Logical Number Sequences

Age: 9-11 years (although can be adapted for other ages)
Type: Offline
Curriculum Links to: Maths
Computational Thinking Concepts & Approaches: Logic

Introduction

In this activity learners explain the rule for a number sequence and predict which numbers come next. In doing so, they extend their knowledge of simple rule based algorithms (a sequence of instructions, or a set of rules for performing a specific task). They also use logical reasoning as they work out and explain their algorithms.

What you will learn

In this offline project, you will learn how use logical reasoning to explain how some simple algorithms work

Ask the learner to recap what an **algorithm** is (a sequence of instructions, or a set of rules for performing a specific task) and share their own examples of algorithms, perhaps from previous work (tying shoe laces, following a cooking recipe, directions to the local shops)

Explain that in this activity they will be examining (or analysing if they can understand this term) rule based algorithms and explaining how they work

To do this they will be using logical reasoning (write this key term on a piece of paper)

You could also find out if they know what logical reasoning means at this stage from their existing knowledge of the words ‘logic’ and ‘reason’ – this in itself is logical reasoning!

Introduction to Algorithms

Explain that you will be using number sequences for this activity and they will be working out the rules for the sequences.

Write a number sequence on a piece of paper with at least one missing entry, such as the one given here. 8, 16, 32, 64, __

Ask the learner to:

1. work out and explain the rule for the sequence

2. predict what number comes next in the sequence

3. write the rule on a piece of paper – i.e. “double the last number”

4. add in the next number in the sequence (128)

Highlight that this is the rule for solving the problem, and therefore a simple rule based algorithm

Ask the learner to consider how they worked out the rule. Invite them to share their ideas. Hopefully they will offer that they have looked at the numbers already in the sequence, identified if they could spot a pattern by working out the relationship between the given numbers, and then predict what number came next (or lead them to this point)

Tell them they have been using **logical reasoning.**

Stress that logical reasoning is concerned with how a problem is solved rather than simply ‘knowing’ the right answer. It is the journey, rather than the destination that is important

They have analysed the problem by using their prior knowledge (of maths) and the existing information (the numbers that were given to them). They then used this to identify the rule and predict what the correct number could be. They then tested their rule and the number by working through the sequence again, using the rule with their new number to check it produces the next number in the sequence. If it didn’t, then they worked through the process again. This is an example of using logical reasoning

Main Activity

1. Use the number sequence worksheet at the end of the document to prepare a series of sequences similar to the example above (there are some more examples along with the answers at the end of this document).

2. Give the learner the worksheet and explain that they need to use their logical reasoning skills to be able to explain the rule (the algorithm) and the missing number.

3. Tell the learner that you will be asking them:
    - how they worked out the answer
    - the rule for the number sequence (the algorithm)
    - the missing number

4. Highlight that the missing number is actually not the most important thing in this task – you are most interested in how they worked their answer out, followed by the rule and then finally what the answer actually is.

5. Explain that some of the sequences are deliberately tricky and they might not be able to work out the rule, but that they should note down how they tried to spot the pattern and work it out, as this is the most important thing.

6. Throughout the process the learner will be developing important skills. They will be collaborating and persevering as they try to explain the rules and find the missing numbers

7. Not all learners will be able to explain all the sequences but do ensure they write down how they have tried to work the rule out

Logical Number Sequence Algorithms Worksheet

Note: *Add suitably challenging number sequences to the first column. You may also wish to replace the first example with one more suited to your learner*

Sequence (what comes next?)	Explain the rule (algorithm)	Explain how you worked it out
11, 26, 41, 56, **71** , 86	add 15 to the previous number	Looked at numbers but couldn't see pattern. Looked at the 1st 2 numbers and took 11 away from 26 = 15. Looked at next 2 numbers and took 26 away from 41 = 15. Saw a pattern. Tested it with 56-41 - also 15. Predicted next number would be 56 +15 = 71. Checked to 86. Rule is add 15 to the previous number. Missing number is 71.

Logical Number Sequence Algorithms Worksheet

Sequence (what comes next?)	Explain the rule (algorithm)	Explain how you worked it out
11, 26, 41, 56, **71** , 86	add 15 to the previous number	Looked at numbers but couldn't see pattern. Looked at the 1st 2 numbers and took 11 away from 26 = 15. Looked at next 2 numbers and took 26 away from 41 = 15. Saw a pattern. Tested it with 56-41 - also 15. Predicted next number would be 56 +15 = 71. Checked to 86. Rule is add 15 to the previous number. Missing number is 71.
3, 6, 12, __ , 48, 96	missing number is 24 as each number if multiplied by 2	
4, 37, 70, __ , 136, 169	Missing number is 103 as 33 is added each time	
25, 23, __, 19, 17, 15,	Missing number is 21 as 2 is deducted each time	
1, 8, 27, 64, ___, 216, 343	Missing number is 125 as the number is cubed each time starting from 1,2,3,4 and here 5x5x5	
0, 1, 1, 2, 3, 5, 8, 13, __, 34,	Missing number is 21 as this follows the fibonacci code (previous 2 numbers are added together)	

This activity was originally created by Barefoot Computing - https://www.barefootcomputing.org/