

**Age 14+ Level ★★  
Worksheet 2****1. 12345**

The pattern 123451234512345... is continued to form a 2000 digit number. What is the sum of all 2000 digits?

**2. Below 400**

If the pattern shown is continued, what number will appear directly below 400?

				1					
				2	3	4			
			5	6	7	8	9		
	10	11	12	13	14	15	16		

**3. Collatz 13**

A sequence of positive integers  $t_1, t_2, t_3, t_4, \dots$  is defined by:

$$t_1 = 13$$

$$t_{n+1} = \frac{1}{2}t_n \text{ if } t_n \text{ is even}$$

$$t_{n+1} = 3t_n + 1 \text{ if } t_n \text{ is odd.}$$

What is the value of  $t_{2008}$ ?

**4. Collatz-ish**

The first term of a sequence of positive integers is 6.  
The other terms in the sequence follow these rules:

if a term is even then divide it by 2 to obtain the next term;  
if a term is odd then multiply it by 5 and subtract 1 to obtain the next term.

For which values of  $n$  is the  $n$ th term equal to  $n$ ?

*These problems are adapted from UKMT ([ukmt.org.uk](http://ukmt.org.uk)) and WMC ([competition.ac](http://competition.ac)) problems.*