



# Centre for Teaching Mathematics News



Issue 13  
Autumn 2004  
[www.tech.plym.ac.uk/maths/CTMHOME/CTM.HTML](http://www.tech.plym.ac.uk/maths/CTMHOME/CTM.HTML)

## Welcome

Welcome to the Autumn 2004 edition of the CTM News. We publish this newsletter every term and distribute it to schools, colleges and interested people. If you are reading somebody else's copy please contact the Centre secretary to be added to the mailing list. Also if you are moving schools and would like to continue receiving the newsletter please send us details of your new school. The newsletter will contain information on the staff and activities of the CTM. Each issue will contain a teaching resource which might be a graphic calculator activity, a problem solving activity or a practical mechanics problem. This term we have a photocopiable resource for all ages – the 24 challenge – can you make the number 24 out of the four numbers given, and the start of a series on 'What's gone wrong'.  
Editor – Jenny Sharp [jsharp@plymouth.ac.uk](mailto:jsharp@plymouth.ac.uk)

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## The Centre for Teaching Mathematics

The CTM is an inter-faculty group of mathematics educators based at the University of Plymouth within the Mathematics Department and the Education Faculty at Exmouth plus associate members.

The aims of the Centre are:

**C**reative Resources and Research

**T**raining for Teachers

**M**athematics Enrichment for Pupils

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## Contacting Us

Members of the CTM can be contacted via the Secretary:

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## Graphic Calculator Key Record Conference

As published in earlier editions (9 and 11), the Centre has developed a piece of Graphic Calculator software which provides a method to reveal the unseen activities of students. The software works in the background collecting the keystrokes as students work with their calculator. Subsequently we can replay the software and observe the students work. This type of observation is unique in the area of calculator usage and we hope that through the software we can gain insights and a better understanding of just what the students are doing with the calculators.

We are holding a one day conference on Wednesday 10<sup>th</sup> November on the use of the key record software. The day will have three main purposes:

- i. Presenting summaries of work which has been done.
- ii. Discussions on technical issues and replaying/capturing of data.
- iii. Discussing potential future projects and collaborative ideas.

The conference will be held at the University of Plymouth and is open to any one interested in how students use their graphic calculators. There is no charge for the day. If you would like to attend the conference or would like further details then please contact Ted Graham on 01752 232773 or by email: [egraham@plymouth.ac.uk](mailto:egraham@plymouth.ac.uk)

## Mathematics and Statistics Student Profile – Maha Abdul- rahman



As an international student I was advised to take a foundation course prior to a degree course. I, therefore, enrolled in the HITECC Extended Engineering programme in 1995 (now called Foundation Pathways in Technology). The

programme was very well structured, and covered a wide range of Engineering subjects. I found the Engineering Applications module very interesting, providing hands-on practical experience in the different aspects of Engineering. The Mathematical module in the course prepared me for the degree I finally chose which was the BSc (Hons) in Applied Statistics with Management Science.

I chose this degree because I wanted to combine statistical analyses with business applications. The course allowed a certain degree of flexibility with optional statistical modules to choose from, as well the choice of a business module, from which I chose Accounting (Financial Accounting and Management Accounting). I found most of the statistical modules very interesting, as they were linked to real-life problems, and a variety of computer programmes were used to solve them. The Operational Research modules, although the most challenging, were perhaps the most appealing to me, and I subsequently undertook an MSc in Operational Research at the London School of Economics in 1999-2000.

I am currently working for the Bahrain Telecommunications Company as a pricing analyst, where I apply my statistical and accounting background to practical use.

## Talks for Schools

The School of Mathematics and Statistics at the University of Plymouth is happy to provide speakers on a wide range of topics to increase interest in our subjects. Each talk lasts for about an hour. There is no charge to the school.

