

Matematický software pod Linuxem

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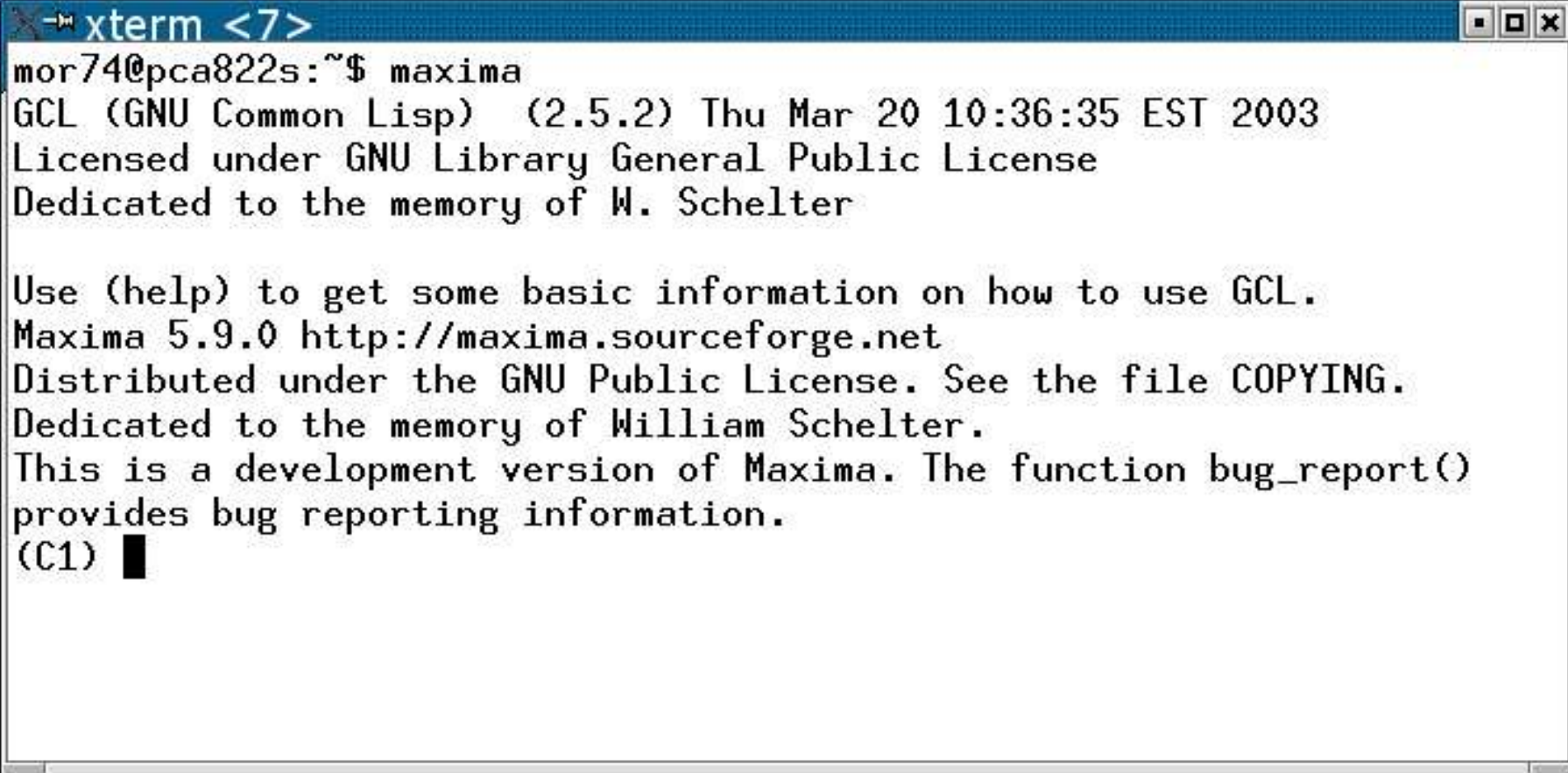
Ostravské Linuxové semináře

- programy pro symbolické počítání „Computer Algebra System“
 - Maple, Mathematica
 - Maxima
- programy pro numerické výpočty
 - Matlab
 - Octave, Scilab

Maxima

- <http://maxima.sourceforge.net>
- historie: program vznikl z DOE Macsyma (konec 60tých let, MIT)
William Schelter 1982 – 2001
- licence: GPL (od roku 1998)
- verze: 5.9
- Debian, RedHat balíčky
- nápověda: `describe(slovo);`
- ukončení: `quit();`

