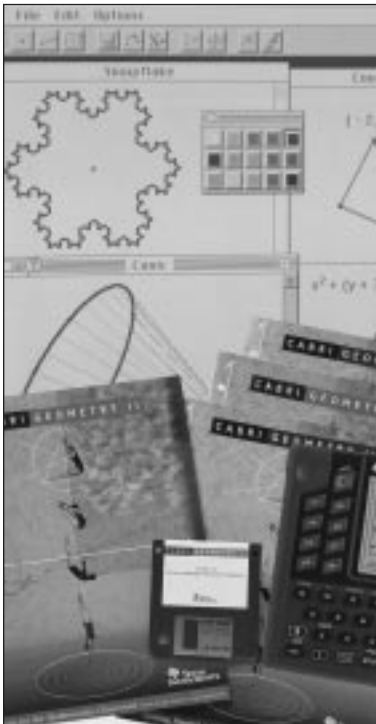


CABRI GEOMETRY II DYNAMIC GEOMETRY INVESTIGATIONS

Dynamic geometry software allows all pupils to explore shape and space in a way that has never before been possible. When you are competent with a few of the basic tools of a package such as Cabri II, it is possible to take a completely new look at some old ideas. The starting point(s) shown on page 2 give pupils a few ideas to explore. Perhaps for the first time in the area of shape and space pupils can start to pose their own



questions and simply and quickly find out what happens for a large number of cases.

It is important that the pupils record what they discover, perhaps using further software to capture their findings into a document on the computer. Some pupils can considerably extend the task by attempting to explain certain of their findings. The possibilities are endless.

Continued on page 2

DEAR TEACHER!

Welcome to the 8th issue of TI-Time! I want to thank those of you who have contributed to this issue with their ideas and articles. Sharing your activities in this newsletter expands your class size to include over 14,000 teachers in the United Kingdom and Ireland.

Your activities help many readers bring new and creative ideas into their classrooms. If you have an activity that you or your students have enjoyed, please share it with us! You can send them to us through any of the contact details on page 2.

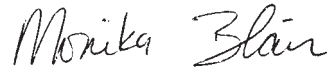
We are in the process of updating the TI-TIME database. If you would like to add yourself or a colleague to the mailing list, or receive multiple copies of upcoming issues, please let us know how many you need when contacting us, via page 2's contact details.

There have been many exciting events in education in the recent months including conferences and in-service training sessions (highlights from two of the in-service sessions from this past autumn

are found on page 7). 1997 will also be a busy year with many opportunities to see how Texas Instruments technology can be used to help enhance Maths and Science teaching. Amongst many events you will find opportunities at:

- The Mathematical Association Annual Conference at the University of Strathclyde in Glasgow (April 2-5).
- The Association of Mathematics Easter Conference at Westminster College in Oxford (April 1-4).
- Teaching with Technology, T³ courses (listed on page 8) provide the opportunity to learn how to use TI technology in your classroom.

Thank you for your continuing support. I look forward to hearing from you in the future!



Monika Blair
Educational Marketing Manager

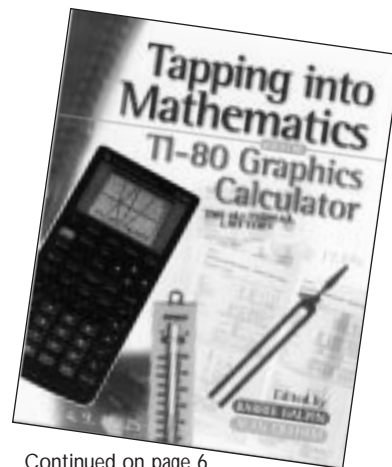
TAPPING INTO MATHEMATICS

Tapping into Mathematics with the TI-80 Graphics Calculator has been written for students who need to acquire basic mathematical skills, and is based on The Open University's very popular Mathematics Entry Course: Open Mathematics. The book takes a fresh approach to teaching basic mathematics, placing the Texas Instruments TI-80 machine at the centre of the learning experience. Students will find that learning mathematical principles in this way can be both exciting and fun.

