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root-mean-square

Canonical name	Rootmeansquare
Date of creation	2013-03-22 13:10:24
Last modified on	2013-03-22 13:10:24
Owner	pbruin (1001)
Last modified by	pbruin (1001)
Numerical id	4
Author	pbruin (1001)
Entry type	Definition
Classification	msc 26-00
Classification	msc 26D15
Synonym	root mean square
Synonym	rms
Synonym	quadratic mean
Related topic	ArithmeticMean
Related topic	GeometricMean
Related topic	HarmonicMean
Related topic	PowerMean
Related topic	WeightedPowerMean
Related topic	ArithmeticGeometricMeansInequality
Related topic	GeneralMeansInequality
Related topic	ProofOfGeneralMeansInequality

If x_1, x_2, \dots, x_n are real numbers, we define their *root-mean-square* or *quadratic mean* as

$$R(x_1, x_2, \dots, x_n) = \sqrt{\frac{x_1^2 + x_2^2 + \dots + x_n^2}{n}}.$$

The root-mean-square of a random variable X is defined as the square root of the expectation of X^2 :

$$R(X) = \sqrt{E(X^2)}$$

If X_1, X_2, \dots, X_n are random variables with standard deviations $\sigma_1, \sigma_2, \dots, \sigma_n$, then the standard deviation of their arithmetic mean, $\frac{X_1 + X_2 + \dots + X_n}{n}$, is the root-mean-square of $\sigma_1, \sigma_2, \dots, \sigma_n$.