



# Centre for Teaching Mathematics News



Issue 16  
www.tech.plym.ac.uk/maths/CTMHOME/CTM.HTML

Autumn 2005

## Welcome

Welcome to the Autumn 2005 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 Centre for Teaching Mathematics – this issue has more news than usual due to exciting changes! As promised in the last issue we have the next instalment of the graphic calculator programs for KS2 and again we have our ever popular 24 challenge – can you make the number 24 out of the four numbers given.

Editor – Jenny Sharp [jsharp@plymouth.ac.uk](mailto:jsharp@plymouth.ac.uk)

## The Centre for Teaching Mathematics

The CTM is an inter-faculty group of mathematics educators based at the University of Plymouth within the School of Mathematics and Statistics 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

## Contacting Us

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## CTM and CIMT to Merge

Over the summer the Centre for Innovation in Mathematics Teaching (CIMT), run by David Burghes and his team, has moved from its base in Exeter to the University of Plymouth. During the current academic year the CTM and the CIMT will merge to form a single centre. This is a very exciting development and will allow the members of both centres to work more closely together. There have always been strong links between the two centres, which has resulted in collaboration between staff. Perhaps the most notable of these have been on the Mathematics Enhancement Project (MEP) and through the Spode Group publications. The new centre will have considerable potential and some significant developments are already taking place. More news on the merger and the title of the new centre will appear in the next few issues of the newsletter.

Readers looking for the CIMT website, which contains a wealth of excellent resources, should visit [www.intermep.org.uk](http://www.intermep.org.uk) or [www.cimt.plymouth.ac.uk](http://www.cimt.plymouth.ac.uk)

## National Centre for Excellence in the Teaching of Mathematics

David Burgess and Ted Graham have been working with a team to develop a proposal for the National Centre for Excellence in the Teaching of Mathematics (NCETM). It has recently been announced that the private education firm Tribal working with the University of Plymouth is the preferred bidder for the centre and we are now working through the fine detail of the contracts and the proposal. The NCETM will begin work in April 2006, but preparations are underway for this exciting new opportunity. There will be national launch in June followed regional events. More details about the NCETM will be available in future issues. As we work up to the launch much of David and Ted's time will be taken up by this task and some new

faces will be appearing to ensure that the existing work of the CTM and the CIMT continues.

At the heart of the work of the NCETM will be the collaborative practice model of professional development. David has provided short introduction to this which is included in this newsletter.

The NCETM will be essentially a virtual centre with a web portal through which its activities are coordinated and resources are disseminated. We will give the web portal address in a future issue when it is up and running.

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## **Cornwall and West Devon Further Mathematics Centre**

Ted has been working with a team of teachers and lecturers from schools and colleges to draw up plans for the Cornwall and West Devon Further Mathematics Centre (CWDFMC). The team has produced a plan that has been provisionally approved by the National Further Mathematics Network and is close to reaching the final agreement. At present we are resolving some minor issues associated with insurance cover. A management team has been formed for the CWDFMC and as soon as the contracts have been signed we will be looking to appoint a Further Mathematics Centre Manager. The Centre Manager will be responsible for coordinating and increasing the provision of Further Mathematics as well as delivering some of the modules needed by the students. The CWDFMC is a very exciting development with considerable potential and will require a dynamic and enthusiastic person to work as its manager. If you would be interested in applying for this post, please register your interest by contact Julie Tombs by email ([jtombs@plymouth.ac.uk](mailto:jtombs@plymouth.ac.uk)) who will send you a job description when it is available. Once the Centre Manager has been appointed work can begin in earnest to increase the provision of Further Mathematics for students in Cornwall and West Devon.

The CWDFMC is one of about 50 Further Mathematics Centres (FMC) that will be

formed across the country. If you are not located in our area there will be plans for an FMC in your area. Please consult the National Further Mathematics Network website for more information.

### **CENTRE MANAGER NEEDED**

An enthusiastic manager is needed for the Cornwall and West Devon Further Mathematics Centre

For more information please contact Julie Tombs.  
([jtombs@plymouth.ac.uk](mailto:jtombs@plymouth.ac.uk))

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## **Collaborative Practice Model for CPD: NCETM Pathfinder Schools and Colleges**

### **1. Introduction**

Despite endless reforms, numerous tests and increased accountability, there still seems to be little progress in implementing more effective strategies for teaching mathematics in schools and colleges, even when considerable sums of money are spent (e.g. the National Numeracy Strategy). Although the funding of the *NNS* was generous, its use of a cascade model of dissemination does not seem to have been effective and its reliance on taking teachers out of the classroom resulted in over-use of supply cover (which in turn has caused more problems).