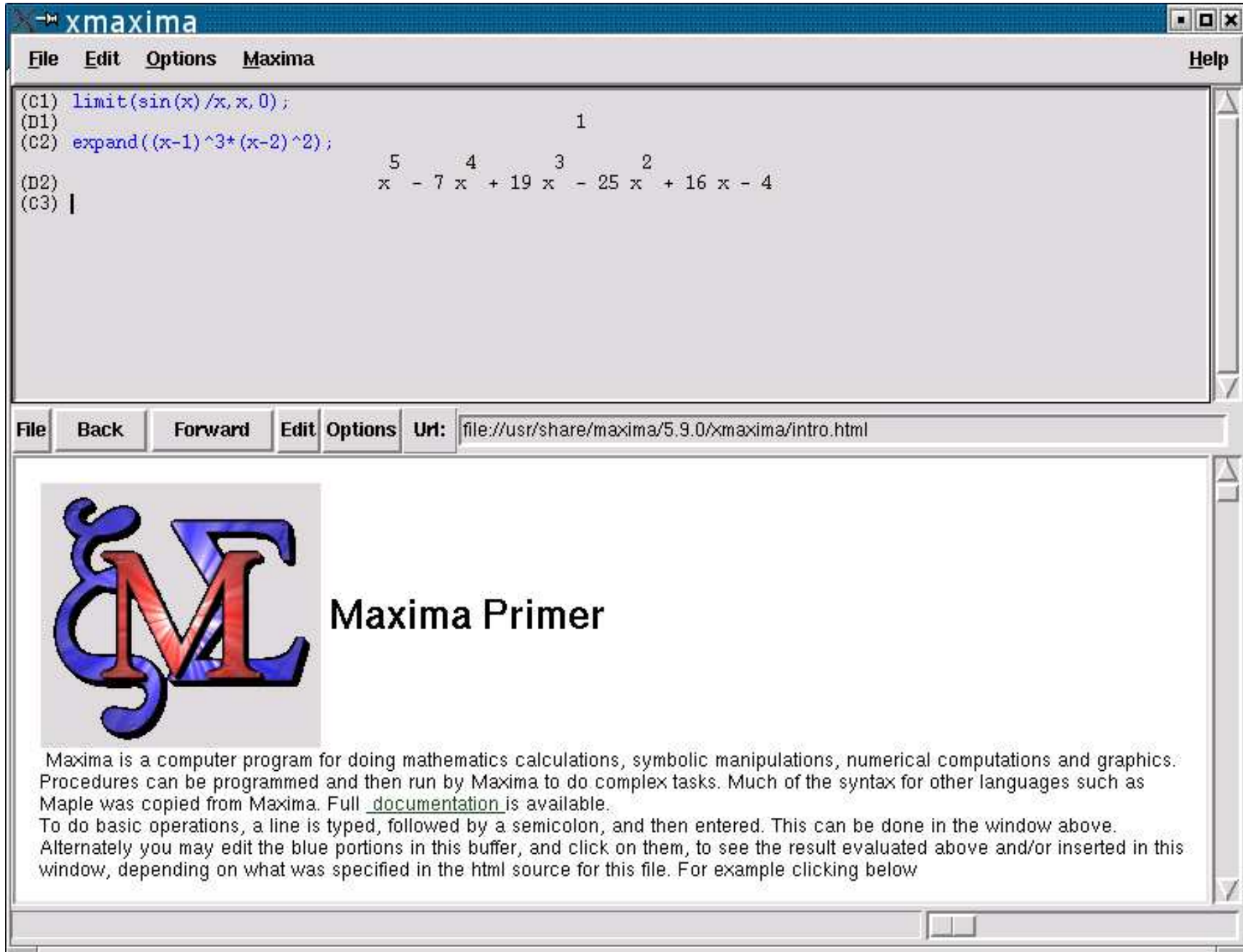
Maxima

A screenshot of an xterm window titled "xterm <7>". The terminal shows the command "maxima" being executed. The output is a multi-line startup message for GCL (GNU Common Lisp) 2.5.2, dated Thu Mar 20 10:36:35 EST 2003. It includes the GNU Library General Public License notice and a dedication to the memory of W. Schelter. It also provides information about Maxima 5.9.0, including the sourceforge.net URL and a note that this is a development version with a bug_report() function. The prompt "(C1) █" is visible at the end of the output.

```
xterm <7>
mor74@pca822s:~$ maxima
GCL (GNU Common Lisp) (2.5.2) Thu Mar 20 10:36:35 EST 2003
Licensed under GNU Library General Public License
Dedicated to the memory of W. Schelter

Use (help) to get some basic information on how to use GCL.
Maxima 5.9.0 http://maxima.sourceforge.net
Distributed under the GNU Public License. See the file COPYING.
Dedicated to the memory of William Schelter.
This is a development version of Maxima. The function bug_report()
provides bug reporting information.
(C1) █
```

XMaxima



The screenshot shows the XMaxima application window. The top window, titled "xmaxima", has a menu bar with "File", "Edit", "Options", "Maxima", and "Help". The main area contains a command prompt with the following text:

```
(C1) limit(sin(x)/x, x, 0);  
(D1)  $\frac{1}{x}$   
(C2) expand((x-1)^3*(x-2)^2);  
(D2)  $x^5 - 7x^4 + 19x^3 - 25x^2 + 16x - 4$   
(C3) |
```

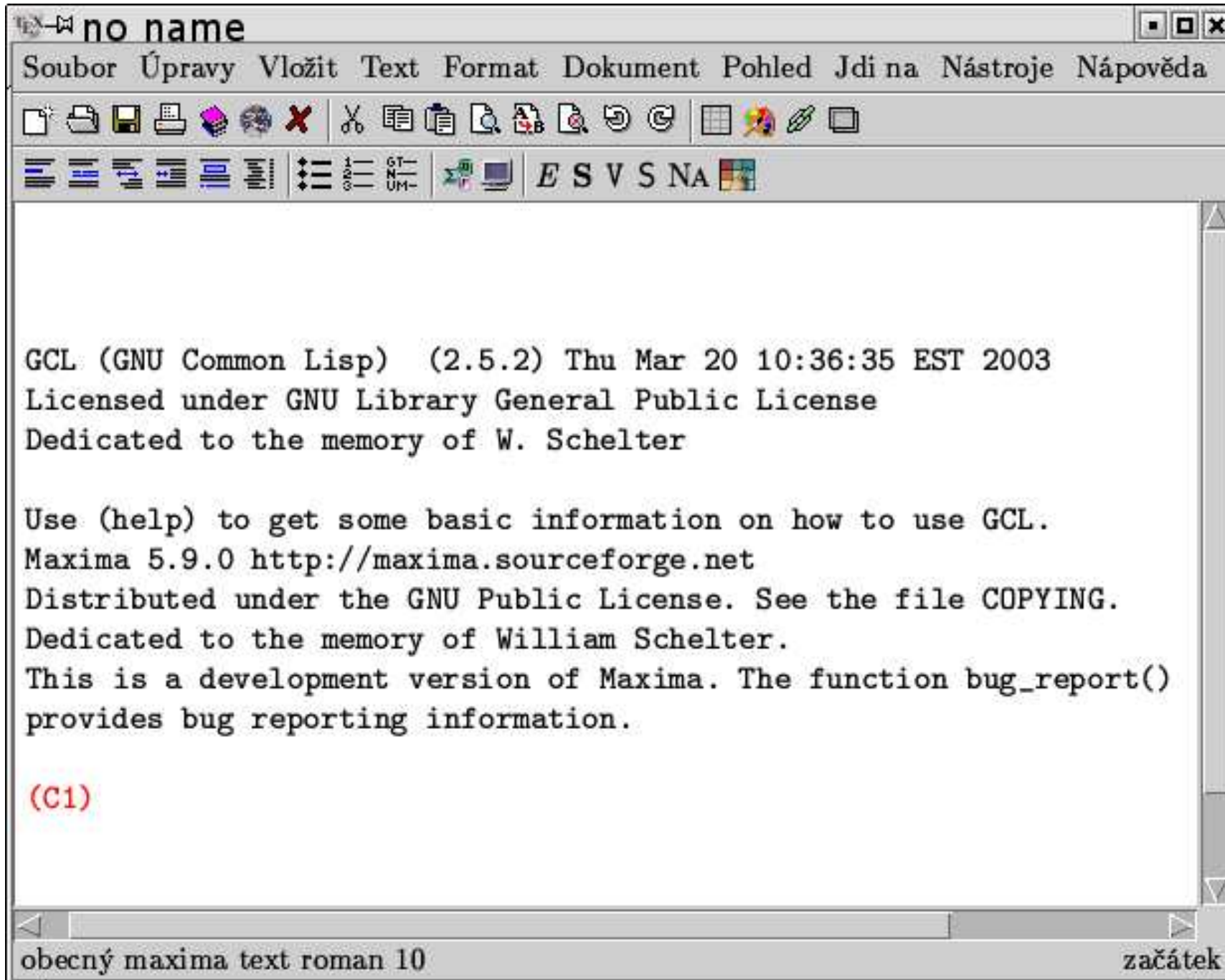
Below the command window is a navigation bar with buttons for "File", "Back", "Forward", "Edit", and "Options". The "Url:" field shows "file:///usr/share/maxima/5.9.0/xmaxima/intro.html".

The main content area of the help window features the Maxima logo, which consists of a stylized blue and red "M" and "C" intertwined. To the right of the logo is the heading "Maxima Primer".

Maxima is a computer program for doing mathematics calculations, symbolic manipulations, numerical computations and graphics. Procedures can be programmed and then run by Maxima to do complex tasks. Much of the syntax for other languages such as Maple was copied from Maxima. Full [documentation](#) is available.

