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# *Graphics Calculators and School Mathematics*

A communiqué to the education community

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## **Preamble**

This communiqué has been prepared for leaders in the wider educational community. It is intended to inform you about the use of graphics calculators for school mathematics, and encourages you to discuss the issues and possibilities with teachers of mathematics. The ideas come from the conference *Students, Mathematics and Graphics Calculators into the Next Millennium* held in Sydney in March 2000. This Conference brought together key leaders in school mathematics from education authorities, teachers and other mathematics educators at the secondary and tertiary levels. The results of their discussions have been incorporated into the Professional Conference Summary which is the source of this document. (The Professional Conference Summary is available at [www.aamt.edu.au/gc/summary.pdf](http://www.aamt.edu.au/gc/summary.pdf).)

The conferees included many of the country's best people working in the area — representatives of the AAMT's state/territory affiliates, education systems and assessment authorities, the tertiary sector and interested organisations from the private and public sectors. The advice of the ninety highly expert and influential attendees is summarised below.

Many of the teachers and others present had significant experience in using graphics calculators, and consequently were supporters of

their use for mathematics learning. The Communiqué (and the Professional Conference Summary) reflects this orientation. There was no attempt at the Conference to reach consensus: hence this Communiqué is the responsibility of the Conference Organisers. One of its key intentions is to promote and inform local discussions about the issues, thereby obliging those who oppose the introduction of this technology to engage in debate, based on the evidence and the facts.

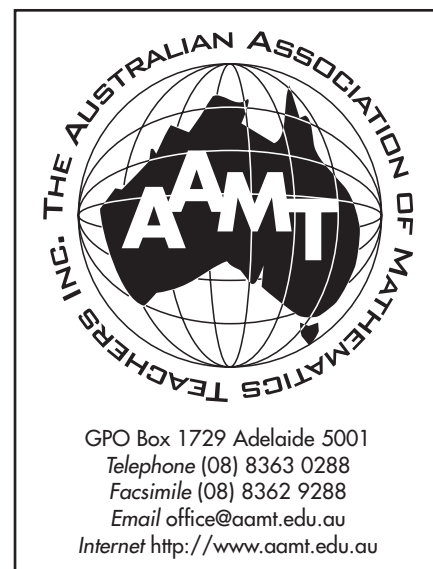
## **What are graphics calculators?**

Graphics calculators are hand-held, battery powered tools with capabilities that support learning in much of secondary school mathematics, just as effective use of basic calculators is integral to learning mathematics in the earlier years. Most graphics calculators can plot graphs, give numerical solutions to equations, perform statistical calculations and operate with matrices; more advanced models can have an array of features such as the ability to perform algebra symbolically, inbuilt or downloadable geometry packages, advanced statistics and many more. Graphics calculators represent a purpose designed information technology. Their responsible use by students is a significant contribution to the general emphasis on enhancing Australian society's skills with information and communication

technologies as human-centred means of enhancing our personal and working lives. Access to these new and mathematically powerful forms of information and communication technologies in school mathematics raises important issues for curriculum design, teaching, assessment and for the capacity of schools to provide and support the use of such technologies.

## **Why is their use valuable?**

Many of the potential benefits have already been realised in Australian classrooms. Overall these are exemplars of the mathematics classroom as a 'community of inquiry'. The use of graphics calculator technology has been a catalyst for pedagogical change in many cases. Through their intelligent use of this technology, these classrooms are in themselves examples of world class



teaching and learning of important mathematics.

In these classrooms:

- the *curriculum* is characterised by challenging and relevant learning experiences, rigour and suitable emphasis on process;
- *teaching and learning* is characterised by approaches that include investigation, individual and collaborative modes of working and an emphasis on developing an understanding of mathematics as richly connected concepts. The use of graphics calculators encourages and enhances these processes, enriching the learning of the students who engage in them.

## ***How can the use of graphics calculators be promoted?***

### ***By being fair to all students***

All students should have access to tools which enhance the learning of mathematics. In the case of graphics calculators this means that students should have appropriate access at all times. This is seen to happen mostly in settings where their use is expected by the education authorities.

Access to the technology is necessary but not sufficient to achieve equity. All students need teachers who are competent and confident users of graphics calculators and related technologies.

### ***Through effective teacher support***

Teachers' knowledge and skills are acknowledged as the most important influence on student learning. Hence, the advantages to students' learning through using graphics

calculators will be maximised when there is sustained, multi-faceted support for teaching and teachers' professional growth. Teachers are most influenced when they are active participants in approaches which enable the sharing of exemplary classroom practice through:

- materials for learning and assessment;
- applied and classroom based research;
- ongoing professional development processes which respond to needs as they are identified.

Supporting the extensive teacher development that is needed for the widespread use of graphics calculators in mathematics teaching and learning is the most important task and will contribute significantly to a major reconstruction of mathematics as experienced by our young people at the beginning of the 21st century.

### ***Through curriculum development***

Teachers and others will be involved in:

- critical review of content and sequencing;
- curriculum design that takes explicit advantage of available technologies for learning, doing and communicating mathematics, as well as learning across the curriculum.

### ***Through enhanced approaches to learning and teaching***

- Develop and disseminate examples of rich learning experiences which incorporate effective use of graphics calculators to assist teachers in creating engaging, dynamic and

productive learning environments.

- Enable graphics calculators to be used in ways which enhance classroom interactions and dynamics.
- Develop strategies to enable students with different learning styles to take advantage of the multi-representational nature of graphics calculators.
- Promote models for integrating use of graphics calculators into teaching and learning goals and processes which emphasise conceptual understanding.
- Emphasise the importance of students becoming critical users of graphics calculators through explicit teaching goals and strategies.

### ***Through enhanced approaches to assessment***

- Exploit the use of graphics calculators to support the assessment of the full range of curriculum goals.
- Ensure that graphics calculator use in assessment processes reflects their use in the classroom.
- Research and development of more effective assessment processes.

## ***Conclusion***

The use of graphics calculators enhances student learning and addresses important issues of equity and relevance of school mathematics to the wider world. There is a compelling case for the advantages offered to students who use graphics calculators when learning mathematics. They are empowering learning tools, and their effective use in Australia's classrooms is to be highly recommended.