



# Oxford Mathematical Institute Spring 2011, Number 9 Newsletter

We hope that you enjoy receiving this annual *Newsletter*. We are interested to receive your comments, and also contributions for future *Newsletters*.

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Photo by Ruth Preston

***I am confident that we'll overcome these challenges and I look forward to playing my part in the years to come.***

## Sam Howison A note of welcome

**On 1 January Prof. Sam Howison, former Director of the Oxford Centre for Industrial and Applied Mathematics and of the Nomura Centre for Mathematical Finance, took over the reins as Chairman of the Mathematical Institute from Prof. Nick Woodhouse.**



*Sam Howison writes:* I took over as Chairman on the first of January, the lowest ebb of the year but also a time of new beginnings. Walked into my office on the first day; phone rang as I took off my coat: six burst water pipes in the Gibson Building (our beach-head on the Radcliffe Infirmary site). Welcome to your new job, Mr Chairman.

My main first impression is that I inherit a department at the top of its game. The list of honours and awards later in the *Newsletter* shows that our academics are world-leading, and they're supported by a first-rate administrative and support staff. According to the Research Assessment Exercise of 2008, we're the leading research department in the UK, and have one of the largest and best undergraduate intakes as well.

These things don't just happen; they have to be planned and executed. We've been through a period of tremendous change in the last few years, during which the whole structure of the department was more or less rebuilt from scratch. When Nick Woodhouse took over in 2001, we were a small, humanities-style department in a fairly centrally controlled university. Following the North Report, many central functions, both academic and financial, were devolved to newly created Divisions and their departments. At a stroke, departments had freedom to steer their own courses. It was a huge achievement on Nick's part to see the

opportunity and put the vision into practice in the often byzantinely complex context of a collegiate university. We're now a large, science-style department with an annual budget greater than the total of EPSRC's funding for research in mathematics. We owe an enormous debt of gratitude to Nick and all who supported him.

However, we face some serious challenges. The episode of the leaking pipes is a pointed reminder of one of them: our physical infrastructure is woefully inadequate and we urgently need our new building. With planning permission secured, the detailed discussions are continuing, but we need to secure further funding to proceed. In this *Newsletter*, we are reaching out to all our alumni to ask you to support us in whatever way you can. More information about the building and its progress can be found on pages 4 and 5.

The financial situation of universities is very uncertain following the Comprehensive Spending Review and ahead of the increase in tuition fees. Moreover, we're gearing up for the Research Excellence Framework, the successor to the Research Assessment Exercise; in 2013, all research in UK mathematics departments will be assessed and the results will determine much of our funding until around 2020.

I am confident that we'll overcome these challenges and I look forward to playing my part in the years to come. ■

# A short history of the Maths and Philosophy Degree

Helen Carasso, *St Anne's 1976*

The Oxford degree in Mathematics and Philosophy – originally a three-year BA (Hons) degree and now also offering a four-year route to an MMathsPhil – owes its origins to The Kneale Report of the mid-1960s that considered the establishment of Joint Schools to include Philosophy within the university.

At about the same time, a group of Oxford academics were meeting regularly to discuss topics in mathematical logic. One of them, John Crossley, recalls the role that these informal meetings played in creating a Mathematics and Philosophy degree: *Michael Dummett put up the idea that, emulating a mixture of the BPhil in Philosophy and PPE, we should propose a Joint Honour School in Mathematics and Philosophy. Our colleagues were positive. Graham Higman, who perforce had learnt logic for his group theory word problems, supported us. Freddie Ayer supported us. There was a price – or rather no price – no new money was to be required. That was possible, and so Mathematics and Philosophy began. Robin Gandy was recruited and he cosseted, cajoled and sustained the new degree.*



John Crossley

More formally, the main paper that proposed the new course for approval by the appropriate University committees argued: *There is a natural bridge between the two disciplines in the philosophy of mathematics and mathematical logic,*

*for in order to attack the problems which arise in present-day philosophy of mathematics much more technical machinery is needed than is generally possessed by philosophers with a purely arts background, and the motivation for the mathematical problems arises from the investigations of the foundations of mathematics.*

It specified that the mathematical elements of the course should be taught by practising mathematicians, and saw the degree as offering an all-round education bridging the arts and sciences.

Pioneer students sat the first Mathematics and Philosophy Moderations in 1969, while others sat the first finals examinations in 1970, having switched to the newly-created Joint Honours course after taking Maths Mods in 1968.