This book teaches mathematical principles and how to use the graphics calculator more effectively. Basic calculations, statistical analysis and plotting, graphs and functions, simple algebra and trigonometry, modelling using the calculator's regression

facilities and simple programming are all covered. By the end you will be a confident calculator user, knowing when and how to apply this mathematical tool in a wide range of applications.

The book will be available in March 1997 from: Addison Wesley Longman Publishers (Tel 01279 623928).



Continued on page 6

CONTENTS

<i>Cabri Geometry II</i>	1	<i>The CBL™ System</i>	4	<i>Teaching Mathematics with a TI-82 Graphics Calculator</i>	7
<i>Tapping into Mathematics</i>	1	<i>Introducing CBR™</i>	5	<i>An Experiment</i>	7
<i>Cabri Geometry II (continued)</i>	2	<i>Tapping into Mathematics (continued)</i>	6	<i>T³ Latest Information</i>	8
<i>Contact Details</i>	2	<i>Inset Activities</i>	7		
<i>Pressing On</i>	3				

CABRI GEOMETRY II

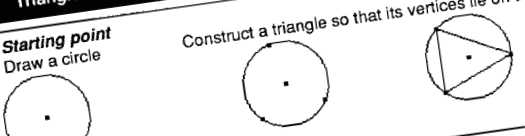
Continued from page 1

THE DYNAMIC INVESTIGATIONS

Illustrated here are examples of investigative starting points produced using Cabri Geometry II software.

Triangles inside circles

Starting point
Draw a circle



Construct a triangle so that its vertices lie on the circle

Investigate ... angles

What if....

- ...you keep one side fixed?
- ...you make one side a diameter of the circle?

Investigate further...

- ...join each vertex to the centre of the circle
- ...add a tangent to the circle...

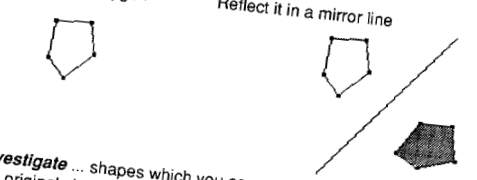
Where next? ...

© MAP, 1997

Write a report about what you find.

Losing the reflection?

Starting point
Construct a polygon



Reflect it in a mirror line

Investigate ... shapes which you can move so that their image lies exactly on top of the original shape.

... almost ...

... there ...

What if...

- ...you start with a different shape...
- ...you have two mirror lines...
- ...at right angles...

© MAP, 1997

Report about what you find.

CABRI GEOMETRY II

Geoff Wake
Mechanics in Action Project
School of Education
The University of Manchester

CONTACT DETAILS

If you would like to comment, contribute an article or simply find out more about TI calculators and accessories you can contact us in the following ways:

Telephone the TI Customer Support Line 9am - 5pm on : 01234 213394

Write to:
TI-TIME, FREEPOST CL4272 HARLOW, CM20 2YF

e-mail:
ticares@msn.com

or find us on the WWW:
<http://www.ti.com/calc/docs/uk.htm>

PRESSING ON

PUTTING THE BRAKES ON

The Highway Code gives a table of total stopping distances for cars travelling at different speeds. The total is made up from the distance travelled before the driver realises what's happening, and the distance travelled in bringing the car to a stop.

Shortest Stopping Distances					
Speed	Thinking Distance	Braking Distance	Total	Total	Total
mph	ft	ft	ft	m	Length
20	20	20	40	12	3
30	30	45	75	23	6
40	40	80	120	36	9
50	50	125	175	53	13
60	60	180	240	73	18
70	70	245	315	96	24

Average car length = 4 metres

Can you display some of this information on a scatter graph of the total distance Y against the speed X? What would you predict the distance might be at 10 mph, 80 mph, 0 mph ...?

Can you find the line of 'best fit' (called 'linear regression') of the form $Y = mX + c$? Would a different kind of curve give a better fit?

