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# Number Theory

## Modular Arithmetic

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*Math for Gifted Students*

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## Instructions

- Write down and submit intermediate steps along with your final answer.
- If the final result is too complex to compute, give the expression. e.g.  $C_{100}^{50}$  is acceptable.
- Problems are not necessarily ordered based on their difficulty levels.
- Always ask yourself what makes this problem a good one to practise?
- Complete the My Record section below before submission.

## My Comments and Notes

Sample

## Modular Arithmetic

**Practice 1**

Find the remainder when  $3^{2015} + 4^{2015}$  is divided by 5.

**Practice 2**

How many terms in the following sequences are square numbers?

4, 44, 444, 4444, 44444,  $\dots$

**Practice 3**

Let positive integers  $a$ ,  $b$ , and  $c$  are relatively prime. If they satisfy the relationship  $a^2 + b^2 = c^2$ , show that  $a$  and  $b$  must be opposite parity.

**Practice 4**

The number  $2^{29}$  is a nine-digit number whose digits are all distinct. Without computing the actual value of  $2^{29}$ , can you find out which digit among 0 to 9 does not appear?