



Problem of the Week

Problem E

A Very Large Prime

A *prime number* is an integer greater than 1 that has only two positive divisors: 1 and itself.

For some six-digit positive integer $216\,09d$ with ones (units) digit d , $2^{21609d} - 1$ is a very large prime number. In fact, the number contains 65 050 digits. The number begins with 746 093 103 064 661 343 and ends with the digit 7.

Determine the value of d .

Here are some facts which may be helpful when solving this problem:

1. If n is a positive integer and divisible by 3, then $2^n - 1$ is divisible by 7.
2. If n is a positive integer and divisible by 5, then $2^n - 1$ is divisible by 31.



DID YOU KNOW?

One use for very large prime numbers is in the area of *cryptography*, the study of coding and decoding information so that it can be securely transmitted. This area of study is very important because of its application to areas like online banking, email, and general internet security, to list just a few.

