

PROBLEM CORNER

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These two problems are suitable for exploration by mathematically gifted students ages 12-18.

Problem 1

The teacher wants to play a game with the students and will offer a reward (a bonus of NT\$1,000) or a punishment (singing a song) based on the result. The rules are as follows:

Each student is asked to choose a prime number between 300 and 400. Then, square that prime number and divide it by 6 to obtain the remainder (r).

Remainder (r)	Result
0	
1	
2	
3	
4	
5	

How should the teacher assign the reward or punishment in the table above so that every student's chosen prime number will result in singing a song? (Note: Choosing a prime between 300 and 400 is not essential.)

Problem 2.

There are 25 prime numbers under 100. Use these prime numbers to create a number chain according to the following rules:

- (1) Use all 25 prime numbers for chaining (each prime can be used only once).
- (2) The leftmost digit of the next prime must match the rightmost digit of the previous prime. For example: 37–71–19–97...
- (3) The chain ends when no further primes can follow or when all primes have been used.

Questions:

(1) What is the maximum number of primes that can be linked in the longest prime chain?

(2) Which prime numbers can serve as the starting number of these longest chains?