Unless otherwise stated, these talks are generally accessible for GCSE and A-level students. Further details can be found at [www.plymouth.ac.uk/maths](http://www.plymouth.ac.uk/maths)

Talks currently available include:

- Mathematics and Statistics Degrees and Careers
- Why Take A-Level Maths? (for Year 11)
- Modelling in Mathematics A-Level
- Coincidences and Statistics
- The Statistics of Medical Trials
- Probability and Risks
- Making Money with Mathematics: how secure is the internet?
- Enigma: the theorem that won the war
- Magnetic Recording: mathematics in small bytes
- Sticky Liquids – Science with Bubbles (for Key Stage 2)
- Expecting the Unexpected (Concepts in Mechanics)
- 100 Years of Quantum Theory
- What's the Matter with Antimatter?
- Quarks: the building blocks of matter
- Why everyone needs to know at least a little numerical analysis: or 'Maths Book + Computer = Wrong Answer!'
- Is Mathematics Invented or Discovered? (for Year 10)

Unless otherwise stated, these talks are generally accessible for GCSE and A-level students. Further details can be found at [www.plymouth.ac.uk/maths](http://www.plymouth.ac.uk/maths)

If you would like to arrange a talk, please contact

Dr Martin Lavelle,  
[mlavelle@plymouth.ac.uk](mailto:mlavelle@plymouth.ac.uk)  
Tel: 01752 232729,  
fax: 01752 232780

## Mathematics and Statistics Subject Conference

The School of Mathematics and Statistics recently held a one day conference for mathematics teachers from schools and colleges. About 30 teachers attended the day and it provided an opportunity for teachers and lecturers to come together and discuss our subjects and students' perceptions of them. Mathematics at post 16, the current structure and contents of degrees in maths and stats and the many career opportunities for graduates were discussed. We also debated the 'maths problem' and how we can together try to promote a greater interest and take up in our subject. It is hoped that this conference will become an annual event. For further details please contact Martin Lavelle on [mlavelle@plymouth.ac.uk](mailto:mlavelle@plymouth.ac.uk)

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## Continuing Professional Development

### Teaching and Learning A Level Mathematics with a Graphic Calculator

**Friday 26<sup>th</sup> November 2004**

The AS and A2 syllabuses in Mathematics expect students to be using a graphic calculator. This hands-on, practical course will provide you with the skills and resources to incorporate this technology into the teaching *and* learning of mathematics. During this full day course you will explore the use of a graphic calculator in teaching topics in pure mathematics and statistics.

The course is designed for those teachers who have no experience of a graphic calculator as well as those who have some experience but would like to extend their competence.

A TI83+ graphic calculator will be provided for delegates use during the course.

The course fee is £160 which includes an extensive set of classroom ready resources, refreshments and lunch.

## Courses for 2005 in Plymouth

We have a number of cpd courses planned for June 2005:

- 21<sup>st</sup> – 24<sup>th</sup> June: CAS, Modelling and Investigations in International Baccalaureate Mathematics
- 27<sup>th</sup> – 29<sup>th</sup> June: Decision & Discrete Maths 1
- 20<sup>th</sup> June: A Level Mathematics with a Graphic Calculator
- 27<sup>th</sup> June: Core Mathematics 1
- 28<sup>th</sup> June: Core Mathematics 2
- 29<sup>th</sup> June: Core Mathematics 3
- 30<sup>th</sup> June: Core Mathematics 4
- 29<sup>th</sup> June: Statistics 1
- 30<sup>th</sup> June: Mechanics 1

## Courses for 2005 in London

We are running a number of courses this year in Central London:

- 22<sup>nd</sup> April 2005: A Level Mathematics with a Graphic Calculator
- 8<sup>th</sup> June 2005: Core Mathematics 3
- 8<sup>th</sup> July 2005: Core Mathematics 4

To receive further details about any of these courses please contact Julie at the address on page 1.

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## Help needed with Research Projects

Two of our research students are looking for volunteers to help with their projects. They need to find teachers and pupils who would be willing to spend a short amount of time completing questionnaires.

Questionnaire A is for teachers and concerns their views about the teaching of geometry.

Questionnaire B is for 14–15 year old school pupils. It concerns their views of the school subjects; mathematics, music and art.

Your help with these projects would be very much appreciated. If you are able to help please contact Ted Graham by email: [egraham@plymouth.ac.uk](mailto:egraham@plymouth.ac.uk) and he will send you the questionnaires and a return envelope.

