Paper Imagination
Teacher Information Sheet

more maths grads
multiplying opportunities

This activity can be run with KS3 students and involves learning how a range of card tricks and number puzzles rely on mathematics to work.

Students should have pencil, paper and calculator.

Suggested timings:

- **10+ minutes** Try out the first two number puzzles on the students. (Contained in "Number Puzzles.doc") The one on the first slide will always yield the same answer. The second one will be a different answer for different students and requires a little mental arithmetic by the 'magician' at the end.
  After you have amazed the students, run through the algebra with them to explain why these tricks work
- **10+ minutes** The next trick requires some setting up and to make it effective you need to find some data for students in your class. Choose two or three good attendees and find out their birthday and/or house numbers – it is much better if the numbers are at least mid-late twenties (you can use the link below to obtain matrices). The matrices in the slides are for someone with a birthday on 21st and someone who lives at house number 92. Use some psychic power to 'choose' the student to take part. The student needs to choose one number in the matrix and circle it. Then you cross out all the other numbers in that row and column and the student chooses another number and you make similar crossings out etc. until all the numbers in the matrix have been either circled or crossed out. Then the student needs to add up the chosen numbers (could get other students to help out) and hopefully he/she will spot that this is a significant number (although experience shows that sometimes a bit of hinting may be necessary!). Run through with at least two students – then show how it works.
  The next two slides show how these matrices were formed – the numbers in the matrix are the sum of the corresponding numbers in the additional row and column. The question is how are the extra numbers are found – they are numbers which sum to the special number.
  Run through how to form a 3×3 matrix (the example on the slide is for 29), and then you could run through why this always work using algebra (see the next slide).
  "magic_matrix.doc" is a worksheet the students can use to make their own.
- **20+ minutes** A selection of card tricks that rely on mathematics. For younger students we have tended to do this part of the workshop as a bit of a show. With older students (and if time permits) we let the students practise the tricks more in pairs with their own pack of cards.

The message we wanted to emphasise was that maths is everywhere, fascinating and extremely useful!

http://www.10ticks.co.uk/s_mathemagician.aspx# has some more tricks and things and also a link to 'The Magic Matrix' which will create the magic matrices for a specific number.
http://www.cs4fn.org/mathemagic/index.php reveals more mathematical tricks and the computer science behind them.

more maths grads is a three-year project funded by the Higher Education Funding Council for England to develop, trial and evaluate means of increasing the number of students studying mathematics and encouraging participation from groups of learners who have not traditionally been well represented in higher education.