See if you can find a quadratic fit of the form $Y = aX^2 + bX + c$.

STOPPING DISTANCES ON THE TI-82 OR TI-83

Press [STAT], use [4] to select {4 : ClrList} and then [L1] [,] [L2] [ENTER]. Now use [STAT] and [1] to select {1 : Edit.}, and enter the data in columns L1 and L2.

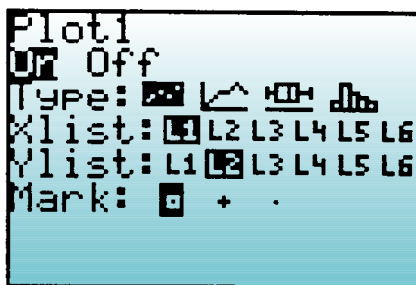
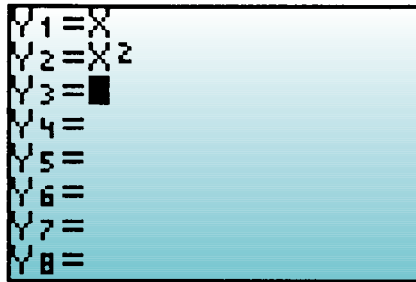


L1	L2	L3
20	40	
30	75	
40	120	
50	175	
60	240	
70	315	

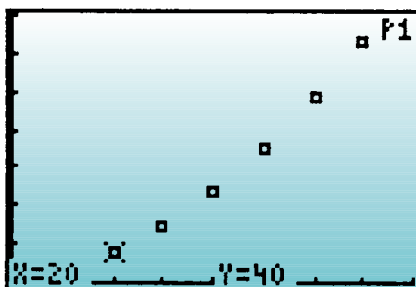
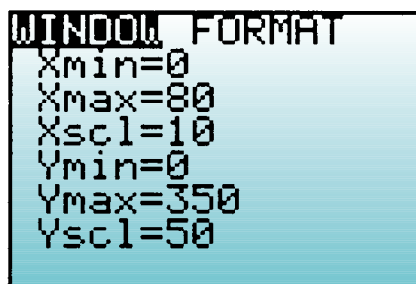
L2 (7) =

Use [MODE] to select {Func}, use [Y=] to display any stored functions. Move the cursor across to any "=" signs which are highlighted and press [ENTER] to deselect them. Then use

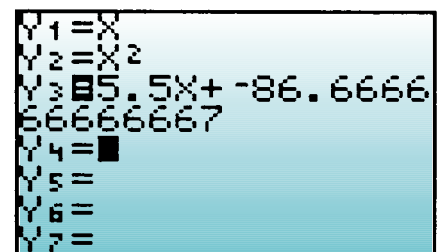
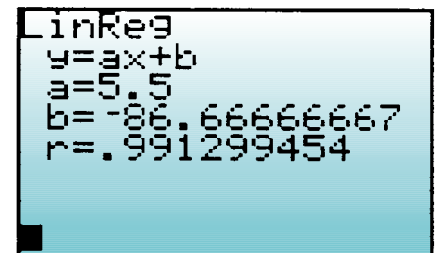
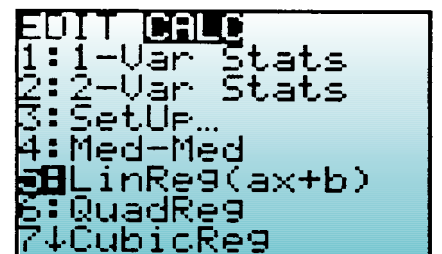
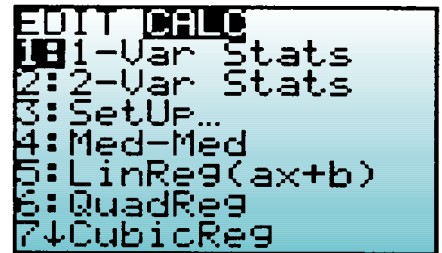
[2nd] [Y=] to select [STAT PLOT] and select {on}. Then press [WINDOW].



