Problem 1. $AB$ is tangent to the circles $CAMN$ and $NMBD$. $M$ lies between $C$ and $D$ on the line $CD$, and $CD$ is parallel to $AB$. The chords $NA$ and $CM$ meet at $P$; the chords $NB$ and $MD$ meet at $Q$. The rays $CA$ and $DB$ meet at $E$. Prove that $PE = QE$.

Problem 2. $A, B, C$ are positive reals with product 1. Prove that $(A - 1 + \frac{1}{B})(B - 1 + \frac{1}{C})(C - 1 + \frac{1}{A}) \leq 1$.

Problem 3. $k$ is a positive real. $N$ is an integer greater than 1. $N$ points are placed on a line, not all coincident. A move is carried out as follows. Pick any two points $A$ and $B$ which are not coincident. Suppose that $A$ lies to the right of $B$. Replace $B$ by another point $B'$ to the right of $A$ such that $AB' = kBA$. For what values of $k$ can we move the points arbitrarily far to the right by repeated moves?

Problem 4. 100 cards are numbered 1 to 100 (each card different) and placed in 3 boxes (at least one card in each box). How many ways can this be done so that if two boxes are selected and a card is taken from each, then the knowledge of their sum alone is always sufficient to identify the third box?

Problem 5. Can we find $N$ divisible by just 2000 different primes, so that $N$ divides $2^N + 1$? [$N$ may be divisible by a prime power.]

Problem 6. $A_1A_2A_3$ is an acute-angled triangle. The foot of the altitude from $A_i$ is $K_i$ and the incircle touches the side opposite $A_i$ at $L_i$. The line $K_1K_2$ is reflected in the line $L_1L_2$. Similarly, the line $K_2K_3$ is reflected in $L_2L_3$ and $K_3K_1$ is reflected in $L_3L_1$. Show that the three new lines form a triangle with vertices on the incircle.