Problem of the Week
Problem A
Circular Calculations

Lorna uses the following instructions to write sequences of numbers.

> Step 1: Start with a whole number greater than 0.
>
> Step 2: If the number is even, divide it by 2 to get the next number. If the number is odd, multiply it by 3 and add 1 to get the next number.
>
> Step 3: Repeat Step 2 to continue the sequence.

For example, suppose Lorna starts with 9.
Since this number is odd, the next number is $9 \times 3 + 1 = 27 + 1 = 28$.
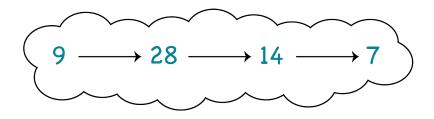Since this number is even, the next number is $28 \div 2 = 14$.
Since this number is even, the next number is $14 \div 2 = 7$.
Thus, the first four numbers in the sequence are 9, 28, 14, and 7.

(a) Follow the instructions using the given starting number and write the first 12 numbers in each sequence.

    (i) 3   (ii) 13

(b) What do you notice about each sequence in part (a)? What would happen if you continued each sequence?

(c) Use your answer to part (b) to predict the 20th number in the sequence starting with 13.