Facts to Know:

Linear algebra, the invariant theory of linear transformation.
Examples:

1. Let $A$ be a square matrix. Prove that
$$\limsup_{k \to \infty} |\text{Tr}(A^k)|^{1/k}$$
exists.

2. Let $A$ be a $2 \times 2$ symmetric real-valued matrix. Prove that
$$(\text{Tr}(A))^2 \geq 4 \det(A).$$