

Outreach talks available from members of the Mathematics Institute

Here is a list of talks that have been given and could be given again, though we cannot guarantee availability. All the talks are to some extent adaptable for a longer or a shorter session. If there is a topic on which your school would like a talk, but which is not listed here, it is worth contacting the outreach coordinator to see if someone can be persuaded to give one.

Outreach Coordinator: David Mond, Mathematics Institute, University of Warwick. Tel: 02476 523570 e-mail: d.m.q.mond@warwick.ac.uk

1. Alex Bartel What is this “butterfly effect” really all about?

Content: Many natural processes, such as the climate for example, can be modelled as so-called dynamical systems. We will play with a very simple dynamical system, and will see that it already exhibits really complicated and surprising behaviour. This talk will feature mathematical experiments, order, chaos, beautiful fractals, and music.

Duration: 1 hour

Age range: Year 10 upwards.

2. Alex Bartel What are Diophantine equations and how do I eat them?

Content: Diophantine equations are equations where the “unknowns” are integers, like the Pythagorean equation $a^2 + b^2 = c^2$, which has infinitely many integer solutions, e.g. $(a, b, c) = (3, 4, 5)$, or $(5, 12, 13)$, or $(39, 80, 89)$, or the Fermat equation $a^3 + b^3 = c^3$, which, as we now know, has no integer solutions (if we discount trivial cases like $a = 0$ and $b = c$). Problems of this type go back to the Ancient Greeks, yet they are also at the heart of modern mathematical research. I will introduce you to this rich area, and will discuss some of the few things that we know and some of the many things that we still do not know.

Duration: 1 hour

Age range: Year 11 upwards.

3. Bruce Westbury The game of Nim

Content: Nim is a very simple game for which it is possible to devise a winning strategy, which turns out to be best described using binary numbers (in which “2” plays the role of “10” in the decimal system). The students will play the game and then work their way towards the winning strategy.

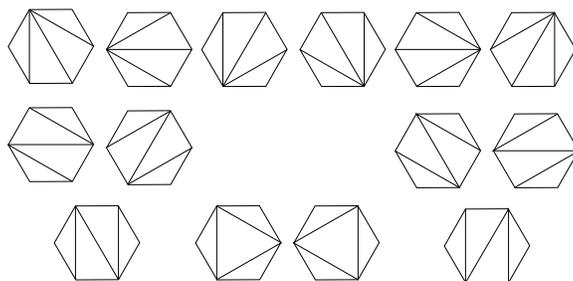
Duration: 1 hour

Age-range: Years 7-10.

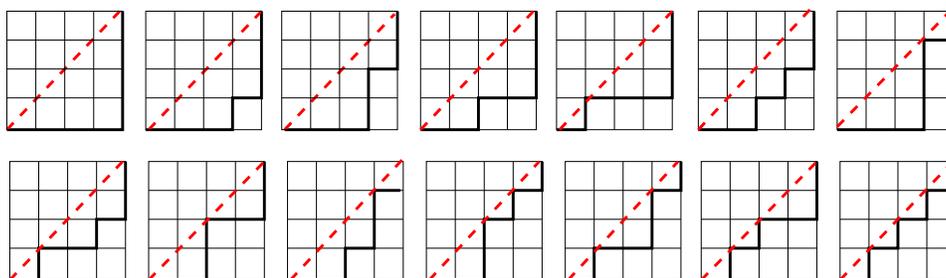
4. Bruce Westbury Catalan Numbers

Content: Catalan numbers are certain positive integers C_1, C_2, C_3, \dots which occur in many different counting problems.

- For example, C_n is the number of ways a regular polygon with $n + 2$ sides can be divided up into triangles by joining its vertices by straight lines. The following hexagons illustrates the case when $n = 4$.



- C_n is also the number of paths from bottom left to top right corner of an $n \times n$ square grid, that do not cross the diagonal, and always go up or to the right. Here we show the case $n = 4$.



These numbers occur in many other different contexts. The talk illustrates several of them and asks the students to look for connections between them.

Duration: 1 hour

Age-range: Year 10 upwards.

5. David Mond Game Theory and Climate Change

Content: Why have climate negotiations failed so far to reach any agreement? Game Theory, a branch of mathematics with many applications to the study of human behaviour, provides some interesting answers. The mathematics is very simple, but it helps to clarify many puzzling aspects of the world, and can sometimes help to provide solutions to political and economic problems. The talk introduces some basic examples such as the Prisoner's Dilemma and the Tragedy of the Commons, and links the abstract structures to their real incarnations in social and economic behaviour.

Duration: 1 hour

Age Range: Year 10 upwards.

6. David Mond The problem solving mindset

Content: What strategies can help us solve mathematics problems? The talk introduces a few, and offers some problems to apply them to. The aim is to help students who are confronted with a problem they do not know how to solve, to progress from thinking “Oh dear, I don’t know the answer”, to saying “How interesting!”.

Duration: 1 hour

Age-range: Year 9 upwards.

7. Damiano Testa Rational Numbers and Knots

Content: I give a practical demonstration of knot-tying. Six audience members stand in a circle and tie a large and complicated knot by following precise numerical instructions. A different set of instructions then leads, if carefully followed, to untying. The untying especially is rather dramatic.

Duration: 30-40 minutes.

Age range: Year 8 upwards.

8. Nigel Burroughs Mathematics in Biology

Content: Life is a very complex thing, and although Biology and Mathematics are often thought of as opposite ends of the school spectrum, mathematical modelling is having a profound impact on understanding Biology. Only through constructing mathematical models can the complexity in Biology be unravelled. Here we will discuss what it means to model a Biological process and show a few examples of modelling in action.

Duration: 1 hour.

Age range: Year 11 upwards.