

# Netbooks and Xcas

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# Plan

- 1 Netbooks versus high-end calculators
- 2 Xcas: computer algebra system, dynamic geometry and spreadsheet

# Current high-end calculators

- Price: 150-200\$ (TI89, Voyage 200, Nspire CAS, Casio Classpad, HP50G)
- Functionalities: math only (graphs, computer algebra system, geometry (2-d), spreadsheet, required for calculators to be recruited as math teacher in France)
- Hardware: calc keyboard, half A5 size, <320x240 pixels, black and white, ARM 70Mhz, 1M RAM, 16M storage, 4 AA or AAA batteries
- ON/OFF 1s
- marketsize in France: about 50,000 units/year ; world: maybe 300,000/year? Much more sales around 120\$ (TI83+).

# Low-end netbooks

- Price: 200\$-250\$
- Functionalities: like on a laptop, advanced math software not preinstalled
- Hardware: qwerty keyboard, A5 size (folded), >800x480 pixels, color, x86 >1Ghz or ARM ?, 1G RAM, 8G storage, battery 3-6h-8h capacity, network
- ON/OFF: 20-30s.

# Replace high-end calculators ?

- Step 1: Price below 200 \$, batteries should last one schoolday, wifi should be easy to disable
- Step 2: Math softwares like Xcas should be preinstalled
- Step 3: Demonstrate to math teachers and get approval from educational community
- The idea of one laptop per child is maturing

# History of Xcas

- 1992-2000: development of the CAS (Computer Algebra System) of the HP calculators (49G, 49G+, 40G, 50G). Not portable and limited.
- 2000-now: development of Xcas, a CAS for PC, portable (Linux, Mac, Windows, Linux ARM and Windows CE), addition of a geometry and spreadsheet module at the request of math teachers.
- 2007: 3rd price awarded at the Trophée du Libre (Free Software Competition) in the scientific software category.

# Computer Algebra System

From highschool to university...

- integer arithmetic : primes, GCD, extended GCD, cryptography...
- polynomials: GCD, factorization, fractions, finite fields...
- linear algebra: vectors, matrices, reduction, factorizations
- calculus: derivatives, integration, limits, series, ...
- numeric and symbolic solvers (equations, systems)
- 2-d and 3-d graphs: functions, parametric curves, level curves, ...
- ...

Fich Edit Cfg Aide Exemples Math Phys Geo Recriture Scolaire Graph Prg

trophee1.xws = real RAD 12 xcas 12.594M STOP Kbd Msg X

1 factor(x^50-1)

2 integration(1/(x^4+1)^4,x,0,inf)=simplify(integration(1/(x^4+1)^4,x,0,inf))

$$\int_0^{+\infty} \frac{1}{(x^4+1)^4} dx = \frac{(27-x)\sqrt{2}}{512}$$

3 plot(x^2,x=-3..3); plotarea(x^2,x=0..2)

x: -0.432  
y: 8.23

in out

Menu



# On-line documentation

## French and partially in English

- tutorial
- commands by themes in the menus
- command completion
- short help with examples to paste
- more complete help inside the browser
- examples sessions
- exercices
- Internet ressources

# Geometry.

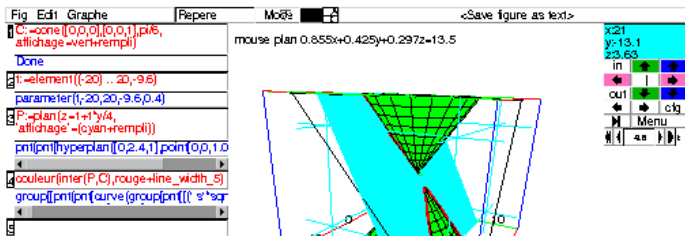
- Make constructions with the mouse or/and by commands
- Interactive figures (pointer mode and parameters)
- In the plane or in the space
- 3-d visualization options inherited from OpenGL
- Analytic proofs of theorems using the CAS

The screenshot shows the Xcas software interface with the following elements:

- Menu Bar:** Fig, Edit, Graphie, Repere, Mode, <Save figure as text>
- Command List (Left Panel):**
  - 25 translation(-3\*1, triangle(Q, R
  - polygone(point(0.96856281
  - 26 translation(0.5-3.5\*1, triangle
  - polygone(point(0.96040570
  - 27 translation(-0.5-3.5\*1, segme
  - segment(point(-5.9, -3.5), po
  - 28 translation(-3.5\*1, segment(f
  - segment(point(0.15060710
  - 29 translation(0.5-3.5\*1, seame
- Main Workspace:** A geometric diagram with points A, B, C, P, Q. A red triangle is visible. Lines connect the points to form a complex shape.
- Toolbar (Right Panel):**
  - Coordinates: x:-5.84, y:-4.14
  - Navigation: in, out, left, right, up, down, left+up, left+down, right+up, right+down
  - Menu: Menu

## 3-d example.

Intersection of a plane and a cone: here an hyperbola



# Spreadsheet.

- numeric values for statistics
- cells may have a symbolic value
- cells may have a graphic value
- import/export with other modules

The screenshot shows the Xcas spreadsheet interface. The menu bar includes 'Table Edit Maths', 'eval val 2-d 3-d', and '<Sauver tableur au format texte>'. The active cell B3 contains the formula `=evalf(subst(B$0,A$0,A3))`. The spreadsheet displays a table with columns A through H and rows 0 through 7. The data in the table is as follows:

	A	B	C	D	E	F	G	H
0	x	x^2	0	0	0	0	0	0
1	0.25	plotparam(	0	0	0	0	0	0
2	-4	16.0	0	0	0	0	0	0
3	-3.75	14.0625	0	0	0	0	0	0
4	-3.5	12.25	0	0	0	0	0	0
5	-3.25	10.5625	0	0	0	0	0	0
6	-3.0	9	0	0	0	0	0	0
7	-2.75	7.5625	0	0	0	0	0	0
	0	1	2	3	4	5	6	7

Below the spreadsheet, a graph of a parabola is visible. The x-axis is labeled 'x' and the y-axis is labeled 'y'. The vertex of the parabola is at approximately x = -0.364 and y = 9.48. The graph shows a downward-opening parabola with a grid.

# Programmation

- interpreted language, not typed
- syntax choice: Xcas, maple, mupad, TI89.
- interactive debugger

```
Fich Edit Cfg Aide Exemples Math Phys Geo Recriture Scolaire Graph Prg
Unnamed horner.xws
? Save = real RAD 12 xcas 13.68M STOP Kbd Msg X
1 Prog Edit Aputer nxt OK Save
// l=liste des coeffs par ordre decroissant, a point ou on evalue,
horner1(l,a):=(
  local j,s,val,lq;
  s:=size(l);
  lq:=[];
  val:=0;
  for (j:=0; j<(s-1); j:=j+1 {
    val:=val*a+l[j];
    lq:=append(lq,val);
  };
  val:=val*a+l[s-1];
  return([val,lq]);
);;
// Parsing horner1
// Success compiling horner1
Done Menu
2 horner1([1,2,3],4)
27 1 6 Menu
```