Set suitable scales and then press [GRAPH] and [TRACE].



From [STAT] {CALC} first use {2 : 2 - Var} then {5 : LinReg}. Use [Y=] then [VARS] {5 : Statistics...} and {EQ} {7 : RegEQ} to paste the regression equation into the Y list, then [GRAPH].



You will find the regression equation now displays graphed through your data. Now try again with e.g. {6 : QuadReg}. Try fitting equations to other sources of data - e.g. span and height.

W. Evans, A. Oldknow and G. Wickham.

The full activity booklet is available for sale at a cost of £3.50 from University College Chichester (Tel: 01243 816365 or 01243 816370).

THE CBL SYSTEM A SIMPLE SOLUTION TO WHOLE CLASS DATA LOGGING

As the Science IT Co-ordinator within an eleven to sixteen Secondary school, I have often been very frustrated with the practical and financial difficulties that restrict us in the use and development of data logging experiments in the classroom.

Within the National Curriculum for Science we are instructed to include data logging activities in our schemes of work, and we are expected to assist with the IT National Curriculums requirement for data collection and processing. There is no doubt that the use of data collection equipment can improve the pupils understanding of practical work but how are we meant to introduce it to all pupils in a convenient and cost effective way?

To meet our requirements most effectively, I would want ideally to have 'hands on experience' for all pupils as part of normal investigation work, and the equipment to be easily available so that all pupils can use it frequently. Some schools are lucky enough already to have complete class sets of data loggers, but often these systems work remotely, still having to be programmed and then downloaded via a PC. The most effective system would be completely



portable so that there would be very little need to involve the use of computers at all.

I had considered this aim to be impossible for us to achieve, as the costs of a totally portable system has been beyond our budget, but now I believe I have found a simple solution to whole class data logging within experimental investigations.

I have a set of ten Texas Instruments CBL's which has enabled me to carry out a number of class practicals with groups of pupils as young as twelve. I have found that the CBL system is totally portable because the calculator controls the data logger and it can also be used to store, study and compare the results of the practical work. There is no need for a computer at all, apart from copying the chosen CBL programs

to the first calculator. I could use a computer to study or print the lists of data collected, but in most cases this is not required, as the calculator's functions are more than adequate to analyse the results properly.

The CBL system is very versatile as it has a wide range of common probes available and I have discovered that it can be adapted to use some of our older electronic sensors. I can store the class set of data loggers very easily in two normal equipment trays and then transport the equipment to other labs for my colleagues to use with any class. All that the teacher has to do is distribute one CBL and calculator per group and the pupils can be collecting data in no time.

To assist with the development of the CBL system, I have become involved in preparing some Pupil Activity Sheets aimed at KS3 and KS4 Science. Each of these has related teacher notes which are linked into the National Curriculum for both Maths and Science. To simplify the use of the CBL with these younger pupils I have also modified some of the CBL programs and prepared some work cards which give simple instructions for starting programs and the sorting or retrieving graph data. A selection of these materials will be available to accompany the CBL as part of the Texas Instruments loan programme, (01234 213394). I can now see that with the inclusion of investigations which utilise the CBL, we will really be able to improve the quality and quantity of Data Logging investigations within our schemes of work.

*Mark Pinsent
Science IT Co-ordinator
The City of Portsmouth Girl's School
MPinsent@aol.com*



INTRODUCING CBR™

AVAILABLE THIS SUMMER

How can we help students gain a better understanding of functions and graphing? Is there an easy way to demonstrate maths applications in the world about us?

TI is introducing the new CBR™ (Calculator-Based Ranger™), to help you bring maths to life!

You can discover how simple and affordable real-world data collection can be with CBR. Everything you need to start is in the box—just connect a graphing calculator! Students quickly explore the physical meaning of slopes, intercepts, derivatives and integrals as they capture the motion of rolling carts, thrown balls, even other students. View and analyse time, distance, velocity, and acceleration graphically or in data lists. Demonstrate linear, parabolic, and sinusoidal relationships using data the students gather themselves.

