

Mathematics

The Collatz conjecture

Unsolved maths problems

Downloadable resource

Miss Kidd-Rossiter



Try this

Yasmin and Zaki are writing number sequences.

To get to the next number, they apply these rules to their sequence.

If your
number is
even, divide it
by two.

Zaki

If your number is
odd, multiply it by
three and then add
one.

Yasmin

Choose a number between 1 and 10 to start your sequence.

Continue your sequence. What do you notice?

Choose a different number and try again.



Connect

Lothar Collatz (1910-1990)

1937:

- The $3x + 1$ problem
- The Collatz conjecture
- The hailstone sequence

A sequence is defined as follows:

Start with any positive integer value (n).

Each term is found from the previous term as follows:

- If the value is even, divide it by 2 ($\frac{n}{2}$).
- If the value is odd, multiply it by 3 and add 1 ($3n + 1$).

No matter the start
number (n), the sequence
will always reach one.



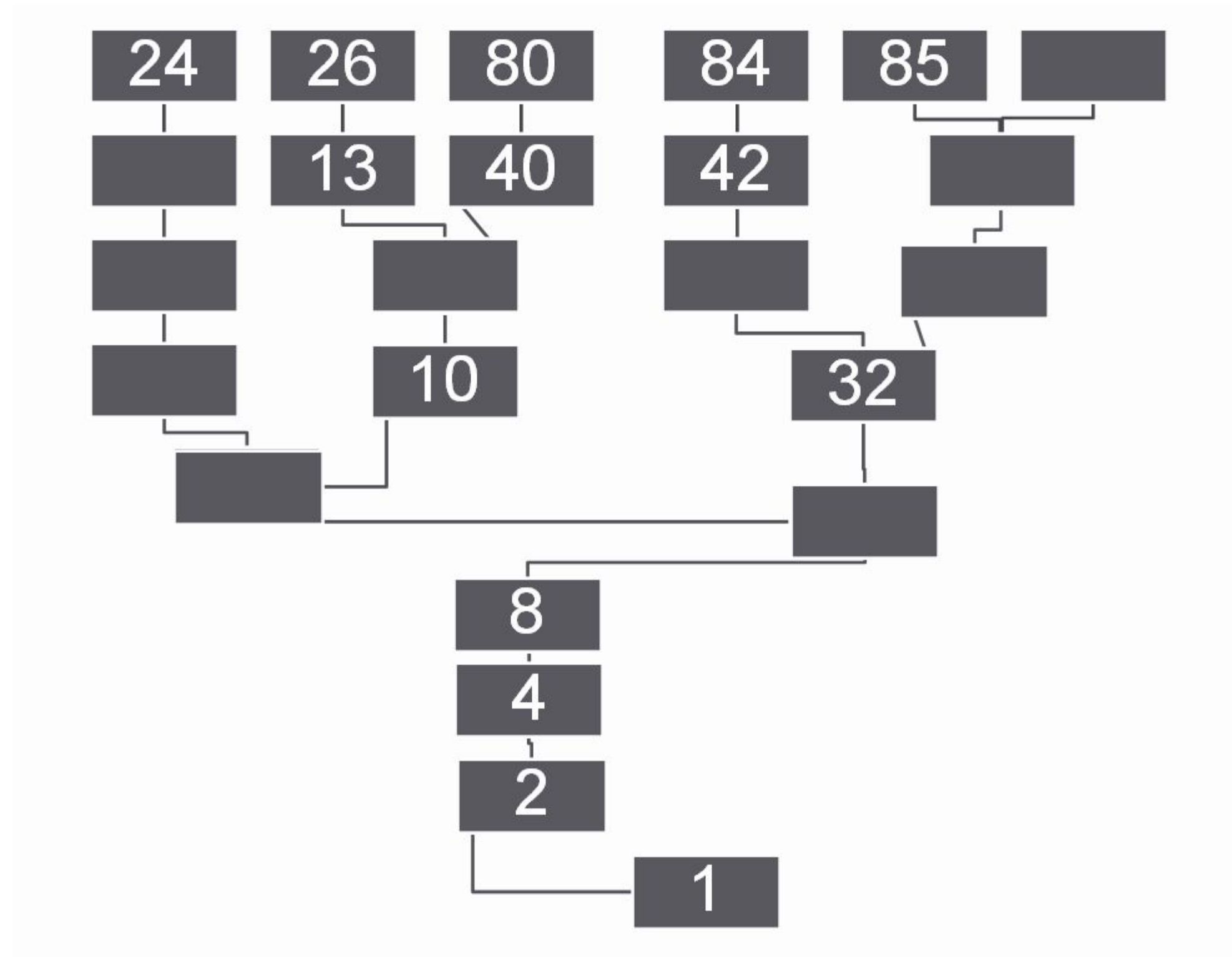
Independent task

1. Which number between 1 and 10 gives the longest sequence?
2. Which number between 1 and 20 gives the longest sequence?
3. Are there any shortcuts you can take with the conjecture?



Independent task

4. Fill in the missing boxes in this representation of the Collatz conjecture.



Explore

Cala is thinking about the Collatz conjecture.

Cala

Some sequences will only contain even numbers.

Do you agree with Cala?

Can you find some examples that either **show** or **don't show** this to be true?