Over the past decade, we at CIMT have learned much about effective mathematics teaching from colleagues in Eastern European countries such as Hungary, Poland and the Czech Republic. The main focus of the *Mathematics Enhancement Programme*, which aimed to put these findings into practice in English schools, was on whole-class interactive teaching, where the pupils in a class learned from each other and supported each other in a positive, friendly atmosphere and where the whole class made progress. More recently, we have gained a

deeper understanding of these countries' methods of initial and inservice training of teachers which are similar in concept to whole-class interactive teaching. They place a strong emphasis on collaborative work where students and teachers learn from, and contribute to, the teaching of others, thus raising standards of pedagogy for all concerned. In addition, it was common for such professional development sessions to include teachers from other schools. Over the past three years, we have been experimenting with this approach in the training of student teachers (through multiple placements) and in CPD and have found the model to be very effective. We are seeking to build on these early experiences by developing a *collaborative practice* model for CPD which could be used in all schools and colleges.

The model is based on the Eastern European model but is also similar to the Japanese 'Lesson Study' and to an initiative instigated by James Stigler in the USA. Our early experiences have enabled us to refine and adapt the model for English schools and colleges, building on the opportunities presented by the Government's current 'remodelling of the workforce' initiative. In what follows, we give more details of how we would like Pathfinder Schools and Colleges to implement the *collaborative practice* model in their particular environments.

## 2. Implementing the Collaborative Practice Model for CPD

In summary, the *Collaborative Practice* model for CPD is an ongoing, regular activity in which colleagues have the opportunity to observe, analyse, discuss and reflect on each other's mathematics lessons in a spirit of cooperation and mutual support. It could also involve collaboration in lesson planning but we do want to stress that the activity should focus on 'normal' lessons, not specially planned ones.

1) Time is found and protected during the school week when as many teachers as possible can be freed to observe a colleague's usual lesson and afterwards can review the lesson in depth in a relaxed atmosphere (e.g. on a Friday, the lesson before lunch, the review taking place over a

special lunch provided by the school).

2) The teachers work as a group under the leadership of the Head of Department, or Mathematics Coordinator, or an expert teacher (e.g. AST) in the school, or an expert teacher from another school or an adviser from the local support network. In secondary schools, the group might involve the whole department or if the department is large, two groups might be more manageable; in primary schools, the group size will be dependent on the size of the school. However, each group should include staff across all years, so that teachers understand their place in a child's mathematical development by knowing and building on what has gone before and knowing and preparing for what is to come.

3) On a regular basis, each teacher in turn plans and teaches his or her usual lesson for that day and the lesson is observed by the rest of the group (A lesson could be videoed if several members of the group are unable to see it in person.) As soon as possible afterwards, the lesson is analysed, discussed and reviewed by the whole group, with the person who taught the lesson giving his or her own analysis first (what went well and what did not, what needs changing next time, etc.) followed by reviews from each member of the group and with final comments and summary from the group leader. In the light of the reviews, the group suggests, discusses and agrees on actions for a specific teacher and/or for the whole group.

4) These priorities for action should be noted and acted on for subsequent lessons, so that teachers learn not only from their own successes and failures but also from the ideas, misconceptions and effective strategies of others.

5) Possible priorities for action could include:

- more detailed planning (detailed on-line lesson plans could be used as a starting point)
- collaborative planning (with one or more of the group involved)
- help with mathematics subject knowledge (audits and self-help material are available on-line, or more knowledgeable teachers could act as tutors)
- pedagogy (observation of more expert

teachers, learning about effective strategies in lesson plans and research papers available on-line, trying out and evaluating new strategies before their next observed lesson)

- classroom management (acting on advice from the group and observing how more expert teachers handle similar difficult situations successfully)
- more effective use of ICT (expert teachers and technicians can give help and advice and demonstrate by example in their own observed lessons)
- information on new topics, contexts, equipment, resources, assessment, etc. for the whole department can be obtained on-line or an inservice session for the whole school or department can be arranged through the local or regional network).

It is crucial that the exercise is seen not as an occasional occurrence but as an ongoing, regular professional development activity which is of benefit to all teachers in the department or school, whatever their level of expertise. It should be regarded as a continuous spiral of small incremental steps leading to a long-term general raising of standards in the teaching of mathematics.

### 3. Networking

We have already learned that for this model of CPD to be effective, it requires at least one expert teacher (but preferably more) to play a key central influencing role.

Although we know that this expertise is already present in the chosen pathfinder schools, initially we are happy to act as a catalyst to get the initiative off the ground.

Once a pathfinder school has become familiar with the model, we envisage that the school itself will act as the external catalyst to influence other local schools.

