Problem 1. Let $ABC$ be a triangle, and let $D$ be a point on side $BC$. A line through $D$ intersects side $AB$ at $X$ and ray $AC$ at $Y$. The circumcircle of triangle $BXD$ intersects the circumcircle $\omega$ of triangle $ABC$ again at point $Z \neq B$. The lines $ZD$ and $ZY$ intersect $\omega$ again at $V$ and $W$, respectively. Prove that $AB = VW$.

*Proposed by Warut Suksompong, Thailand*

Problem 2. Let $S = \{2, 3, 4, \ldots\}$ denote the set of integers that are greater than or equal to 2. Does there exist a function $f : S \to S$ such that $f(a)f(b) = f(a^2b^2)$ for all $a, b \in S$ with $a \neq b$?

*Proposed by Angelo Di Pasquale, Australia*

Problem 3. A sequence of real numbers $a_0, a_1, \ldots$ is said to be *good* if the following three conditions hold.

(i) The value of $a_0$ is a positive integer.

(ii) For each non-negative integer $i$ we have $a_{i+1} = 2a_i + 1$ or $a_{i+1} = \frac{a_i}{a_i + 2}$.

(iii) There exists a positive integer $k$ such that $a_k = 2014$.

Find the smallest positive integer $n$ such that there exists a good sequence $a_0, a_1, \ldots$ of real numbers with the property that $a_n = 2014$.

*Proposed by Wang Wei Hua, Hong Kong*

Problem 4. Let $n$ be a positive integer. Consider $2n$ distinct lines on the plane, no two of which are parallel. Of the $2n$ lines, $n$ are colored blue, the other $n$ are colored red. Let $B$ be the set of all points on the plane that lie on at least one blue line, and $R$ the set of all points on the plane that lie on at least one red line. Prove that there exists a circle that intersects $B$ in exactly $2n - 1$ points, and also intersects $R$ in exactly $2n - 1$ points.

*Proposed by Pakawut Jiradilok and Warut Suksompong, Thailand*

Problem 5. Determine all sequences $a_0, a_1, a_2, \ldots$ of positive integers with $a_0 \geq 2015$ such that for all integers $n \geq 1$:

(i) $a_{n+2}$ is divisible by $a_n$;

(ii) $|s_{n+1} - (n + 1)a_n| = 1$, where $s_{n+1} = a_{n+1} - a_n + a_{n-1} - \cdots + (-1)^{n+1}a_0$.

*Proposed by Pakawut Jiradilok and Warut Suksompong, Thailand*