

Let p and q be prime numbers with $p < q$. Suppose that in a convex polygon $P_1P_2\dots P_{pq}$ all angles are equal and the side lengths are distinct positive integers. Prove that

$$P_1P_2 + P_2P_3 + \cdots + P_kP_{k+1} \geq \frac{k^3 + k}{2}$$

holds for every integer k with $1 \leq k \leq p$.