To do basic operations, a line is typed, followed by a semicolon, and then entered. This can be done in the window above. Alternately you may edit the blue portions in this buffer, and click on them, to see the result evaluated above and/or inserted in this window, depending on what was specified in the html source for this file. For example clicking below

Maxima v TeXmacsu (Text → Sezení → Maxima)



The screenshot shows a TeXmacs window titled "no name". The menu bar includes "Soubor", "Úpravy", "Vložit", "Text", "Format", "Dokument", "Pohled", "Jdi na", "Nástroje", and "Nápověda". The toolbar contains various icons for file operations, editing, and viewing. The main text area displays the following information:

```
GCL (GNU Common Lisp) (2.5.2) Thu Mar 20 10:36:35 EST 2003
Licensed under GNU Library General Public License
Dedicated to the memory of W. Schelter

Use (help) to get some basic information on how to use GCL.
Maxima 5.9.0 http://maxima.sourceforge.net
Distributed under the GNU Public License. See the file COPYING.
Dedicated to the memory of William Schelter.
This is a development version of Maxima. The function bug_report()
provides bug reporting information.
```

At the bottom left of the text area, the prompt `(C1)` is shown in red. The status bar at the bottom of the window displays "obecný maxima text roman 10" on the left and "začátek" on the right.

Příklad – práce s výstupy

(C1) `expand((x-1)^3*(x-2)^2);`

(D1)

$$x^5 - 7x^4 + 19x^3 - 25x^2 + 16x - 4$$

(C2) `d1=0;`

(D2)

$$x^5 - 7x^4 + 19x^3 - 25x^2 + 16x - 4 = 0$$

(C3) `solve(%)`;

(D3)

$$[x = 2, x = 1]$$

Příklad – řešení soustavy lineárních rovnic s parametrem

(C4) rov1: $x-y+3z-a=0$; rov2: $-x+z=1$; rov3: $2y-z-a=-1$;

(D4)

$$3z - y + x - a = 0$$

(D5)

$$z - x = 1$$

(D6)

$$-z + 2y - a = -1$$

(C5) (C6) (C7) `linsolve([rov1,rov2,rov3],[x,y,z]);`

(D7)

$$\left[x = \frac{3a - 6}{7}, y = \frac{5a - 3}{7}, z = \frac{3a + 1}{7} \right]$$

Příklad – řešení rovnic, zkouška

(C8) `solve(x^6-1=0);`

(D8)

$$\left[x = \frac{\sqrt{3}i + 1}{2}, x = \frac{\sqrt{3}i - 1}{2}, x = -1, x = -\frac{\sqrt{3}i + 1}{2}, x = -\frac{\sqrt{3}i - 1}{2}, x = 1 \right]$$

(C9) `ev(x^6-1,%[4]);`

(D9)

$$\frac{(\sqrt{3}i + 1)^6}{64} - 1$$

(C10) `expand(%);`

(D10)

0

Příklad – limita funkce, derivace, integrace

(C11) `limit(sin(x)/x,x,0);`

(D11)

$$1$$

(C12) `diff(exp(x^2),x);`

(D12)

$$2xe^{x^2}$$

(C13) `integrate(sin(x)*cos(4*x-1),x);`

(D13)

$$\frac{\cos(3x-1)}{6} - \frac{\cos(5x-1)}{10}$$

Příklad – definice funkce, parciální derivace

(C14) $f(x, y) := \exp(2*y) - x^2 * \log(x - y);$

(D14)

$$f(x, y) := e^{2y} - x^2 \log(x - y)$$

(C15) $f(1, 0);$

(D15)

1

(C16) $\text{diff}(f(x, y), y);$

(D16)

$$2e^{2y} + \frac{x^2}{x - y}$$

Příklad – práce s komplexními čísly, Taylorův rozvoj

(C17) `expand((2-3*i)*(1-2*i));`

(D17)

$$-7i - 4$$

(C18) `realpart(%); abs(d17);`

(D18)

$$-4$$

(D19)

$$\sqrt{65}$$

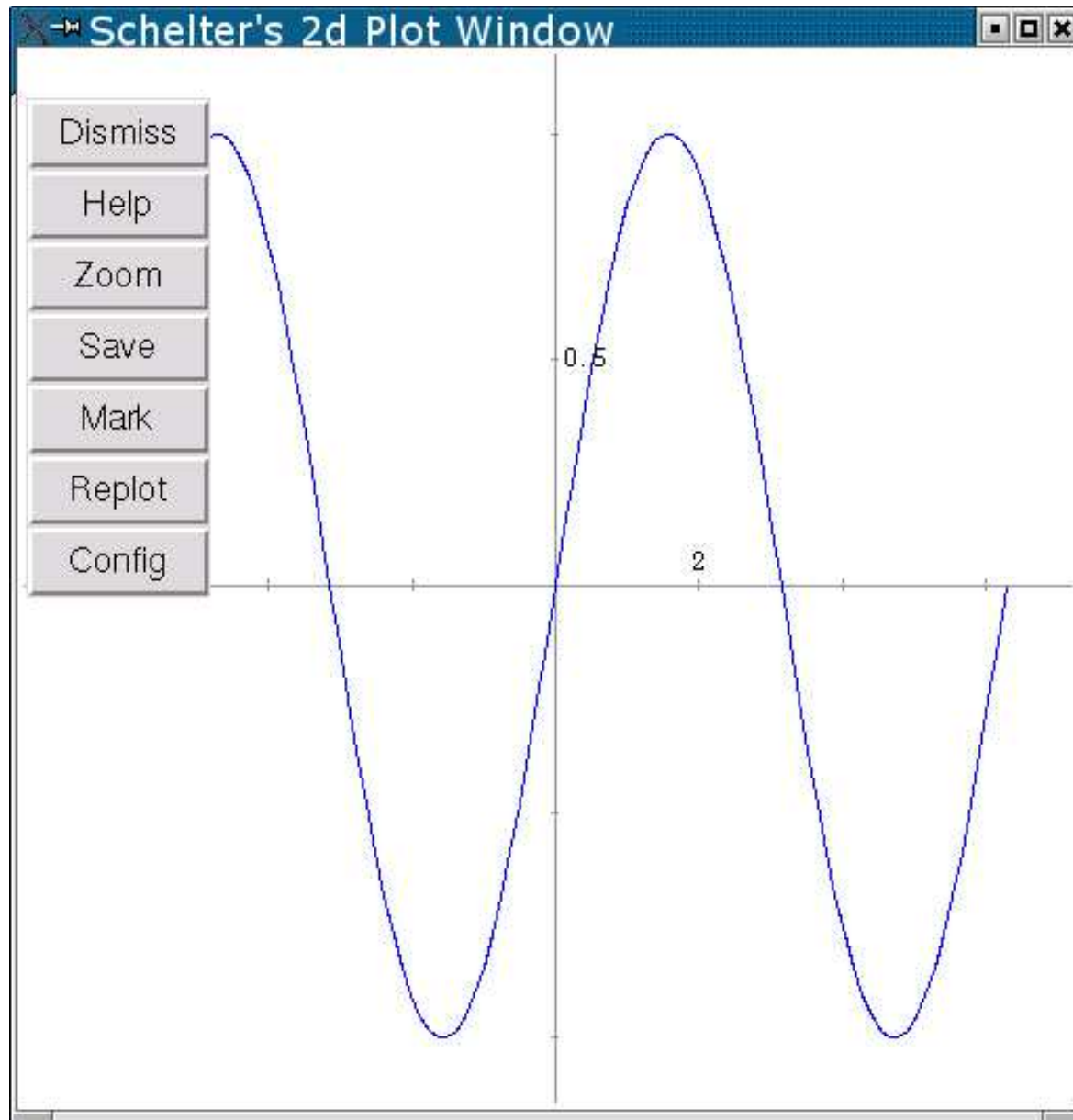
(C20) `taylor(tan(x),x,0,5);`

(D20)