Since then, some 600 students have read for the joint degree and, while the course has always been one of the smaller ones on offer in Oxford, its supporters believe the effort was worthwhile, as John Crossley explains: *It was a struggle at times, but the idea was, and is, a good one. The combination of technical skill and deep understanding that Mathematics and Philosophy represents will endure.* ■

## How to raise one billion pounds...

Find the weight of a parallelepiped of platinum defined by three vectors (in metres):

$$\vec{r} = (50, 1, -2), \quad \vec{O} = (-20, 0, 50), \quad \vec{f} = (6, -2, 989)$$

$$\text{Density } d = 40 \times 10^3 \text{ lbs/m}^3$$

$$\vec{C} = \vec{O} \times \vec{f} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ -20 & 0 & 50 \\ 6 & -2 & 989 \end{vmatrix} = 100\vec{i} + 20080\vec{j} + 40\vec{k}$$

$$\vec{C} \cdot \vec{r} = (100\vec{i} + 20080\vec{j} + 40\vec{k}) \cdot (50\vec{i} + \vec{j} - 2\vec{k}) = 5000\vec{i} \cdot \vec{i} + 20080\vec{j} \cdot \vec{j} - 80\vec{k} \cdot \vec{k} = 25 \times 10^3$$

$$\text{Weight} = \vec{C} \cdot \vec{r} d = 25 \times 10^3 \text{ m}^3 \times 40 \times 10^3 \text{ lbs/m}^3 = 10^3 \text{ lbs}$$

The answer is:

$$(\vec{O} \times \vec{f}) \cdot \vec{r} d = 1,000,000,000 \text{ pounds.}$$

*Thank you  
on behalf of the whole University*

Special thanks to Professor Alan Goriely and OCCAM for creating this billion pound equation.

**Oxford Thinking**  
The Campaign for the University of Oxford



**Professor Alain Goriely**, Director of OCCAM, came up with this innovative way of advertising Oxford University's billion pounds fund-raising campaign.



## Oxford Mathematics degrees

There are now five mathematics-related degrees at Oxford.

They are available as 3-year courses, leading to a BA degree, and 4-year courses, leading to an MMath or MComp degree.

**Mathematics:** introduced in the 19th century

**Mathematics and Philosophy:** 1968

**Mathematics and Computer**

**Science:** 1985

**Computer Science:** 1994

**Mathematics and Statistics:** 2003

# The place to be for PDE!

**Emma Waters** *Project Manager at the Mathematical Institute*

*OxPDE Members, January 2011*

**Partial differential equations (PDE) are ubiquitous in almost all applications of mathematics, where they provide a natural mathematical description of many phenomena. The behaviour of every material object, with length scales ranging from sub-atomic to astronomical and time scales ranging from picoseconds to millennia, can be modelled by PDE or by equations with similar features.**

With an EPSRC Science & Innovation award of £3.3 million, the Oxford Centre for Nonlinear PDE (OxPDE), launched in 2007, has focused on the fundamental analysis of nonlinear PDE and numerical algorithms for their solution. More recently, areas of interest have expanded to include the calculus of variations, nonlinear hyperbolic systems, inverse problems, homogenization, infinite-dimensional dynamical systems, geometric analysis for PDE arising in solid and fluid mechanics, materials science, liquid crystals, biology and relativity. The Centre, based in the Gibson Building, is a vibrant and stimulating research environment, providing leadership in the field of nonlinear PDE within the UK.

The inaugural lecture of Gui-Qiang Chen, Professor in the Analysis of Partial Differential Equations, held last November,



marked the beginning of the fourth year of OxPDE. He brings to the Centre expertise in the mathematical analysis of nonlinear hyperbolic PDE, an area of research that was not previously represented in the UK.

With twelve faculty members, six postdoctoral researchers, and eleven research students, the Centre runs a thriving visitor programme, an active events programme, a regular Monday seminar series and a Thursday lunchtime seminar series, a dedicated technical report series, and a highly successful undergraduate summer research project scheme. Outreach activities include hosting national PDE events and visitors' calendars, in addition to supporting and

contributing to national PDE events. OxPDE has formed successful collaborative links with other UK PDE centres based in Swansea, Bristol, Warwick, Bath and Cambridge, with a particularly strong cooperation with the Maxwell Institute in Edinburgh, the other Science and Innovation Centre in the UK. With firm foundations in the field of nonlinear PDE now in place in the UK, the OxPDE Centre's focus for the foreseeable future is to continue to create critical mass in the UK and to establish and maintain a solid exchange programme with groups from across the world.

Sir John Ball, OxPDE's Director, comments: *We are very lucky to have attracted to Oxford outstanding researchers in PDE from different parts of the world. OxPDE is now recognized as a significant international centre, and is certainly the strongest research group in PDE that there has been in the UK in my lifetime. We hope to strengthen it still further in the future.* ■

(Further information on OxPDE can be found on the website: [www.maths.ox.ac.uk/oxpde](http://www.maths.ox.ac.uk/oxpde).)



