct, but missing any explanation.

The student’s work meets the essential demands of the task. There will be no mistakes (or only very minor mistakes) in the tables. Problems 3 through 7 will fully demonstrate ability in all five core elements of performance. There may be an error in one of the elements of performance; however, that element will be correctly demonstrated elsewhere (for example, many otherwise very strong students will make a mistake on problem 7).