$$x + \frac{x^3}{3} + \frac{2x^5}{15} + \dots$$

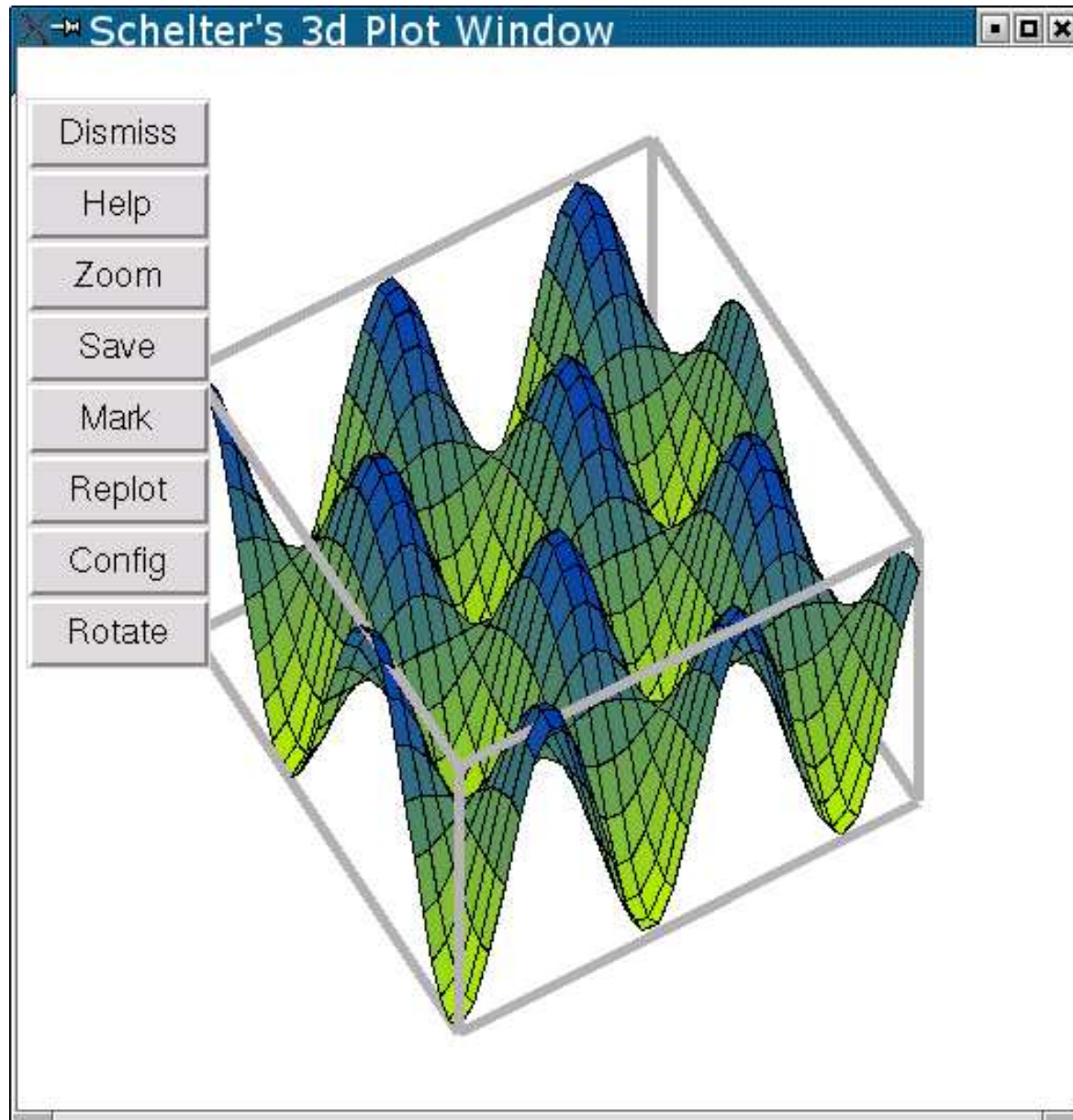
Příklad – graf funkce $f(x) = \sin(x)$ na intervalu $\langle -2\pi, 2\pi \rangle$

```
plot2d(sin(x), [x, -2*%pi, 2*%pi]);
```



Příklad – graf funkce $f(x) = \sin(x) \cos(y)$ na $\langle -5, 5 \rangle \times \langle 0, 15 \rangle$

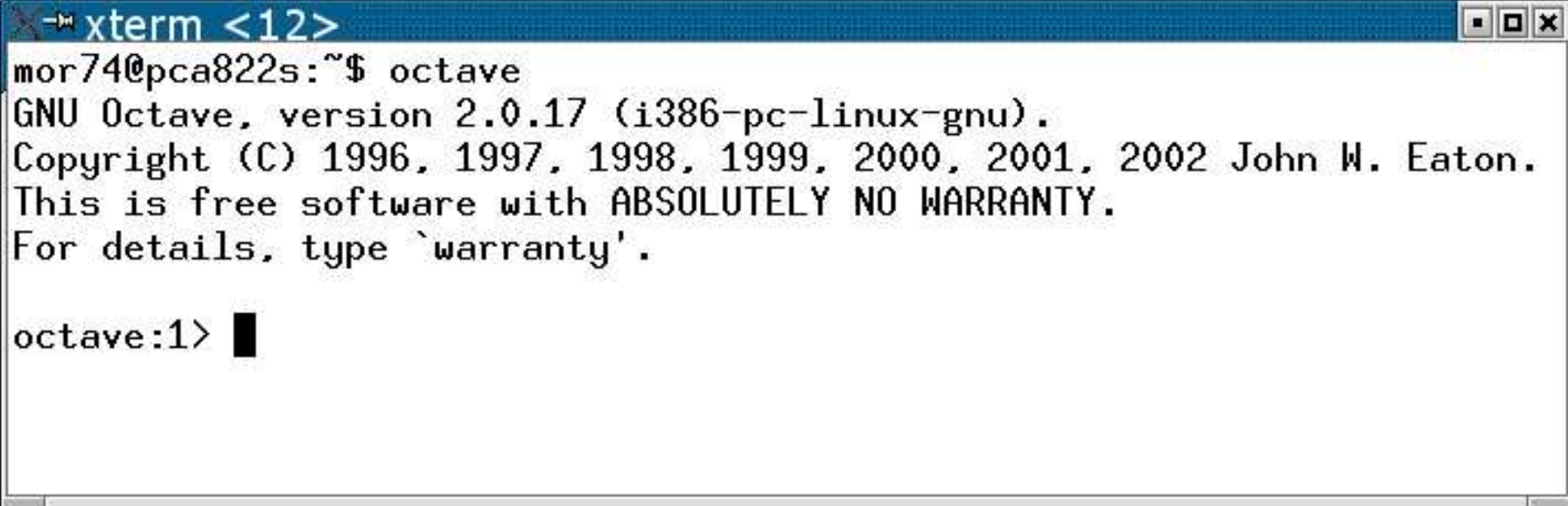
```
plot3d(sin(x)*cos(y), [x,-5,5], [y,0,15]);
```



