

Define $q = \prod_{i=1}^n p_i$

There is a prime outside the set $\{p_1, p_2, \dots, p_n\}$

Define $q = \prod_{i=1}^n p_i + 1$

Define q

The remainder from dividing q by p_i (for any $1 \leq i \leq n$) is 1

QED

q has no prime dividers, therefor q is prime

The set of primes can be written as $\{p_1 < p_2 < \dots < p_n\}$ for some $n < \infty$

Proof by contradiction