Photo by Peter Hudston

*The inaugural lecture of Gui-Qiang Chen, November 2010*





## The new building

**Nick Woodhouse** *Former Chairman of the Mathematical Institute*

**The cover page of our first *Newsletter* in 2003 told of the forthcoming move to the new building. Although Oxford sets its own pace, the move at last appears real and imminent.**

**Contractors have been appointed, diggers are at work, and the timetable to hand over in 2013 has been set out in detail. The planning meetings have progressed from discussing broad principles to debates on the positioning of lecterns and electrical sockets.**

The last few years of planning have been as frustrating as they have been exhilarating. We were assigned a fantastic site between two 18th-century masterpieces, the original Infirmary building and the Radcliffe Observatory (the Tower of the Winds), but one that has brought with it the obligation to respect both buildings to the exacting standards of English Heritage. Not an easy challenge: it introduced complex geometric constraints, and the need to design a building with no 'back'.

The sense that the project is now moving rapidly is not false: there has indeed been decisive progress over the past year. In the summer, we finally obtained planning consent for Rafael Viñoly's beautiful and imaginative design. Despite the growing gloom about university finance in general, and HEFCE capital funding in particular,

we were given the green light to proceed to RIBA stage F, which involved going out to tender, appointing a contractor and proceeding to the detailed design stage. This will take us until June, when a decision will be made on whether to start construction of the building itself. We must secure further funding before then if the project is to continue without a break. In the meantime, demolition is complete and the work on the site infrastructure is well under way. After eight years, we at least have the drains in place.

As Margaret Rayner recounts in her chapter in *Oxford Figures*<sup>1</sup>, nearly 40 years passed between Hardy's plea to the University administration for adequate facilities for mathematicians and the opening of the Institute's first purpose-built quarters in the late 1960s. That was a huge step

*Above left: Front view of the new Maths Institute*

*Above: View from Woodstock Road*

*Above right: Common Room*

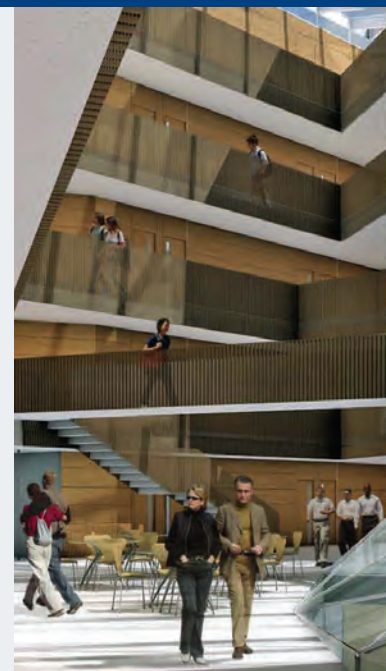
*Far right: Upper Walkways and Atrium*

*Below: Spacious and light Interior Lobby*

*Below right: Access to the Mezzanine*







forward, but, with the passage of another 40 years, the St Giles' building has proved inadequate to cope with the growth of mathematics in Oxford and with the changing styles of teaching and research. The Institute is now spread over three sites: the St Giles' building, Dartington House in Little Clarendon St, and the Gibson Building, a 1950s ward block grimly awaiting demolition on the North-West corner of the old hospital site. There is not enough space. First- and second-year lectures are held in the Museum, physical dispersal inhibits research collaboration, and there is nowhere to create a sense of community for the undergraduate mathematicians.

The new Viñoly building will bring us all together on one site and provide for the whole Oxford mathematics community. There will be room to create a proper working environment for research students, faculty, visitors, and the growing cohort of post-docs. Undergraduates will have somewhere to grab a cup of coffee between lectures, write up their notes, and chat to their lecturers and contemporaries.

Above all, the brief has focused strongly on the promotion of interaction: there is to be a single entrance lobby to maximize those crucial chance encounters that seed breakthroughs, and a large common-room looking out on the Tower of the Winds for teatime discussions. The layout, with offices opening off atria, will make it impossible even for our most elusive colleagues to creep into their offices unobserved.

The fundraising campaign was boosted by the extremely generous initial gift from the Clay family,

but it has not been easy to build on that at a time of financial crisis and with the final shape of the building still unclear. The decisions of the last year have allowed us to move forward on that front as well, and the development campaign now has new momentum, with the project accorded high priority in the Campaign for Oxford.

The coming months will be critical. The University has asked us to raise £36M, half the cost of the project, from our friends and supporters. We have secured £10M towards this target, but there is still a long way to go. Before construction can begin, we must demonstrate the support of our alumni through donations and pledges. This edition of the *Newsletter* provides you with the opportunity to offer your support. ■

***The new Viñoly building will bring us all together on one site and provide for the whole Oxford mathematics community.***

1. John Fauvel, Raymond Flood and Robin Wilson, *Oxford Figures: 800 Years of the Mathematical Sciences*, Clarendon Press, Oxford, 2000.