CBR FEATURES:

Plug-and-Go capability:

Connect your TI-82, TI-83, TI-85, TI-86, or TI-92. Press one button to automatically send the built-in RANGER program to your calculator. CBR will take advantage of the display and processing power of the calculator, while making your job

less complicated.

Simplified setup:

Begin collecting data immediately with the Easy-Sample option.

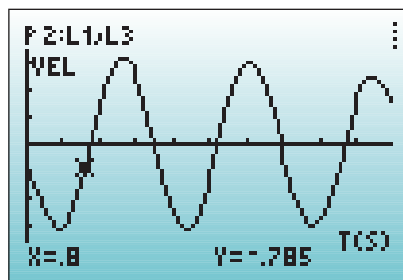
Versatility:

It's easy to use. CBR guides you effortlessly through even the most advanced setups.

Status indicators:

Find out quickly how you're doing.

Green light: everything is fine; red light: attention requested. Status is also indicated by simple tones.



Plotting options:

View graphs of your data, either as you sample or afterwards. Choose distance, velocity, or acceleration versus time and let CBR's automated plot options handle the rest. Challenge your students to reproduce random distance-time or velocity-time plots using the interactive MATCHIT.

Convenient pointing:

CBR offers the flexibility you'll need to handle challenging situations. Hold CBR in your hand, lie it flat on a table, or mount it to a table or door edge using the handy clamp (included). Flip open the sensor head to point precisely at the object.



Triggering choices:

To start sampling, use the calculator's ENTER key, or select 10-second delay for hands-free operation.

Need real portability? Setup your sample, disconnect CBR and take it where you need it, then press the TRIGGER button to start. Later, attach the calculator to get your data.

CBR™/MBL compatibility:

You can use CBR as your motion probe, or use a CBL motion program with CBR.

Computer connectivity:

Use TI-Graph Link™ to send the data and graphs from your calculator to a computer for further analysis, or for creating exciting reports.

Support:

Discover the value of CBR immediately. Getting Started with CBR™ (included) features quick setup instructions, motion fundamentals, and ready-to-use classroom activities. Other materials are being developed to meet specific classroom needs in the future.

CBR can help you bring a new level of excitement to your maths or science class. For further information on this exciting new development please contact customer support: 01234 213394.



TAPPING INTO MATHEMATICS

Continued from page 1

EXCERPTS FROM 'TAPPING INTO MATHEMATICS WITH THE TI-80 GRAPHICS CALCULATOR'

The following excerpts are a sample of the "Brain Stretchers" found throughout the text to encourage further exploration.

Brain stretcher

Can you produce the following graphing screens? ZDECIMAL has been used for the window settings.

Circling around

Brain stretcher

(a) How do the graphs of $y = \sin^{-1}x$, $y = \sin^{-2}x$, and $y = \sin^{-5}x$, compare with those of $y = \sin x$, $y = \sin 2x$ and $y = \sin 5x$?
What generalizations you can make here?

(b) How do the graphs of $y = 2\sin x$, $y = 3\sin x$, and $y = 5\sin x$ compare with the graph of $y = \sin x$?
What generalizations can be made here?

(c) Can you produce the following screen displays?

Times of the sines

Earlier in this chapter you met MIN and MAX, both of which required a single argument, the name of a list. RANDINT requires two arguments. These may be integers (whole numbers) or lists of integers. You will use RANDINT with integers in this section: in this case, the first integer must be smaller than the second.

Select RANDINT by pressing 5.

Then press 1 \square 6 \square \square **ENTER**

Your should have produced an integer chosen at random in the range 1 to 6, *inclusive*. Get the calculator to do this again a few times. Remember that you do not need to enter the whole command again: simply pressing **ENTER** repeatedly will cause the last command entered to be carried out again and again. Your screen should look rather like the one below, although it would be surprising if it looked exactly the same: after all you are expecting randomly chosen numbers. Spend a few minutes now exploring the command RANDINT with different integer arguments.