## Work Experience at the CTM

Last term saw three year 10 students from two different schools spending a week at the Centre for their work experience. During the week they followed a programme of varied activities, which left free time to work on a task set by the Centre's staff.

The programme followed by the students included:

- Carrying out experimental work on particle physics and quantum theory, in one of the University's laboratories.
- Talking to a mathematician about the careers that are available for mathematics graduates.
- Talking to a statistician about the career opportunities for graduates from statistics degrees.
- Sitting in on a session of one of our cpd courses
- Helping staff run a widening participation maths taster day for year 8 students.

During their "free" time the pupils worked on their task of developing programmes for the TI-83 graphics calculator. They were given some introductory advice and shown an existing programme. Armed with this, they bravely got stuck into the task. As the week progressed they asked lots of questions, and needed some help debugging their programmes. By the end of the week they were confident and fairly accomplished programmers. The programmes can be downloaded from the resources section of the CTM website (the address is on the front page of this newsletter). Work experience students this term will be assisting in the production and checking of material for a text book.

The pupils seemed to gain a great deal from the experience, and left seeming to have had a good experience of life in a mathematics department at a University.

We have allocated two weeks next year for work experience students. They are September 27<sup>th</sup> – October 1<sup>st</sup> 2004 and June 6<sup>th</sup> – 10<sup>th</sup> 2005. If you would like to discuss the possibility of students applying for work experience at the Centre please contact Ted Graham on 01752 232773 or by email: [egraham@plymouth.ac.uk](mailto:egraham@plymouth.ac.uk)

## Revision Days

The Centre runs A level Revision Days throughout the year. We have two planned to coincide with the January Examinations, one in Plymouth and one in London.

### C1 Revision Day – Plymouth

**15<sup>th</sup> December 2004**

Suitable for MEI, AQA and Edexcel. The provisional time table for the day is as shown:

10:30 Algebra  
11:20 Calculus 1 or Binomial Expansion  
12:00 Lunch  
13:00 Coordinate Geometry (Straight Lines)  
13:40 Calculus 2 or Curve Sketching  
14:20 Break  
14:40 Series and Sequences (APs) or  
Coordinate Geometry (Circles)  
15:00 Graphs and Transformations or  
Factor and Remainder Theorems  
15:30 Day Ends

### C1 Revision Day – London

**20<sup>th</sup> December 2004**

Suitable for Edexcel. The provisional time table for the day is as shown:

10:30 Algebra  
11:20 Coordinate Geometry (Straight Lines)  
12:00 Lunch  
13:00 Differentiation  
13:40 Integration  
14:20 Break  
14:40 Series and Sequences (APs)  
15:00 Graphs and Transformations  
15:30 Day Ends

The cost of each day is £12. For more details and an application form please contact Julie Tombs at the address on page 1.

It is possible for us to come to your school to run a revision day specifically tailored to your students and board. We can do C1, C2, C3, C4, S1 or M1. The cost of such a day would be £360 for groups up to 30. For larger groups we would charge £360 (for 30 students) plus £6 for each additional student. In addition, travelling expenses would also need to be covered by the school. For more information please contact Ted Graham on 01752 232773 or by email: [egraham@plymouth.ac.uk](mailto:egraham@plymouth.ac.uk)

