



Age 14+ Level ★★
Worksheet 1

1. Diagonals

A square has 2 diagonals, a regular pentagon has 5 and a regular hexagon has 9.

How many diagonals does a regular icosagon (20 sides) have?

2. Difference Sequence

The first term in a sequence is 2016 and the second term is 2017.

Every other term is given by the difference between the two terms before it. So, for example, the third term is the difference between 2016 and 2017, which is 1.

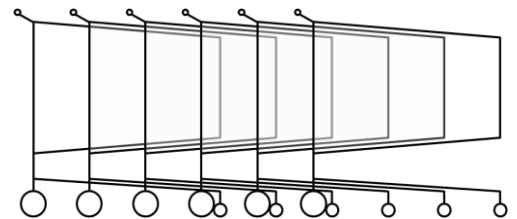
The n^{th} term is equal to 2000; what is the value of n ?

3. Trolley Park

In a supermarket, there are two lines of tightly packed trolleys.

The first line has ten trolleys and is 2.9m long. The second line has twenty trolleys and is 4.9m long.

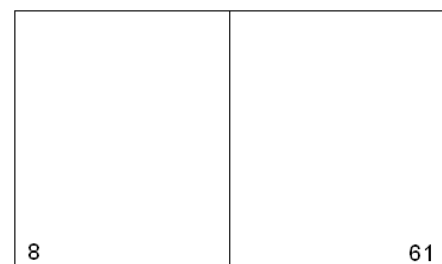
What is the length of one trolley, in m?



4. Newspaper Sheets

Here is a sheet of a newspaper.
Each sheet has four pages.

How many sheets are there altogether?

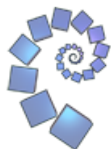


5. Alternating Sum

Given that the number 2008 is the correct answer to the calculation below, what is n ?

$$1 - 2 + 3 - 4 + 5 - 6 + \dots + (n - 2) - (n - 1) + n$$

These problems are adapted from UKMT (ukmt.org.uk) and SEAMC (seamc.asia) problems.



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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) and WMC (competition.ac) problems.