

Inequalities Notes

Abror Maksudov

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1 Algebraic Inequalities

Theorem 1 (AM-GM). *Let a_1, \dots, a_n be non-negative real numbers. Then:*

$$\frac{a_1 + \dots + a_n}{n} \geq \sqrt[n]{a_1 \dots a_n}$$

with equality if and only if $a_1 = a_2 = \dots = a_n$.

Theorem 2 (Cauchy-Schwarz). *Let $a_1, \dots, a_n, b_1, \dots, b_n$ be real numbers. Then:*

$$(a_1^2 + \dots + a_n^2)(b_1^2 + \dots + b_n^2) \geq (a_1 b_1 + \dots + a_n b_n)^2$$