

**Problem 1 ( $\leq$ 10min)**

Find all functions that verify  $\forall x \in D_f, f(x) + f(\frac{1}{1-x}) = x$

**Problem 2 ( $\leq$ 10min)**

Show that  $\forall n \in \mathbb{N}^*, E_n : i^x = n$  has an infinite number of solutions.

**Problem 3 ( $\leq$ 30min)**

Find all functions  $f : \mathbb{Q}_+^* \rightarrow \mathbb{Q}_+^*$  that verify  $f(x^2 f(y)^2) = f(x)^2 f(y)$

**Problem 4 ( $\leq$ 40min)**

Find the smallest  $n \in \mathbb{N}^*$  such that 2015 divides  $3^n - 2^n$

**Problem 5 ( $\leq$ 40min)**

Find all  $(m, n) \in \mathbb{N}^2$  such that  $2^m + 3^n$  is a perfect square.