'Networks' are currently very much on the political map at the moment but what we want to show here is how networks can be formed and used effectively to improve mathematics teaching in a local area. It is the practical implementation that needs to be worked on rather than the production of

glossy brochures containing words which do not have any precise meaning in the real world.

### 4. Pathfinder Schools

The main purpose of the Pathfinder Schools is to find out how we can implement the *collaborative practice* model most effectively in a variety of schools and colleges. Although the time needed for implementation of the model should be available through the 'remodelling the workforce' initiative, it will also require creative timetabling in secondary schools and colleges and the use of classroom assistants to supervise suitable activities for pupils in primary schools. There might be other issues, problems and solutions that we are not yet aware of and that is why we want to learn from you.

It is hoped that the *collaborative practice* model of CPD will also influence the teaching of other subjects in primary schools and transfer across to other departments in secondary schools and colleges.

In summary, we want you to make this work in your own institution and to pass on your experiences to others. We will give you as much support as we can.

**Ted Graham and David Burghes**

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## Continuing Professional Development

### Courses for 2005/2006 in Plymouth

We have a number of courses for teachers of A level mathematics who wish to update their subject knowledge or for teachers who are about to teach A level for the first time.

- 26<sup>th</sup> June 2006: Mechanics 1
- 27<sup>th</sup> June 2006: Core Mathematics 1
- 28<sup>th</sup> June 2006: Core Mathematics 2
- 29<sup>th</sup> June 2006: Core Mathematics 3
- 30<sup>th</sup> June 2006: Core Mathematics 4

These one day courses costs £150 which includes lunch, refreshments and resources

- 27<sup>th</sup> – 30<sup>th</sup> June 2006: CAS, Modelling and Investigations in International Baccalaureate Mathematics. This four day course costs £5300 which includes accommodation, meals, resources and a TI-89.

## Courses for 2005/2006 in London

We are running a graphic calculator course this year in Central London:

- 13<sup>th</sup> December: A Level Mathematics with a Graphic Calculator. This one day course costs £175 which includes lunch, refreshments and resources. A TI84 will be made available for delegates use on this course.

Further details and reservation forms can be found on the website:

<http://www.tech.plym.ac.uk/maths/CTMHOM>

[E/training\\_courses.htm](http://www.tech.plym.ac.uk/maths/CTMHOM)

or contact Julie at the address on page 1.

## 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. Both days are suitable for all exam boards.

### C1 Revision Day – Plymouth

Monday 19<sup>th</sup> December 2005

10:30am – 3:30pm

### C1 Revision Day – London

Tuesday 20<sup>th</sup> December 2005

10:30am – 4:30pm

The cost of each day is £12. Further details and reservation forms can be found on the website:

<http://www.tech.plym.ac.uk/maths/CTMHOM>

[E/MEP\\_revision\\_days.htm](http://www.tech.plym.ac.uk/maths/CTMHOM)

or contact Julie 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)

## Graphic Calculator Programs for KS2

In the last newsletter we gave details of the work by Ted Graham and Paulette Smith on the use of graphic calculators in KS2. As part

of this work they have developed a number of programs for use by the students during their year 5 mathematics lessons. This issue concentrates on the **Convert, Metric and Metricu Programs**

These three programs are concerned with working with units, both metric and imperial.

Figure 1 shows the opening screen for the Convert program and typical problem.

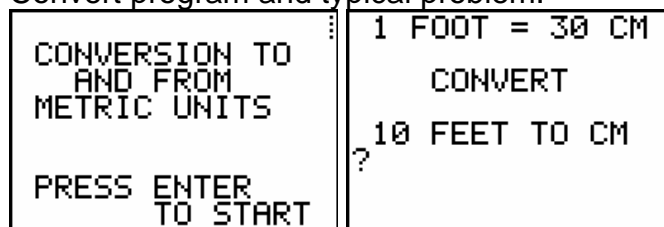


Figure 1 – Two Screens from the Convert Program

In all of the problems the pupils are given a conversion factor and a quantity, in this case a distance, in one set of units to convert to different units. There are six conversions that are included in the program and these are available in two levels. Table 1 lists the allocation of conversion factors to levels.

Level	Conversion Factors Used
1	1 inch = 2.5 cm 1 mile = 1.5 km 1 foot = 30 cm
2	1 inch = 2.5 cm 1 mile = 1.5 km 1 foot = 30 cm 1 kg = 2.2 pounds 1 ounce = 30 grams

Table 1 – Conversion factors used in the Convert Program

When the pupil gives an incorrect answer, they are shown the calculation that was required and the correct answer as illustrated in Figure 2.