Octave

- <http://www.octave.org>
- historie: vznik 1988 John G. Ekerdt (University of Texas)
James B. Rawlings (University of Wisconsin-Madison)
- licence: GNU
- verze: 2.0.17
- Debian, RedHat, Suse balíčky
- nápověda: `help -i slovo, help příkaz`
- ukončení: `quit`

Octave

A terminal window titled "xterm <12>" with standard window controls. The terminal shows the command "octave" being executed, followed by the GNU Octave version 2.0.17 startup message. The prompt "octave:1>" is visible with a cursor.

```
xterm <12>
mor74@pca822s:~$ octave
GNU Octave, version 2.0.17 (i386-pc-linux-gnu).
Copyright (C) 1996, 1997, 1998, 1999, 2000, 2001, 2002 John W. Eaton.
This is free software with ABSOLUTELY NO WARRANTY.
For details, type `warranty'.

octave:1> █
```


Příklad – práce s maticemi

```
octave:5> A=[ 2 3 5; -1 0 2; 9 9 0]
```

```
A =
```

$$\begin{pmatrix} 2 & 3 & 5 \\ -1 & 0 & 2 \\ 9 & 9 & 0 \end{pmatrix}$$

```
octave:6> A(1,:)
```

```
ans =
```

$$(2 \ 3 \ 5)$$

```
octave:7> A(2,3)
```

```
ans =
```

2

Příklad – determinant, inverzní a transponovaná matice

```
octave:8> det(A)
```

```
ans =
```

−27

```
octave:9> inv(A)
```

```
ans =
```

$$\begin{pmatrix} 0.66667 & -1.66667 & -0.22222 \\ -0.66667 & 1.66667 & 0.33333 \\ 0.33333 & -0.33333 & -0.11111 \end{pmatrix}$$

```
octave:10> A'
```

```
ans =
```

$$\begin{pmatrix} 2 & -1 & 9 \\ 3 & 0 & 9 \\ 5 & 2 & 0 \end{pmatrix}$$

Příklad – řešení soustavy lineárních rovnic

```
octave:11> b=[1;2;0]
```

b =

$$\begin{pmatrix} 1 \\ 2 \\ 0 \end{pmatrix}$$

```
octave:12> x=A\b
```

x =

$$\begin{pmatrix} -2.66667 \\ 2.66667 \\ -0.33333 \end{pmatrix}$$

```
octave:13> abs(A*x-b)
```

x =

$$\begin{pmatrix} 0.0000e + 00 \\ 0.0000e + 00 \\ 1.3323e - 15 \end{pmatrix}$$

Programování

Rozhodovací bloky: `if`, `switch`

Cykly: `while`, `do...until` , `for`

```
function [výstupní parametry] = jméno(vstupní parametry)  
tělo funkce  
endfunction
```

Graf funkce jedné proměnné

Grafy funkcí $f(x) = x^2$, $f(x) = \cos(x)$ na $\langle -3, 3 \rangle$

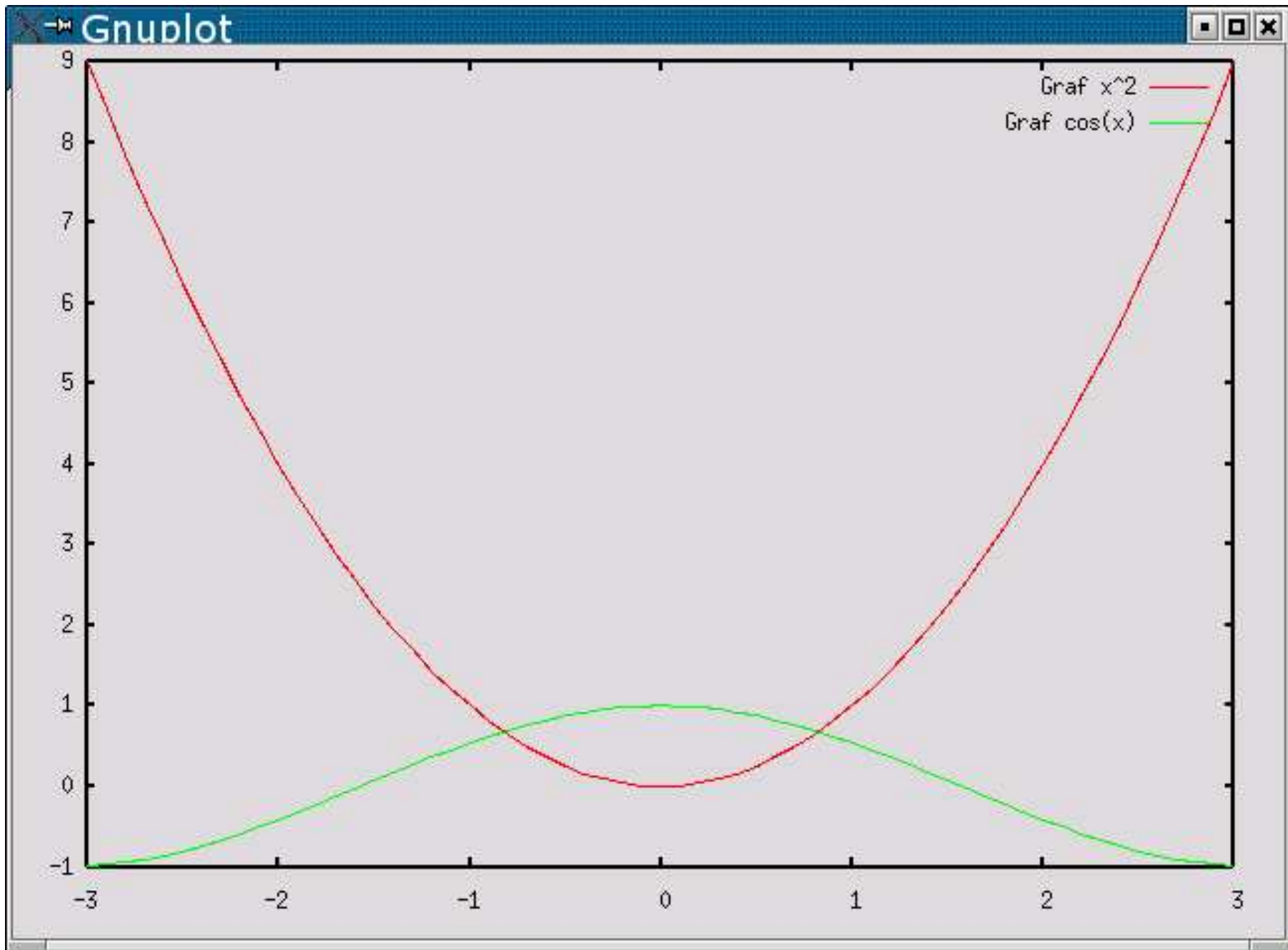
```
x=-3:0.1:3
```

```
y1=x.^2
```

```
y2=cos(x)
```

```
plot(x,y1,";Graf x^2;",x,y2,";Graf cos(x);")
```

Grafy funkcí $f(x) = x^2$, $f(x) = \cos(x)$ na $\langle -3, 3 \rangle$



Graf funkce dvou proměnných

Graf funkce $f(x, y) = \cos(xy)$ na $\langle -\pi, \pi \rangle \times \langle -\pi, \pi \rangle$

```
x=-pi:pi/16:pi
```

