Introduction to Mathematical Software
Lecture 0: Getting started

(c) 2007, Michael Joswig

Topics

- Mathematics on the Computer
- Maple
- UNIX/Linux
- TeX/LaTeX

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Organization

- integrated course: lectures and computer exercises alternate
- exercises will be worked on in pairs
- one (or two) homework assignments to pass this course

Web page

http://www.mathematik.tu-darmstadt.de/lehrmaterial/WS2007-2008/mathsoft/

Some of the things that Maple can do

Simple computations

```
> 3+4
```

$$7 \tag{1}$$

```
> sin(Pi/2)-exp(0)
```

$$0 \tag{2}$$

```
> log(sqrt(0.234))
```

$$-.7262170818 \tag{3}$$

```
> factorial(100)
```

$$933262154439441526816992388562667004907159682643 8\backslash \tag{4}$$

$$162146859296389521759999322991560894146397615651828625369792082722375825118521091686400000000000000000000000$$

Solving equations

> $solve(x^2+4\cdot x-1=0)$

$$-2+\sqrt{5},\ -2-\sqrt{5} \tag{5}$$

Symbolic computations

> $simplify((a+b)^2-a^2-b^2)$

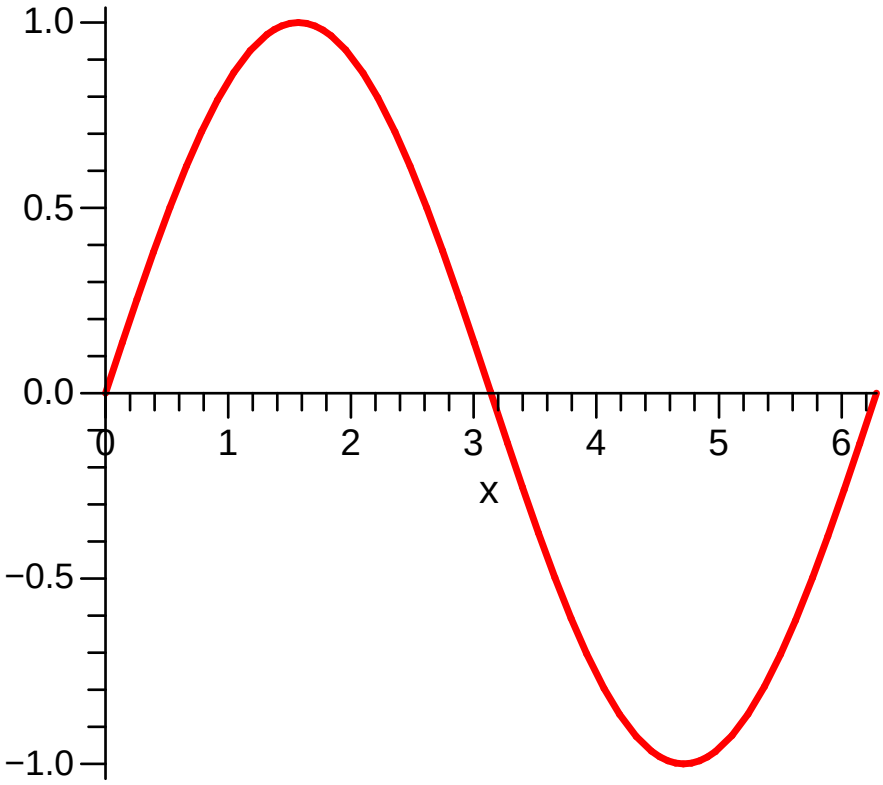
$$2\,a\,b \tag{6}$$

> $solve(a\cdot x^2+b\cdot x+c=0,\ x)$

$$-\frac{1}{2}\,\frac{b-\sqrt{b^2-4\,a\,c}}{a},\ -\frac{1}{2}\,\frac{b+\sqrt{b^2-4\,a\,c}}{a} \tag{7}$$