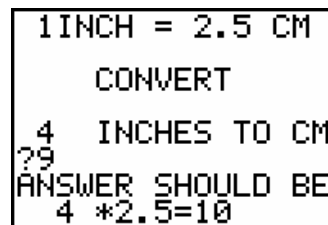


Figure 2 – Typical Feedback Following an Incorrect Response in the Convert Program

The program then creates the next question using the same conversion factor. Once a correct response has been obtained the

program selects a different conversion factor at random from the options.

The **Metric** program was developed to give the pupils practice in rounding metric units and also in converting between different metric units. Figure 3 shows the opening screen for the program and a sample question. In this question the pupils is required to round a distance using the units specified, but not to change the units that are involved.

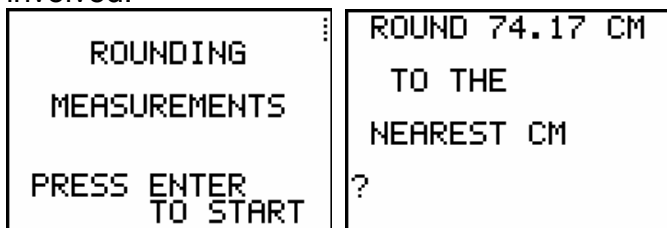


Figure 3 – The Opening Screen and a Simple Rounding Question from the Metric Program Problems at the higher levels also require a change of units as well as some rounding. Figure 4 shows two questions where the pupil has to convert units as well as carrying out some rounding. In these two examples, the students has convert from cm to metres and grams to kg.

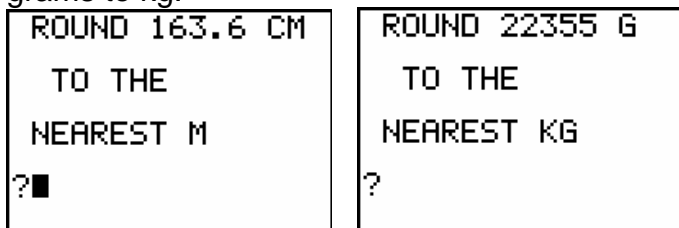


Figure 4– Two examples from the Metric Program that Require a Change of Units as well as Rounding

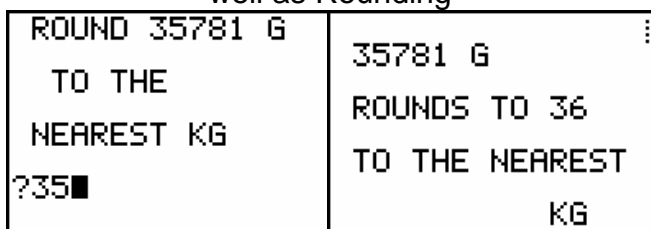


Figure 5 – Typical Feedback Following an Incorrect Response in the Metric Program

Further work on metric units is also to be found in the program **Metricu**. The program operates at two levels. In the lower level a definition of the relationship between the two units is given, while in the second level no such definition is included. Figure 6 shows two problems one from each level. The range of conversions also vary between the two

levels. Table 2 lists the conversions that were required at each level.

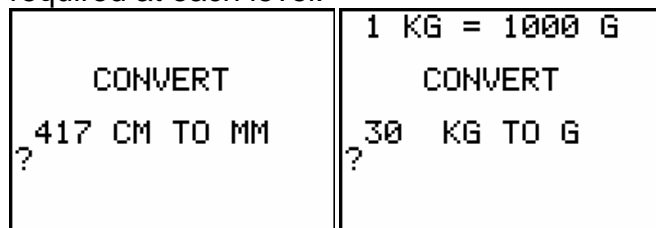


Figure 6 – Screens from Levels 1 and 2 of the Metricu Program, with and without the conversion factor.

Level	Conversions Required
1	km to metres metres to cm cm to mm kg to grams
2	km to metres metres to cm cm to mm kg to grams metres to km cm to metres mm to cm grams to kg

Table 2 – Conversions Used at the Different Levels of the Metricu Program

Again constructive feedback is given when a pupil inputs an incorrect value. Figure 7 shows the type of feedback that was given in these cases.

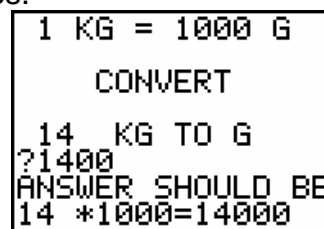


Figure 7 – Feedback From Metricu Program

All the programs are written for the TI83 or TI84 range of calculators and can be downloaded from our website: [www.tech.plym.ac.uk/maths/CTMHOME/Resources\\_GC\\_KS2\\_Programs.htm](http://www.tech.plym.ac.uk/maths/CTMHOME/Resources_GC_KS2_Programs.htm)

(note Resources is all one word)  
In the next issue we will give details on the perimeter and area programs  
**Ted Graham**  
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  $\div$