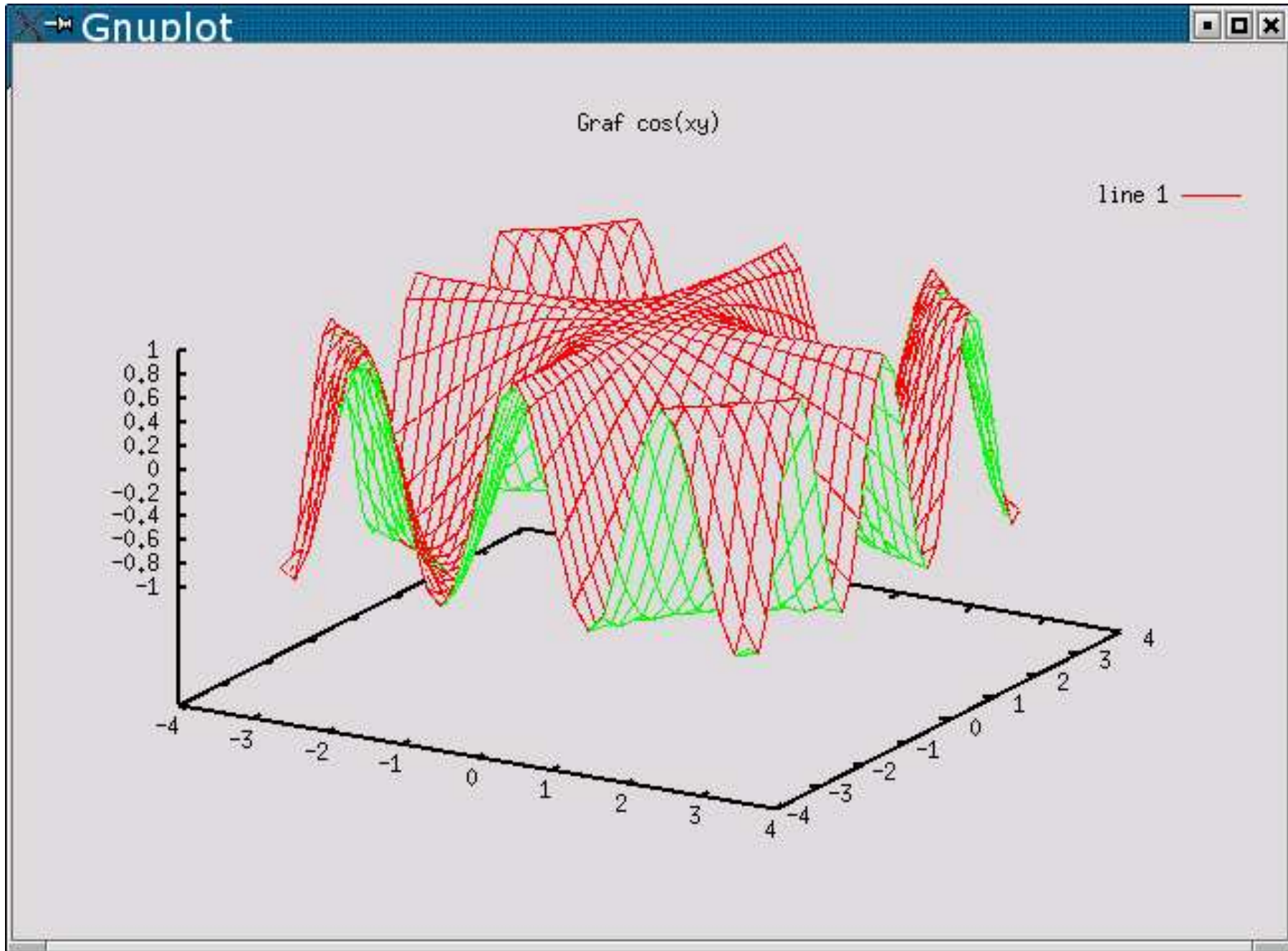
```
y=x
```

```
[X,Y]=meshgrid(x,y)
```

```
z=cos(X.*Y)
```

```
mesh(x,y,z)
```

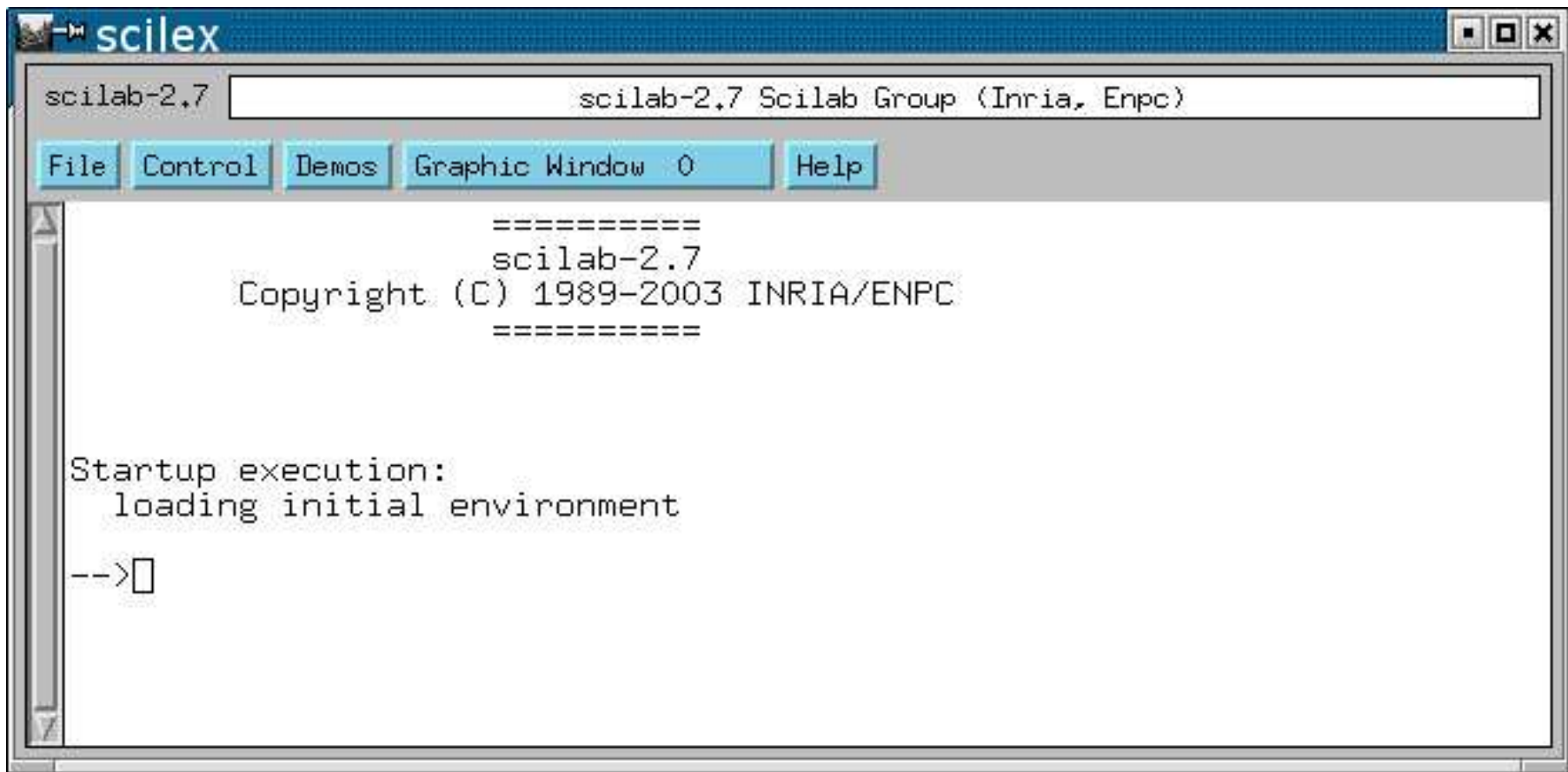

Graf funkcje $f(x, y) = \cos(xy)$ na $\langle -\pi, \pi \rangle \times \langle -\pi, \pi \rangle$



