

How I Use MAPLE in Teaching and Research
Steven Gendler
Clarion University of Pennsylvania

In teaching, MAPLE found its way naturally into the course in Precalculus. Students could simplify expressions, graph, and examine slope, and inflection points. But the students thought that a TI-82 calculator, or the TI-92 was better for their needs than using a computer to do their homework. Students do love to see how MAPLE does all the grubby algebraic manipulation they don't enjoy.

In MAPLE, "with networks" contains software to create graphs and to explore many of the properties such as shortest path, degree, and colorings, and implement them in pictures. This provided a way for students to get hands on experience with the structures they were learning. The text of Rosen, Discrete Structures with MAPLE, is now available and has in it numerous MAPLE programs that implement algorithms explored in that class. Bubble sort and Huffman's algorithm are among those considered. Students can also use the power of MAPLE to implement recursive functions, and determine general terms and limits of these functions. Letting the students explore the power of MAPLE "on their own" in groups seemed very productive. In student research, MAPLE can be useful. One of my students is currently doing a research project to study the behavior of Pisot sequences. Pisot sequences are defined by giving a_1 and a_2 and letting a_n be $[a(n-1)]^2/a(n-2)$ rounded to the nearest integer. It is known that many, but not all of these sequences can be expressed as linear recurrences of degree n . Whether all of these sequences have this property and the distribution of the limits $\lim(a_n/a(n-1))$ as n increases is a project that was difficult 30 years ago, but can now be examined using MAPLE.

In my own personal research, MAPLE has been invaluable. We have solved several problems from the problem sections of various journals using MAPLE. Invariably these problems involve roots of higher degree equations, or radical equations of moderate complexity. For one example, dividing an equilateral triangle by drawing a line from one vertex to an arbitrary point on the opposite side and expressing the side of the triangle in terms of the radii of the inscribed circles in the two smaller triangles. Another was maximizing the area of an isosceles triangle with a given inscribed circle. MAPLE simply eliminates the hours of symbolic manipulation that accompanies such solutions.

In my paper for the MAA regional meeting in 1998, we used MAPLE to study the numerology of Kaballah, in particular the number of ways to generate words with numerical value equal to the lucky number 18 using generating functions. MAPLE generates the 3 page long generating function necessary to model the problem and provides the answer desired. Kaballah and numerology are an area of interest in religious studies and mathematics and I am trying to form a group with a religious scholar and a linguist to further study this interesting application. (See for instance the MAA publication "Numerology" by Underwood Dudley where "the demon" 666 is discussed for an entire chapter.).

I've been using MAPLE in Business Calculus, and even Intermediate Algebra and have found it enriches these courses substantially. I feel it has a major role to play in making the mathematics of the future more problem solving and less algebraic manipulation.

Many thanks to Ben Freed, Dept. Chair, for his encouragement and support without which many of these adventures with MAPLE would not have been possible, and to Karen Bolinger who first suggested that I integrate MAPLE into the Discrete Mathematics. Their support is much appreciated.

Visit my web page at
<http://gendler.clarion.edu>