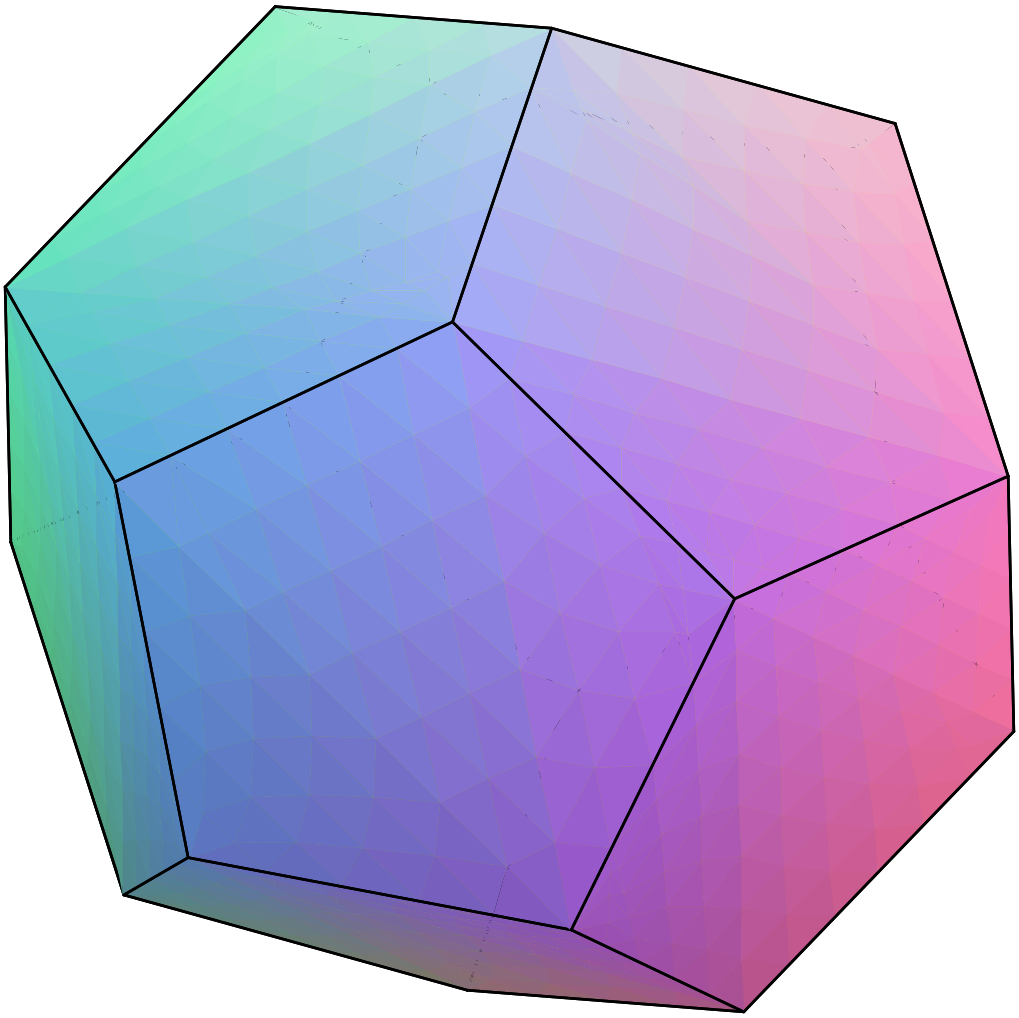
Plotting function graphs

> $plot(\sin(x),\ x=0..2\cdot\pi)$

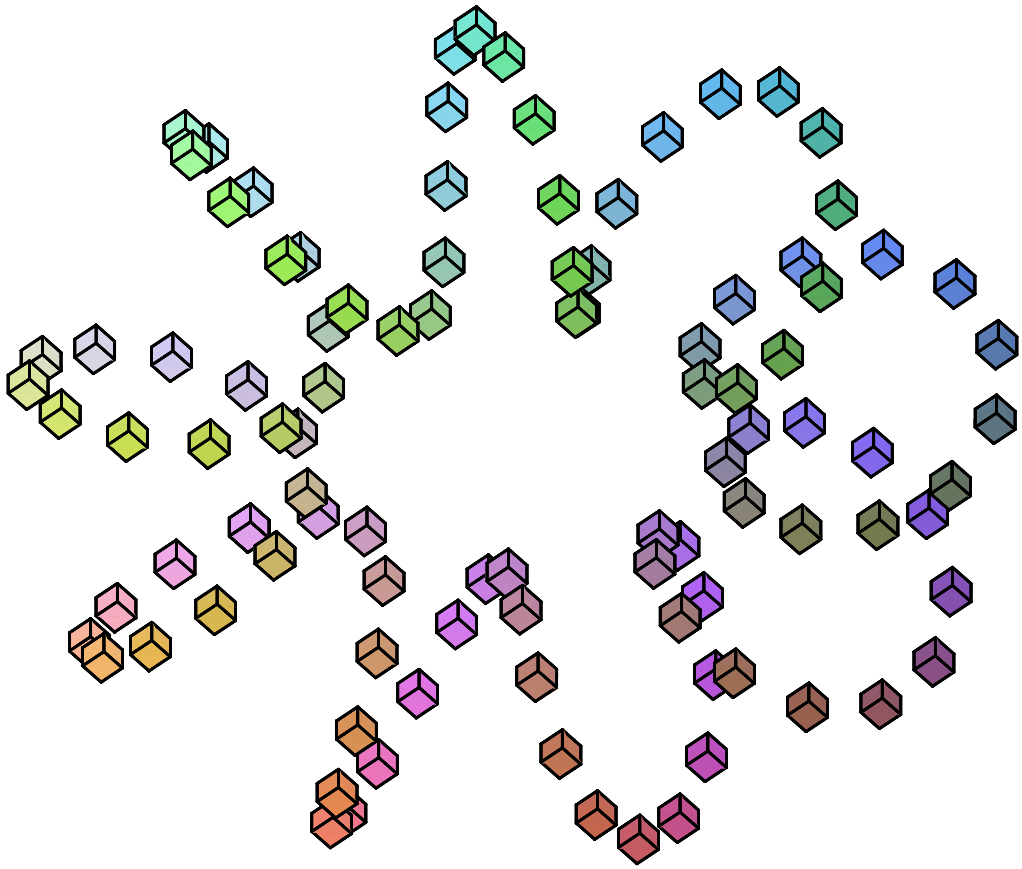


Interactive graphics

```
> with(plots):
  polyhedraplot([0, 0, 0], polytype = dodecahedron, style = PATCH,
                scaling = CONSTRAINED, orientation = [71, 66]);
```



```
> π := evalf(π);
  p := seq([cos(t*π/50)*(10+4*sin(9*(t*π/50))),
        sin(t*π/50)*(10+4*sin(9*(t*π/50))),
      4*cos(9*(t*π/50))], t=0..200) : polyhedraplot([p],
  polyscale=.4, polytype=hexahedron, scaling=CONSTRAINED,
  orientation=[76, 40]);
                          π := 3.141592654
```



>

Typesetting with LaTeX

> $latex(int(\sin(x)^{12}, x))$

```
-1/12\, \left( \sin \left( x \right)  \right) ^
{11}\cos \left( x
 \right) -{\frac {11}{120}}\, \left( \sin \left( x
\right)  \right) ^{
9}\cos \left( x \right) -{\frac {33}{320}}\, \left
( \sin \left( x
 \right)  \right) ^{7}\cos \left( x \right) -
{\frac {77}{640}}\,
 \left( \sin \left( x \right)  \right) ^{5}\cos
\left( x \right) -{
\frac {77}{512}}\, \left( \sin \left( x \right)
\right) ^{3}\cos
 \left( x \right) -{\frac {231}{1024}}\,\sin \left
( x \right) \cos
 \left( x \right) +{\frac {231}{1024}}\,x
```

Programming

```
> myownfactorial := proc(n) if (n < 2) then return 1 else return n·
      myownfactorial(n-1) fi; end proc:
> myownfactorial(5)
```

$$120 \tag{8}$$