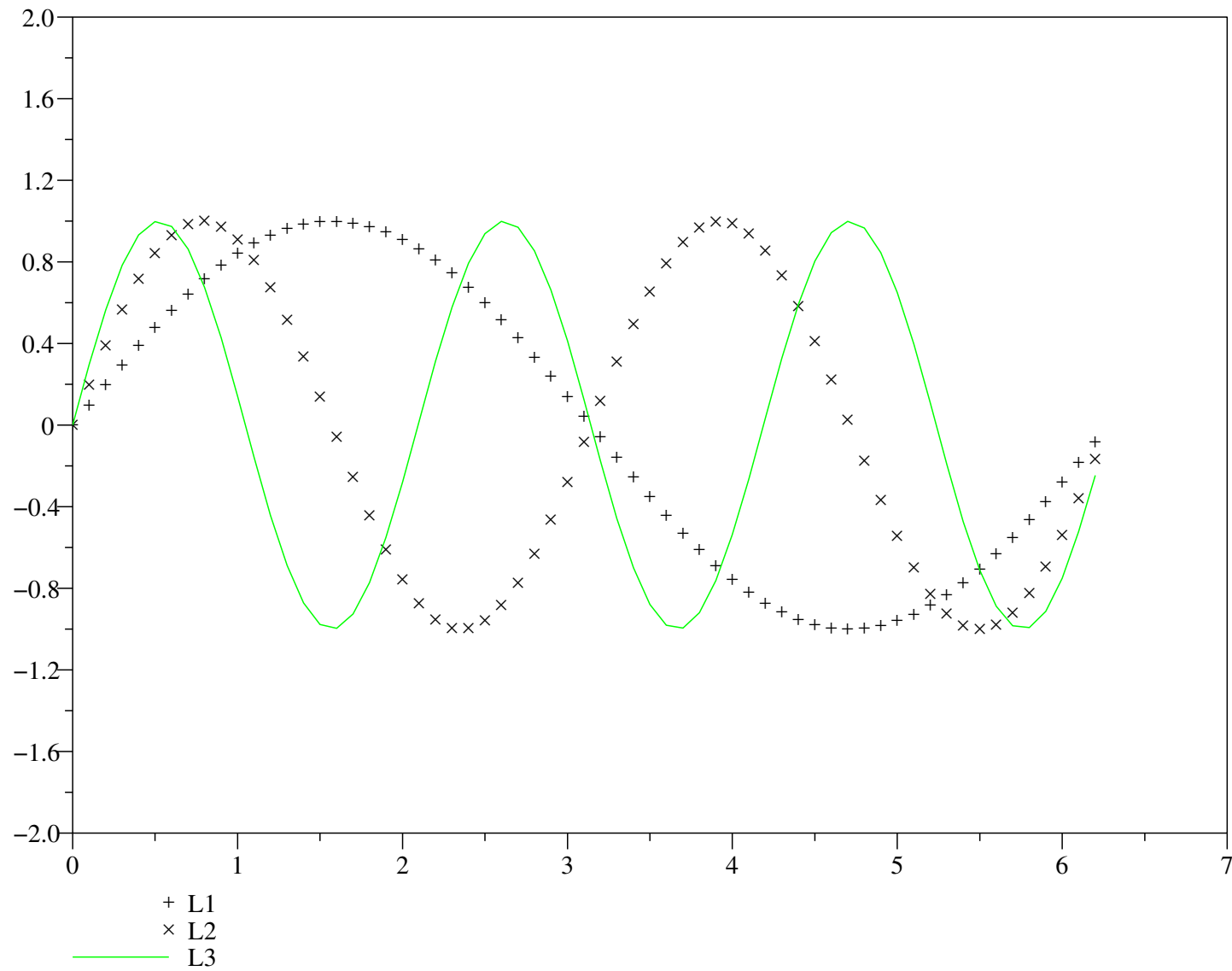
Scilab

- <http://www.scilab.org>
- historie: 1989 Scilab Group
- licence: free (od 1994)
- verze: 2.7