RANDINT(1,6)

5

Brain stretcher

In Chapter 2, you used SEQ(to produce a sequence of numbers. For example, SEQ(2X, X, 1, 6, 1) produces the first six even numbers.

If you had RANDINT (1, 49) instead of 2X, it would produce six random numbers between 1 and 49. To enter this, use the following key sequence.

2nd **[LIST]** **4**
MATH **[>]** **5** **1** **[,]** **4** **9** **[,]**
[,] **X,T** **[,]** **1** **[,]** **6** **[,]** **1** **[,]** **ENTER**

There could be a problem if you wanted to use these numbers in a lottery draw. Can you see what the problem might be? Can you think how it might be solved?

Lottery

Brain stretcher

Imagine that you are standing at the water's edge of a totally calm sea. How far away is the horizon?

The popularly held view seems to be about 25 miles or 40 km. Check this for yourself with your calculator using Pythagoras' theorem. You can calculate the radius r of the earth since you know the circumference is 40011 km. Use an appropriate figure for your height.

Now try standing on a 50-m cliff.
Surprised?

I can see for miles and miles

MATHEMATICS TEACHING WITH THE TI-92

The Mathematics Education Group within the School of Computing and Mathematical Sciences at Liverpool John Moores University recently presented an Inset course 'Mathematics Teaching with the TI-92', assisted by a grant from NCET and support from Texas Instruments.

The sessions were attended by a dozen teachers from the Liverpool and Merseyside area and offered two afternoons and one evening of hands-on experience with a TI-92 each. As well as providing an opportunity for delegates to explore the TI-92's ability to support topics from the National Curriculum (the topics covered included solution of simultaneous equations, function transformation, geometry, statistics and its ability to aid the visualisation of mathematical concepts) the sessions also addressed issues such as the impact on:-

- Curriculum content, ordering and presentation
 - Teaching
 - Assessment
- and provided a forum for debate on the general issue of technology in the classroom. Subsequent to the first session, members of the Group have been invited to visit several local schools to give pupils the opportunity to work with the TI-92.

*Stewart Townend
Reader in Mathematics Education
Liverpool John Moores University*

TEACHING MATHEMATICS WITH A TI-82 GRAPHICS CALCULATOR

21 OCTOBER -18 NOVEMBER 1996

This Course was aimed at Mathematics Teachers in Scottish Secondary schools and at the Higher Grade Mathematics course in particular. The emphasis was on the use of the calculator in teaching the content of the course and it was assumed that the teachers attending the course had little or no knowledge of the calculator. This indeed was predominantly the case. For those who did not have a TI-82; a calculator was loaned for the duration of the course. The course was split over 5 consecutive evenings and the programme of events is given below.

- Evening 1 Introduction to the main features of the machine
Here the teachers were introduced to the facilities that the TI-82 has that are beneficial to teaching Higher Grade Mathematics.
- Evening 2 Algebra topics and the TI-82.
- Evening 3 Calculus topics and the TI-82.
- Evening 4 Geometry topics and the TI-82.
- Evening 5 Trigonometry topics and the TI-82.

Each evening participants received teaching materials for use within the classroom and notes giving details of what had been covered in that evenings work.

As well as the necessary course materials participants learned how to save work as a graph database (GDB), transfer from one TI-82 to another and transfer data between a TI-82 and a

MAC/PC and vice versa. This is ideal for preparing class lessons and for their safe storage until they are needed again. On the final evening the participants were given a disc of programs that could be used in the classroom with their pupils. The course was found to be very useful to all those taking part, although those with a greater working knowledge did find the pace a little too slow. However even those that have a knowledge of the machine found that they were learning things that the TI-82 could do that they did not know about! A follow up course is planned in April for those that attended this course and any newcomers, contact me by e-mail for more information; JGCReid@aol.com

