







**O) Limit free derivatives**

$$s \ x \ -9 \ \mu \ 9 \ \sim x - 9 \ \mu \ 9 \ \vee$$

The standard approach to finding the gradient of a function at a point is via a limiting argument. This generalises readily to calculate the derivative of the function, literally the “derived function”. All textbooks provide the standard limiting argument involving  $h$  tending to zero. In this workshop, I will discuss an alternative “limit free” approach to calculating the derivative of polynomial and rational functions. The limit free approach avoids all the philosophical difficulties of starting with  $h > 0$  but then using the result when  $h = 0$  “in the limit”. While the limit free approach is not intended as a serious alternative to the standard approach, it does enable us to link together graphical representations and transformations of polynomials with polynomial long division and ultimately Taylor's theorem in interesting ways.

**P) If only we had a device...**

*Phil Moon*

There are some questions that Dr. Google can't answer, but good thinkers can. Good thinkers make good mathematicians. Employers looking for good thinkers are increasingly using techniques such as Fermi questioning. We will discuss Fermi questions, their place in the classroom and other ways to encourage good thinking in maths education.

**Q) 60 Years of the International Mathematical Olympiad**

*Adam McBride*

On the occasion of the Diamond Jubilee of the IMO, I shall talk about some of its history and personalities, look at a few of the questions set and recall a few personal experiences.

**R) Connecting up the C-P-A sequence**

*Stuart Welsh @maths180*

The use of concrete materials and pictorial representations can provide students with opportunities to use their own awareness to develop fundamental mathematical concepts. However, consideration must be given to the “journey” through the representations as we guide students towards the ultimate goal of symbolic fluency.

In this hands-on workshop, Stuart will demonstrate how Cuisenaire rods and algebra tiles can be used to develop conceptual understanding in topics ranging from negative numbers and fractions, to completing the square and algebraic division, and how we can support students as they work towards purely symbolic representations.

**S) A Mathemagical Mystery Tour 3 ... .. a Recurring Relation**

*Mike Smith*

Even more mathemagical mysteries, numerical nonsense, coded conundrums, Möbius manipulations, algebraic agility and a few other alliterative activities! Not in any syllabus but engenders engagement, enhances enthusiasm and promotes positivity. Relax with a Saturday session of sums!

For your record

Your choices	1	2	3	4	5	6
Workshop/Talk/Discussion Group						

**MA Bookstall**

A stall will be available for delegates to see the wide range of material which is produced by the MA. It will be an opportunity to buy at special conference rates and also for non-members to join.

**Come prepared!**

Preview at:

[www.m-a.org.uk/Shop](http://www.m-a.org.uk/Shop)