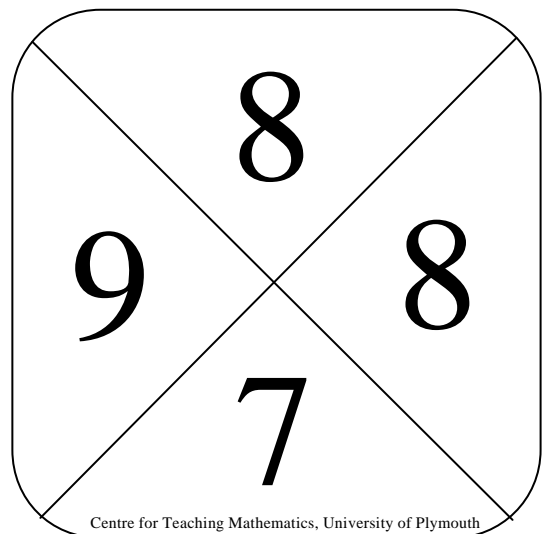
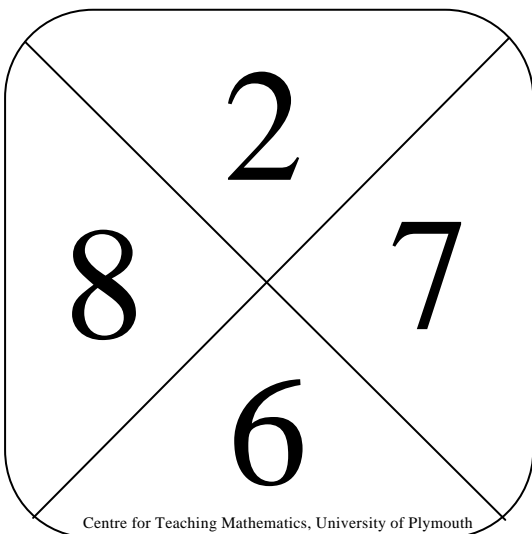
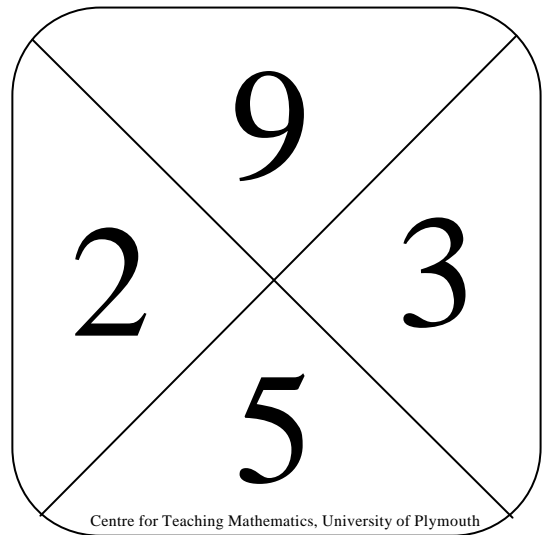
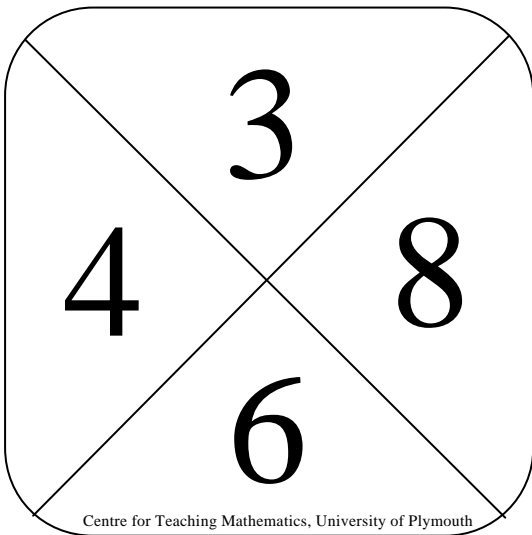
# The 24 Challenge

