

**Age 11+ Level ★★★
Worksheet 1****1. Colossal Sum**

What is the units digit of $9^{2015} + 9^{2016}$?

2. Seven from Nine

In how many different ways can seven different numbers be chosen from the numbers 1 to 9 so that the seven numbers have a total which is a multiple of 3?

3. 17s and 23s

How many 2010-digit numbers are there in which every pair of consecutive digits forms a two-digit number that is divisible by 17 or 23?

4. Cinema Costs

At a cinema a child's ticket costs £4.20 and an adult's ticket costs £7.70. When a group of adults and children went to see a film, the total cost was £ C , where C is a whole number greater than 90 and less than 96.

What is the value of C ?

5. Missing Digit

The 8-digit number 1234_678 is a multiple of 11.

What is the missing digit?

6. Big Blackboard

The whole numbers from 1 to 2016 are written on a blackboard.

Moritz underlines all the multiples of two in red, all the multiples of three in blue, and all the multiples of four in green.

How many numbers does Moritz underline exactly twice?

These problems are adapted from UKMT (ukmt.org.uk) and WMC (competition.ac) problems.

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Worksheet 2****1. Leap Monday**

In 2016, the 29th of February was a Monday. When will be the next leap year when the 29th of February is a Monday?

2. Factor Sum

Given any positive integer n , Paul adds together the distinct factors of n , other than n itself.

Which of the numbers 1, 3, 5, 7 and 9 can never be Paul's answer?

3. Powerful Finale

What is the last digit of 3^{2011} ?

4. Common Remainder

When 144 is divided by n , this leaves a remainder of 11.

When 220 is divided by n , this also leaves a remainder of 11.

What is the value of n ?

5. HCF Expression

If p and q are distinct primes less than 7, what is the largest possible value of the highest common factor of $2p^2q$ and $3pq^2$?

6. Trailing Zeros

The symbol $50!$ represents the product of all the whole numbers from 1 to 50 inclusive; that is, $50! = 1 \times 2 \times 3 \times \cdots \times 49 \times 50$.

If I were to calculate the actual value, how many zeros would the answer have at the end?

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