Computer Algebra for teachers

Using *Maple* to teach Mathematics

in secondary education.

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- Introduction to Computer Algebra
- Example *Maple* commands
- The *Maple* Help system
- *Maplets* Demo - Differentiation
- Hands-on
  - Commands
  - Sample task - Max Cone

What is computer algebra? (CA)

CA deals with mathematical computations on mathematical objects (e.g. numbers, symbols, expressions, formulae) in an exact manner, as opposed to numeric computation that deals with floating-point numbers.

Typical operations include symbolic differentiation, integration, analytic solution of differential equations, etc.

Advantages of CA to mathematicians

- Speed
- Exact arithmetic
- Large algebraic computations
- Interactive
- Accurate manipulation of data structures
- . . . beyond the usual capabilities or boredom threshold of a human

A number of Computer Algebra Systems (CAS) exist such as Derive, Mathematica, Maple, MuPAD and Axiom.

We will be using *Maple*

Maple

- *Maple* was the result of a research project at the University of Waterloo, Canada, in the early 1980s
- Maplesoft was founded in 1988 and now develops and markets *Maple*
- Over three million people worldwide are using *Maple* technology

- Over 300 books written about *Maple* applications
- Commercial users of *Maple* include Toyota, Sun Microsystems, Hewlett Packard and Boeing.

How can *Maple* help you as a teacher?

- Create handouts and web pages using graphics, animations, symbolics and tables created in *Maple*
- Export *Maple* output as graphic files that can be imported into DTP, word processors, web pages, etc.
- Use *Maple* to help create examples and exam problems that work out ‘nicely’

Advantages of using CA with maths students

- Exposure to modern mathematical software
- Learn how to input maths in to a computer (making them careful about brackets and BIDMAS)
- Illuminate theory and visualisation of concepts
- Greater understanding

- Check homework and test themselves
- Use it to answer “What if” questions
- Student projects

“Used imaginatively, *Maple* can help students learn better and faster, and help prepare them using the mathematics technology that they will need throughout their personal lives.”

Gregory A. Moore, Cerritos College.

Maple - Example commands

Let’s see some examples of what *Maple* can do.

Open *Maple*

Maplets

A *Maplet* is a custom graphical user interface to *Maple*'s computational engine.

- to access specific functions related to a learning activity
- removes the chore of learning *Maple* syntax

Launch Differentiation Maplet

Now over to you!

- Questions
- Hands-on *Maple*
  - *Maple* Commands
  - Sample task - Max Cone

Web links

- http://www.maplesoft.com/
- http://www.maple4students.com/
- http://www.mapleapps.com/
- http://maplenet.maplesoft.com/demo/

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