EXHAUSTIVE PRIMALITY TESTING: PROOF OF CORRECTNESS

Theorem. If for all integers x such that $2 \leq x \leq \sqrt{n}$, x does not divide n, then n is prime.

The following statements constitute a proof of the theorem above, but they are out of order. Order them.

(1) Therefore, $p \leq \sqrt{n}$.

(2) $p^2 \leq pq$ and $pq = n$, so $p^2 \leq n$.

(3) Suppose that n is not prime.

(4) $n = pq$ for some p and q such that $2 \leq p \leq q$.

(5) We will show that there exists an integer p such that $2 \leq p \leq \sqrt{n}$ and p divides n.