*Jim Reid
Assistant Principal Teacher
Hermitage Academy*

AN EXPERIMENT LINEAR ALGEBRA AND THE TI-92

During the academic year 1996-97 the teaching of the second level module 'Linear Algebra' during the first semester has been supported with a loaned class set of TI-92's. They will be similarly used to support the second semester's module 'Applied Linear Algebra'. The students were already familiar with DERIVE and adapted quickly to the TI-92. After the first session their first questions were 'How much are they?' and 'Where can I get one?!' The students inputted matrices easily

but unless told otherwise they tended to use x for the name of a matrix. This proved hazardous if they stayed in the main folder and subsequently did some calculus or used x in another context. Since the TI-92 remembers everything it is given, some strange entries appeared in the Homefield! Well, how do you differentiate the square of a matrix?! In the tutorials, for light relief, the students were introduced to Cabri Geometry II™. They were fascinated and looked forward to more in the following weeks. Wonderful to see a group of students who were clearly enjoying spending time doing mathematics which is neither on their syllabus nor assessed.

*Brian H. Denton
Liverpool John Moores University*

CORRECTION

Thank you to those who identified an error in the autumn issue of TI-TIME, within the AIRSHOT program. In the fourth section the line $\text{rand}+H$ should read $\text{rand} \rightarrow H$. Our apologies for any inconvenience this may have caused.

TEACHERS TEACHING WITH TECHNOLOGY



The Teachers Teaching with Technology, T³ programme is underway! This program provides three days of inservice for teachers on the use of Texas Instruments technology in the teaching and learning of Mathematics. All course materials are developed by a team of teachers with national and international expertise in the use of technology, curriculum design, teaching and training. The course team have designed the materials to increase teacher confidence in using hand held technology, identify examples of good practice in use, and enable teachers to enhance student understanding. This effort is being co-ordinated by the Centre for Teaching Mathematics at the University of Plymouth.

The three day courses that were developed by this team are:

● **Enhancing Mathematics with Graphic Calculators (Maths KS3/4).**

This course is designed around the TI-83 calculator particularly for 11-16 mathematics. It covers familiarity with the major features of the graphics calculator, practical examples of their use in teaching, strategies for developing new teaching approaches, assessment issues, and introduces associated technologies (such as CBL).

● **Teaching and Learning A Level Mathematics with Graphing Calculators (Maths A Level).**

This course uses the TI-83 to enhance core A Level mathematics. The topics explored include the properties of polynomials, differential calculus, trigonometry, transformation of functions, differential equations, and numerical solutions of equations.

● **Visual Imagery and Geometry Software in Developing Understanding (Geometry).**

This explores ways in which images produced using Cabri Geometry II software and the TI-92 can be used interactively to motivate students. As well as being relevant to the Shape, Space and Measures programme of study in mathematics curriculum, ideas will be explored on notions of proof, justification, and reasoning, as well as modelling.

The T³ summer school, #9 on the matrix below, will be held in Devon. Three courses will be offered consecutively and are open to teachers from across Europe. The three courses that will be offered are:

● **Advanced Mathematics with the TI-92.** This course is aimed at teachers of upper secondary school mathematics. The content of the course explores the use of the TI-92 in teacher algebra, calculus, graphs, numerical methods, matrices, complex numbers and modelling.

● **Understanding Statistics.**

This course aims to show teachers how the concept of statistics may be effectively explored using the TI-83. During the course, teachers are engaged in modelling, exploring probabilities, empirically deriving critical values, validating models, discovering properties of parameters, capturing data and exploring bivariate data.