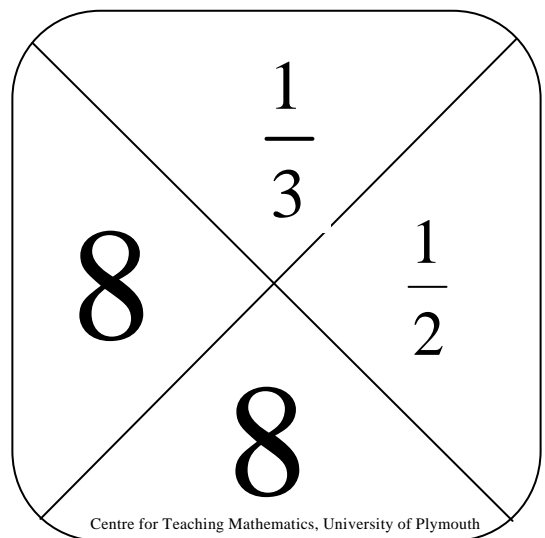
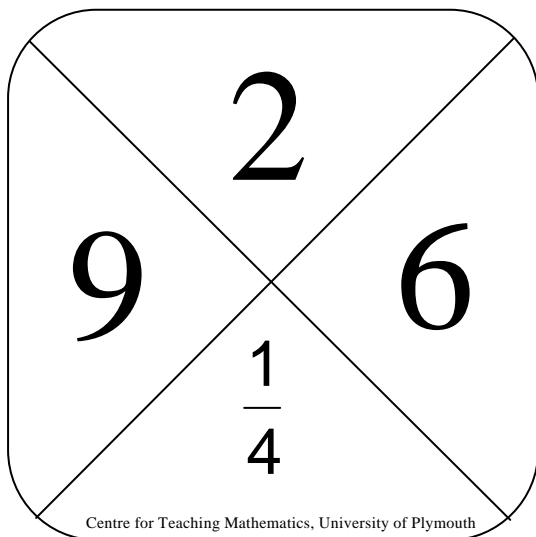
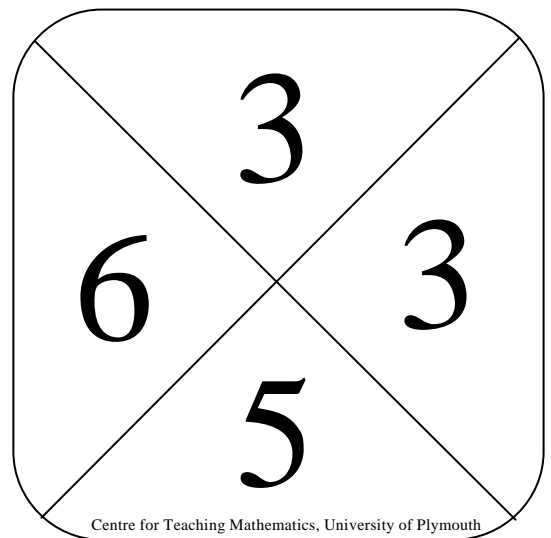
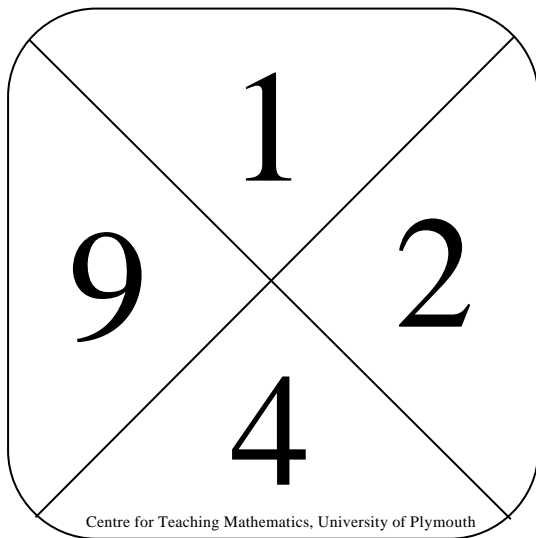
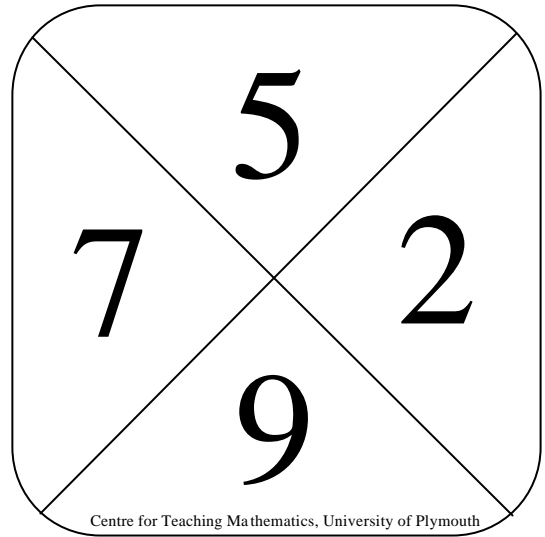
We have used the 24 challenge with students from Primary through to VIth form as a way of getting the brain going – ideal for the mental starter! 24 is a great number to work with because it has a large number of factors. We will be publishing 10 cards an issue, you can photocopy them onto card for students to use individually or in pairs or onto transparency to use with an OHP for a whole class activity.

