A sequence is a list of numbers or other objects. In math, we often study sequences that follow a pattern rule. A pattern rule is used to determine how to form or continue a sequence. This activity will explore the importance of having a clear pattern rule.

Before you start:

Look at the first three terms of a sequence with six terms in total: 2, 3, 5.
Are you confident that you know which three numbers come next in this sequence? Why or why not?
Without the context (or a pattern rule), we cannot be sure exactly how a sequence was meant to continue. Here are a few continuations of this sequence based on some possible pattern rules. See if the sequence you first imagined is among these:

- 2, 3, 5, 8, 13, 21
  Rule: Add the two previous terms to get the next term.
- 2, 3, 5, 9, 17, 33
  Rule: Double the previous term and subtract 1 to get the next term.
- 2, 3, 5, 8, 12, 17
  Rule: Add 1 to the first term to get the second term, add 2 to the second term to get the third term, and continue in this way, adding n to the nth term to get the term after that.

These are just three of the many different pattern rules that could describe the sequence. Can you come up with some more? We will explore the idea of pattern rules further in the following activities.

You Will Need: As many toothpicks as you can find!

Any small straight objects, similar in length, can be used in place of toothpicks if needed.

Question 1: Use toothpicks to build the following two figures, side by side as shown.

![Figure 1 and Figure 2](image)

(a) Describe a possible pattern rule for a sequence of figures starting with Figure 1 and Figure 2. 
We are looking for a pattern rule that describes how to create the next shapes in the sequence.

(b) Use your pattern rule to build Figure 3 and Figure 4 in the sequence.

(c) Without sharing your pattern rule, have a friend or family member build what they think Figure 3 and Figure 4 in the sequence should be. Are they the same as your figures?

(d) You may have found that everyone you asked in (c) built exactly the figures you expected. Does this mean that the pattern rule is clear? Can you come up with a few different possible pattern rules that also make sense with the first two figures? Try and be as creative as possible!
**Question 2:** Use toothpicks to build the following three figures, side by side as shown.

(a) Determine a possible pattern rule for a sequence of figures starting with Figures 1, 2, and 3.
(b) Use your pattern rule to build Figures 4, 5, and 6 in the sequence.
(c) Without sharing your pattern rule, have a friend or family member build what they think Figures 4, 5, and 6 in the sequence should be. Are they the same as your figures?
(d) Using your pattern rule, can you determine
   - how many toothpicks are needed to build Figure 10 in the sequence?
   - how many toothpicks are needed to build Figure 25 in the sequence?

**Extension:** Create a toothpick pattern activity yourself!

Come up with a new idea for a pattern that can be formed using toothpicks. For an extra twist, why not throw in two or three different types of objects to be used in the pattern you build? Make the first few figures in the sequence with your pattern rule, and see if your friends and family can figure out your intended pattern. If they get it wrong on their first attempt then ask them to try again, or help them out by adding one extra figure and have them try again!