● **Visual Imagery and Geometry Software in Developing Understanding (Geometry).**

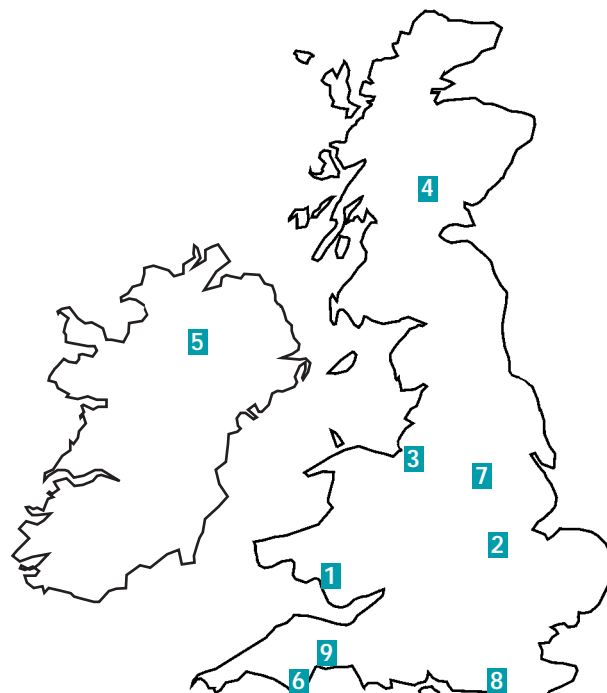
(Outlined Left).

● **T³ in Scotland**

The Scottish team hopes to offer courses based on the best classroom practice and on new technology. A major reorganisation of post-sixteen education is about to take place in Scotland so the team is concentrating initially on the use of technology in lower secondary mathematics classrooms. Believing that the introduction of new teaching approaches is achieved more effectively when whole departments are involved, the team will offer short courses to groups of cooperating schools, giving the course in one of the schools to minimise staff travel etc. The team is drawn from across the whole of Scotland and is co-ordinated by John Searl at the University of Edinburgh. Dates are not available at the time of printing. John Searl can be contacted by e-mail for updates Searl@maths.ed.ac.uk

	DATES	COURSES	VENUES	ORGANISER	ADDRESS
1	July 3,4,18	LC1 (Maths KS3/4)	Swansea	Sonia Jones	Department of Education University of Wales, Swansea, Hendrefoalon, Swansea SA2 7BN
2	May 30,31, June 14	LC3 (Maths KS3/4)	Leicester	Wendy Fisher	Bosworth College, Leicester Lane, Desford, Leicester LE9 9JL
3	April 18,19, May 23	LC4 (Maths KS3/4)	Liverpool	Terence Eтчells	School of Comp & Math Sciences, Liverpool John Moores University, Liverpool L3 3AF
4	T.B.A.	T.B.A.	Scotland	J. Searl	Mathematical Education Dept University of Edinburgh, JCMB, Kings Buildings, Edinburgh EH9 3JZ
5	June 23,24,25	LC6 (Maths KS3/4)	Jordanstown	Ken Houston	School of Computing & Maths University of Ulster, Jordanstown, N Ireland BT37 0QB
6	March 1,15, April 12	LC7 (Maths A level)	Plymouth	Roger Fentem	College of St. Mark & St John, Derriford Road, Plymouth PL6 8BH
7	March 1,15, April 12	LC8 (Maths A level)	Sheffield	Harry Gretton	School of Science & Mathematics, Sheffield Hallam University, City Campus, Pord St, Sheffield S1 1WB
8	May 1,9,20	LC9 (Geometry)	Winchester	Adrian Oldknow (apply to Mrs Barbara Spray)	The Maths Centre Chichester Institute of H.E. Bognor Regis, Sussex PO21 1HR
9	July 3,5,	SS1 (Advanced Maths & TI-92) SS2 (Statistics) SS3 (Geometry)	Devon	John Managhan Roger Fentem Adrian Oldknow	Crossmeads Conference Centre, Exeter, Devon.

T³ and T³ Europe are trademarks of Texas Instruments Inc.



For more information on the T³ courses, please contact the Centre for Teaching Mathematics at the University of Plymouth, 01752 232772.

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..... Postcode

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Subject taught: Maths Engineering Sciences IT
Position: Teacher Head of Dept Head Teacher Maths Adviser
Lecturer Student Other (please state)



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