A: There exist primes \( p \) such that \( p + 6k \) is also prime for \( k = 1, 2 \) and 3. One such prime is \( p = 11 \). Another such prime is \( p = 41 \). Prove that there exists exactly one prime \( p \) such that \( p + 6k \) is also prime for \( k = 1, 2, 3 \) and 4.

B: Prove that if \( n \in \mathbb{Z} \), then \( n^3 \) gives a remainder of 0, 1, or 6 when divided by 7.

C: Prove that if \( n \) is an odd integer, then \( n \) is of the form \( 4k + 1 \) or \( 4k + 3 \), where \( k \in \mathbb{Z} \).

D: Prove that if \( n \) is an odd integer, then \( n^2 \) gives a remainder of 1 when divided by 8.

E: Prove that if \( n \) is an even integer, then \( n^2 \) gives a remainder of 0 or 4 when divided by 8.

F: Do problem 6 on page 25.

G: Consider the equation \( x^2 - 6y^2 = 10 \). It turns out that this equation has infinitely many solutions where \( x, y \in \mathbb{Z} \). Suppose that \( x = a, y = b \) is one of those solutions. Prove that \( (a, b) = 1 \).