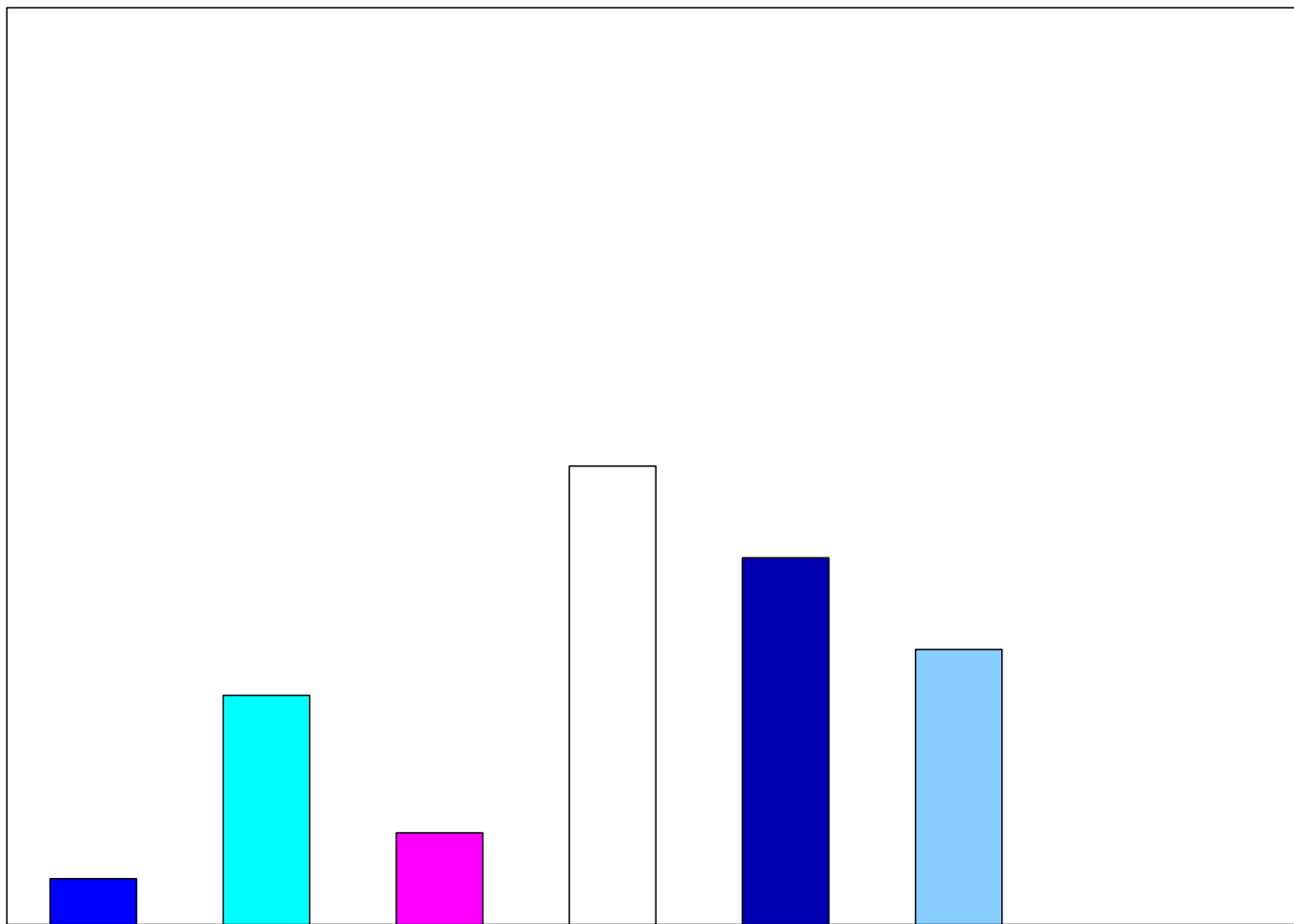
Scilab



Demo – graf funkce jedné proměnné



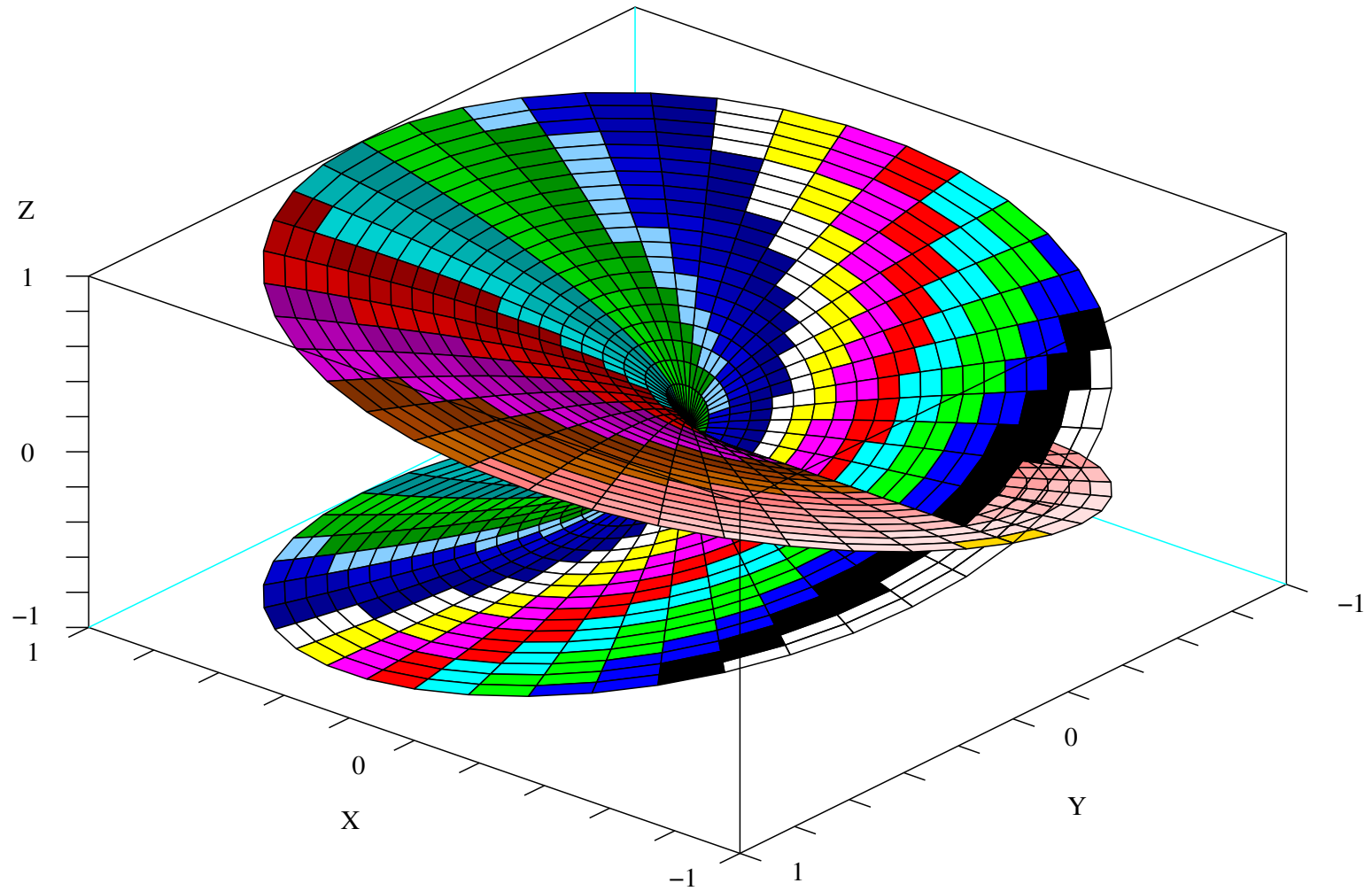
Demo – sloupcový graf



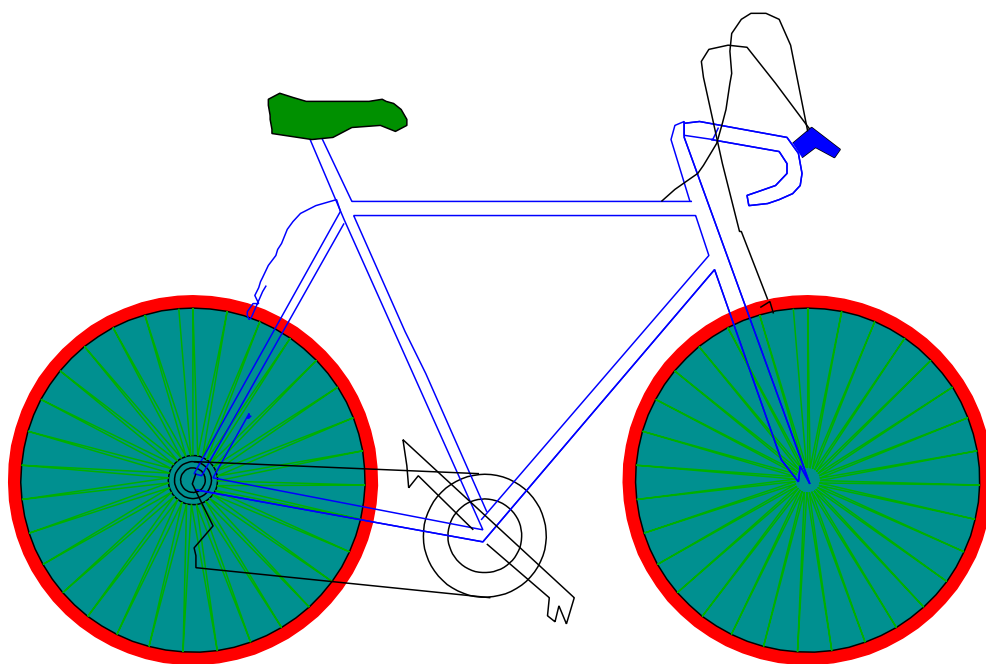
Demo – koláčový graf



Demo – Riemannova plocha



Demo – jízdní kolo



Konec