

CAS (Computer Algebra System)

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A computer algebra system (CAS) is a software program that allows [one] to compute with mathematical expressions in a way which is similar to the traditional handwritten computations of the mathematicians and other scientists. The main ones are Axiom, Magma, Maple, Mathematica and Sage (the latter includes several computer algebras systems, such as Macsyma and SymPy).

Computer algebra systems began to appear in the 1960s, and evolved out of two quite different sources—the requirements of theoretical physicists and research into artificial intelligence.

A prime example for the first development was the pioneering work conducted by the later Nobel Prize laureate in physics Martin Veltman, who designed a program for symbolic mathematics, especially High Energy Physics, called Schoonschip (Dutch for "clean ship") in 1963.

Using LISP as the programming basis, Carl Engelman created MATHLAB in 1964 at MITRE within an artificial intelligence research environment. Later MATHLAB was made available to users on PDP-6 and PDP-10 Systems running TOPS-10 or TENEX in universities. Today it can still be used on SIMH-Emulations of the PDP-10. MATHLAB ("mathematical laboratory") should not be confused with MATLAB ("matrix laboratory") which is a system for numerical computation built 15 years later at the University of New Mexico, accidentally named rather similarly.

The first popular computer algebra systems were muMATH, Reduce, Derive (based on muMATH), and Macsyma; a popular copyleft version of Macsyma called Maxima is actively being maintained. As of today, the most popular commercial systems are Mathematica and Maple, which are commonly used by research mathematicians, scientists, and engineers. Freely available alternatives include Sage (which can act as a front-end to several other free and nonfree CAS).

In 1987 Hewlett-Packard introduced the first hand held calculator CAS with the HP-28 series, and it was possible, for the first time in a calculator, to arrange algebraic expressions, differentiation, limited symbolic integration, Taylor series construction and a solver for algebraic equations.

The Texas Instruments company in 1995 released the TI-92 calculator with an advanced CAS based on the software Derive. This, along with its successors (including the TI-89 series and the newer TI-Nspire CAS released in 2007) featured a reasonably capable and inexpensive hand-held computer algebra system.

A Partial List of CAS:

Axiom; GNU Octave; Magma; Maple; Mathcad; Mathematica; Mathomatic; Symbolic Math Toolbox (MATLAB); Maxima; Sage; SCaVis; SymPy; Wolfram Alpha; GAP; Yacas; Xcas