# *Mathematica* 2.0

## A System for Doing Mathematics by Computer

**Function:** Numerical, symbolic, graphical computation, interactive programming. Integrated technical computing environment.

**Numerical Computation:** Arbitrary-precision arithmetic, complex numbers, special functions (hypergeometric, elliptic, etc.), combinatorial and integer functions. Matrix operations, root finding, function fitting, Fourier transforms, numerical integration, numerical solution of differential equations, function minimization, linear programming.

```
In[1]:=
3^70
Out[1]:=
2503155504993241601315571986085849
In[2]:=
Hypergeometric2F1[7,5,4.1,3-I]
Out[2]:=
-0.00403761 - 0.00295663 I
```

*Numerical Computation*

**Symbolic Computation:** Equation solving, symbolic integration, differentiation, power series, limits. Algebraic operations, polynomial expansion, factorization, simplification. Operations on matrices, tensors, lists, strings.

**Graphics and Sound:** 2D, 3D plots of functions, data, geometrical objects. Contour, density plots. 3D rendering with intersecting surfaces, lighting models, symbolic descriptions. Combining and labeling graphics. Color PostScript output, publication quality graphics, animation (most versions). Sampled sound generation from functions and lists.

```
In[1]:=
Integrate[x/(a + Exp[x]), x]
Out[1]:=
```
$$\frac{x^2}{2a} - \frac{x \, Log[1 + \frac{E^x}{a}]}{a} - \frac{PolyLog[2, -(\frac{E^x}{a})]}{a}$$

*Symbolic Computation*

**Programming:** High-level, interactive, symbolic system. Full procedural language, functional programming constructs. General transformation rule paradigm based on pattern matching.

*Graphics and Visualization*

**External Interface:** Input from external files, programs. Expressions, strings, words, records, numbers (in *Mathematica* or Fortran format), with arbitrary word and record delimiters. Output in TeX, C, Fortran, PostScript. System functions, file manipulation. External function calls, general interprocess communication, and data exchange via *MathLink*™.

**Notebook Front End (Macintosh, NeXT, Microsoft Windows 3.0):** Based on word processor analogy. Notebook interactive documents mixing text, graphics, animations, *Mathematica* input, output. On NeXT and Macintosh, front ends can be used with kernels on other computers, and support sound.

**Documentation:** *Mathematica: A System for Doing Mathematics by Computer*, Second Edition, by Stephen Wolfram (Addison-Wesley, 1991) available at bookstores. Additional documentation supplied with specific versions. *The Mathematica Journal* published quarterly by Addison-Wesley. Many other *Mathematica* books also now available.

**Versions Available:** Apple Macintosh • 386 MS-DOS and Microsoft Windows 3.0 • 386 Unix • CONVEX • Data General • Digital Equipment Corporation • Hewlett-Packard Apollo • MIPS • NeXT • Silicon Graphics • Sony • Sun Microsystems • Educational, volume, reseller, and other discounts available • Now shipping Version 2.0.

```
log[1] = 0
log[E] = 1
log[x_ y_] := log[x] + log[y]
log[x_^n_] := n log[x]
log'[x_] = 1/x    (* derivative *)
log/: InverseFunction[log] = exp
log/:
Series[log[x_], {x_, 1, n_}] :=
Sum[-(-1)^k (x-1)^k/k, {k,1,n}] +
                     O[x,1]^(n+1)
```

*High-Level Programming*

**Implementation:** 843 pre-defined *Mathematica* functions (kernel C source 330,000 lines).

**Typical Applications:** Research, engineering, education, mathematical modeling, publication graphics, data analysis, visualization, systems analysis, algorithm development.

**Awards:** *MacWelt*, 1991 • *Macworld*, 1990-91 • *Discover*, 1990 • *BYTE*, 1989 • *MacUser*, 1989 • *Business Week*, 1988 • *InfoWorld*, 1988

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