

**Problem 1.**

If  $E$  is a measurable subset of  $[0, 2\pi]$ , then

$$\int_E \cos^2(nx + u_x) dx \rightarrow \frac{|E|}{2}, \quad \text{as } n \rightarrow \infty$$

for any sequence  $\{u_n\}$ .

**Problem 2.**

Prove the Cantor-Lebesgue Theorem: If

$$\sum_{n=0}^{\infty} A_n(x) = \sum_{n=0}^{\infty} (a_n \cos nx + b_n \sin nx)$$

converges for  $x$  in a set of positive measure (or in particular for all  $x$ ), then  $a_n \rightarrow 0$ .