The rules are simple:

Make the number 24 by:

- Using all four numbers once and only once
- Using the four operations  $+$ ,  $-$ ,  $\times$  and  $\div$



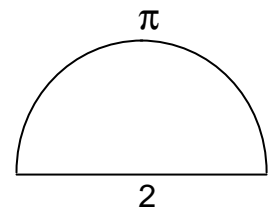


# What's Gone Wrong?

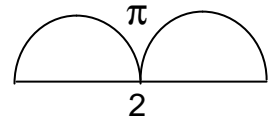
In issues 10 and 11 we ran our 'magic maths' challenges to encourage the use of formal proof in mathematics. As a result I was sent a nice 'What's gone wrong' question by John Miller – many thanks John it took me a while to work it out! This inspired me to include a number of other 'What's gone wrong' proofs. If you have any others that we can share then please email me on [jsharp@plymouth.ac.uk](mailto:jsharp@plymouth.ac.uk).

## What's gone wrong 1

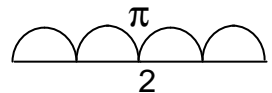
Consider a semicircle of diameter 2. The length of the perimeter is therefore  $\pi$ :



Split the arc into two, maintaining the base at 2. The total perimeter is still  $\pi$ .



Split each arc into two, maintaining the base at 2. The total perimeter is still  $\pi$ .



And so on! If we continue to increase the number of semicircles but keep the length of the line as 2 then the 'humps' approach the straight line and we can prove that  $\pi = 2$

## What's gone wrong 2

$$+1 = \sqrt{+1}\sqrt{+1} = \sqrt{+1 \times +1} = \sqrt{-1 \times -1} = \sqrt{-1}\sqrt{-1} = -1$$

## What's gone wrong 3

Suppose that  $a = b$

$$\text{Then } a^2 = ab$$

$$\text{Hence } a^2 - b^2 = ab - b^2$$

$$\Rightarrow (a - b)(a + b) = b(a - b)$$

$$\Rightarrow (a + b) = b$$

Now substituting  $a = b = 1$  for example, we obtain  $2 = 1$ .

## What's gone wrong 4

$$\frac{x+3}{x-5} - 4 = \frac{3x-23}{7-x}$$

$$\Rightarrow \frac{x+3-4(x-5)}{x-5} = \frac{3x-23}{7-x}$$

$$\Rightarrow \frac{-3x+23}{x-5} = \frac{3x-23}{7-x}$$

$$\Rightarrow \frac{3x-23}{5-x} = \frac{3x-23}{7-x}$$

Hence  $5 = 7$

## What's gone wrong 5 – Supplied by John Miller

$$3^2 = 3 + 3 + 3 \quad (3 \text{ of them})$$

$$4^2 = 4 + 4 + 4 + 4 \quad (4 \text{ of them})$$

$$x^2 = x + x + x + \dots + x \quad (x \text{ of them})$$

Differentiate with respect to  $x$

$$2x = 1 + 1 + 1 + \dots + 1 \quad (x \text{ of them})$$

$$2x = x \quad (\text{assuming } x \text{ does not equal } 0)$$

$$2 = 1$$

### What's gone wrong 1

This is a classic example of the dangers of infinity – basically take care whenever you make the generalisation that things remain the same when they get infinitely large.

### What's gone wrong 2

The fourth step is wrong because  $\sqrt{a \times b} = \sqrt{a} \times \sqrt{b}$  only if  $a$  and  $b$  are positive

### What's gone wrong 3

If  $a = b$  then  $a - b = 0$  and as you know you should never divide by zero!

### What's gone wrong 4

The original statement was an equality to solve not an identity presumed true! Take care to do what you are meant to be doing.

### What's gone wrong 5

Line 3 is only true for integer values of  $x$ . To differentiate a function it must be continuous.