# ideals

# Definition

Let $A$ be a ring. A subset $\mathfrak{a} \subset A$ is a left ideal if $A\mathfrak{a} \subset \mathfrak{a}$.

A subset $\mathfrak{a} \subset A$ is a right ideal if $\mathfrak{a}A \subset \mathfrak{a}$.

A subset $\mathfrak{a} \subset A$ is a two-sided ideal if $A\mathfrak{a}A \subset \mathfrak{a}$.

Let $A$ be a commutative ring. Then, any left or right ideal is two-sided. We will simply say an ideal.

# Question

Let $k$ be a field. For an integer $n \geq 2$, consider $A = M_n(k)$, the ring of all square matrices of size $n$ with entries in $k$. Can you find a non-zero proper left ideal $\mathfrak{a} \subset A$?