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September 1998

Staff room

Geometer's corner



In the first instalment of a series of articles on the use of Geometry software at A-level, Paul Blythin of Peter Symonds' College takes us through his experiences with Geometer's Sketchpad.

Geometer's Sketchpad: an evaluation for use at A-level in a VIth form college

The Maths department in Peter Symonds' College, Winchester recently acquired a demonstration copy of "Geometer's Sketchpad" having seen some useful example files on the internet. There has been considerable activity using it in our department and, whilst as yet, we have rather limited experience with students to find the shortcomings, staff reaction has been positive. We believe that the tool will allow us to enhance the variety of delivery for a number of topics at A-level. The aim of this contribution is to explain the practicalities of acquisition and usage of the package and describe its use in some areas.

It costs nothing and is relatively simple to set up a working version on a stand alone 486 PC or on a college intranet. There is a lot of useful material available from the internet and it is that process that is described here. It will be familiar to colleges further down the ICT track and there will be similar stories to be told in other institutions concerning other applications. It is hoped that these pages might provide an exchange of such ideas.

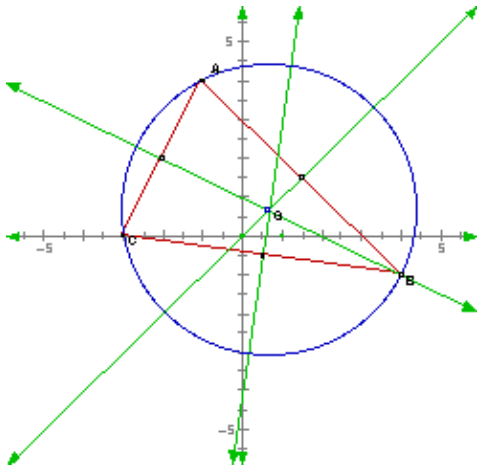
Our current state of play is that in addition to frequent use of IT for short demonstrations in maths classes we have been trialling the delivery of sections of the pure syllabus to the lower sixth, totally through a computer-based, interactive, open-learning approach. Students are given a brief introduction to the use of the materials and then work through a combination of software activities and written worksheets in their own time. Students may use any of the computers around the site to access the maths activity through the college intranet, however they are mainly to be found in the IT centre working on it. In addition to the college IT centre we have a PC in each maths classroom each with a video splitter that allows two monitors each to display the same screen image, enabling all of a class of 20+ to see a demonstration. The full benefit of Geometer's Sketchpad is probably only seen when used in a workshop environment, with each student at a machine and a class exchange of ideas with teacher guidance. There is a useful video provided with the single licence which shows this use of the tool in schools in San Jose, California.

This computer activity replaces their normal homework for a number of weeks and they take the regular topic test after an allotted time. Last year the topic was "Sequences and Series". The overall effectiveness of the

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process was considered to be successful for a majority of students. The main platform for the sequences and series work was the Excel Spreadsheet into which students enter their answers to problems posed following text explanations. Their answers are checked by the application as they are entered and hints or correct answers are available following any incorrect entries. This year the topic has been "Exponentials and Logarithms". The spreadsheet platform has been used again but with a slight extension of the technique using "action buttons" to pull in other applications as required. This item covers the assimilation of the Sketchpad into the college and its subsequent use in the open learning topic.

We had been introduced, in training days, to dynamic geometry software in the guise of Cabri Geometre, and had seen demos such as dragging an angle in a circle. If you have not come across it, dynamic geometry allows the creation of a geometric drawing that can be altered whilst maintaining given constraints (dragging points) to demonstrate a general point. For example, the angle formed by joining the ends of an arc to any point on the circle can be measured as the point is dragged around the circle.



A typical drawing constructed with Geometer's Sketchpad

At that time we thought that, with the emphasis on geometry, it was biased towards GCSE and probably not a justifiable purchase for use at A-level. During a quiet period after the exams, browsing the net, we found the Geometer's Sketchpad home page and the free demo. Out of curiosity we downloaded it and started to look at the contributed files from other colleges and was interested to find useful A-level material already there.

Although the name suggests that the tool is primarily for geometry, the latest release allows the definition of co-ordinates of points via mathematical functions and this, coupled with the locus facility, provides a means to extend its use into Cartesian geometry and into other aspects of the pure syllabus. The demo seems to have most of the function of the full licence except that it regularly reminds the user that it is only a demo and, although files can be edited and new files created, it will not allow anything to be saved. It also appears that some of the help is not there. This is not a great limitation, however, and it is quite useful just to have the demo and to download files produced in other institutions from the net to run on it. We have contacted the distributors in this country, Capedia^[1], and they are quite happy for teaching establishments to follow this same route to evaluate the package. They will provide the demo on disk, actually slightly more convenient than trying to download on our intranet, we found, with the added bonus of a hard copy of key pages of the manual and suggested lesson activities thrown in.

We started with the demo and a few downloaded sample files on our intranet and a hardcopy summary of their function was given to maths staff with the suggestion that they might be useful as illustrations in lessons. During an INSET session we were able to tinker with the samples a bit and generally criticise the layout but no one at that time was particularly enthused to use it. It was during a discussion of methods of teaching

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differentiation of exponentials and the properties of e that it was recalled that Sketchpad has a file on this topic. The file displays the graph of a^x and allows the student to drag the point $(1,a)$ on a vertical line through $(1,0)$, effectively changing the value of a .

At the same time the gradient function of the curve is displayed and students are invited to investigate the value of a when the curves overlap. We were able to bring that application up for use in the lesson that followed. Students were given the chance to interact with it and we were able to judge their reaction. One student was asked to collate their views and prepare the following paragraph for this article. At this stage we could only manipulate the file provided by another college and were unable to save any changes or create our own.

Views from a LVI Further Pure Maths class:

"The program allowed us to graph an exponential function and its gradient function. It was particularly useful to be able to zoom in to draw curves for different functions. It was particularly useful because it provided a visual representation which would be difficult to achieve with hand drawn graphs. The definition of graphics was much better than that of calculators and the way in which the graph shape could be altered by dragging the mouse made it more versatile than a calculator which simply displays a function. It was a simple way of helping to visualise a function alongside its gradient function – a chance to explore the relationship between the two that would not be possible with 'static' graphs and was therefore a useful aid to the course."

Whilst waiting for a department meeting to start a number of colleagues were discussing the pros and cons of the tool and had the application running on the computer. Other staff members began to take an interest and try other files in the downloaded directory. There are some enlightening dynamic demonstrations of the various graphical demonstrations of Pythagoras' law. The head of maths could see that there was a high degree of interest in the use of this package and the relative ease with which some members were creating new demonstrations, which prompted him to enquire as to the cost of being able to keep these original ideas. This amounted to the expenditure of about £80 for a single licence, which he agreed to, there and then. When the licence arrived it came with a video of sample classroom activities (San Jose Schools USA), photocopiable sheets for student investigations and a very concise reference manual. This allowed us to generate our own material and modify the existing file to suit our preferences and then have students use them on the demo copy on the intranet. There are a few nitty problems to do with the setting of preferences in the two versions to ensure that the graphs look the same in both. We will give details of that in a later issue.

We have since created files that allow students to investigate the properties of exponentials and lead into the basics of the rules of logs.

Downloading instructions

The free demo and sample files may be downloaded from the following site:

Key Curriculum Press

From the home page, select "Sketchpad resource centre" and then "Demo download". The files need to be unzipped. The workshop notes are there but need Adobe Reader and we found it easier to obtain them from Capedia, snail mail.

[1] Address: Capedia Ltd., Harford Centre, Hall Road, NORWICH NR4 6DG. Tel: 01603 259 900

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If you'd like to contribute to "Geometer's corner" please write to PASS Maths using [Any comments?](#).



Plus is part of the family of activities in the Millennium Mathematics Project, which also includes the [NRICH](#) and [MOTIVATE](#) sites.