# Appointments...



**Luis-Fernando Alday**  
(*Institute for Advanced Study, Princeton*) to a Lecturership in Mathematical Physics and a Fellowship at

Hertford College. *Research interests:* string theory, super-symmetric gauge theories, conformal field theories and string/gauge theory dualities.



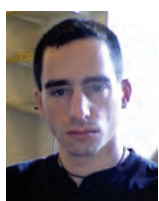
**Thomas Bridgeland**  
(*University of Sheffield*) to a Senior Research Fellowship at All Souls. *Research interests:*

homological techniques in algebraic geometry and relations with string theory and mirror symmetry.



**Christopher Douglas**  
(*University of California, Berkeley*) to a University Lecturership and a Fellowship at Keble

College. *Research interests:* algebraic and geometric topology, 3- and 4-dimensional topological quantum field theory, elliptic cohomology.



**Kevin McGerty**  
(*Imperial College, London*) to a Royal Society University Research Fellowship and a Fellowship at

Christ Church, and a University Lecturership in Pure Mathematics thereafter. *Research interests:* interactions between representation theory and algebraic geometry, in particular quantum groups,  $D$ -modules and non-commutative resolutions



**Alexis Vasseur**  
(*University of Texas at Austin*) to a Professorship of Mathematics and a Fellowship at Lincoln

College. *Research interests:* partial differential equations, and especially their applications to fluid mechanics.



**Dominic Vella**  
(*Cambridge*) to a University Lecturership in Applied Mathematics and a Fellowship at Lincoln

College. *Research interests:* fluid and solid mechanics, particularly the effects of surface tension.

## ...and farewells



We're sorry to say goodbye to **John Norbury** (*Lincoln*), faculty member of OCIAI,



**John Ockendon** FRS (*St Catherine's*), first Director of the Oxford Centre for Collaborative Applied Mathematics (OCCAM),



and **Michael Vaughan-Lee**, Fellow in Mathematics at Christ Church. ■

## Achievements

**It has been another bumper year for awards and appointments:**

**David Acheson**, *Emeritus Fellow of Jesus College*, has been appointed President of the Mathematical Association for 2010–11.



**Philip Candelas**, *Rouse Ball Professor of Mathematics*, has been elected a Fellow of the Royal Society.

**Marcus du Sautoy**, *Charles Simonyi Professor for the Public Understanding of Science*, has received an honorary D.Sc. degree from the University of Bath.



**Radek Erban**, *OCCAM Research Fellow*, has been awarded a Philip Leverhulme prize for his work in applied mathematics.

**Roger Heath-Brown** FRS, **Marc Lackenby**, **Philip Maini**, **Oliver Riordan**, **Gregory Seregin** and **Xunyu Zhou** were all invited speakers at the 2010 International Congress of Mathematicians in Hyderabad, India.

**Colin Macdonald**, *OCCAM University Lecturer*, has won the 2010 SIAM Richard DiPrima Prize.

**Bill Morton**, *Former Professor of Numerical Analysis*, has been awarded the De Morgan Medal, the London Mathematical Society's highest award (given every three years).



**Graeme Segal** FRS, *Emeritus Fellow of All Souls College*, has been awarded the Royal Society's Sylvester Medal.

(J. J. Sylvester was appointed Oxford's Savilian Professor of Geometry in 1883.)

**Sir Martin Taylor** FRS, *Vice-President of the Royal Society*, has taken up residence as Warden of Merton College.



**Nick Trefethen** FRS, *Professor of Numerical Analysis*, has taken up the position of President of SIAM, the International Society

for Industrial and Applied Mathematics. He was also awarded the 2010 IMA Gold Medal by the Institute of Mathematics and its Applications.

**Robin Wilson**, *Lecturer at Pembroke College*, has been appointed Vice-President of the British Society for the History of Mathematics, and an Honorary Fellow of Gresham College, London. ■



# Obituary:

## Dr Patrick Martineau



**We are sorry to report the death on 6 September 2010 of Dr Patrick Martineau, Emeritus Fellow of**

**Wadham College. A group theorist, Patrick will be remembered by former undergraduates for his algebra lectures.**

*Brian Stewart writes:* Patrick's mathematical talent was nurtured at home (his father was a wrangler as well as a bishop) and at school (Liverpool Institute). Elected a Scholar at Wadham College in 1962, he remained as Mathematics Fellow from 1968 until retirement.

After finals Patrick joined Higman's research group, writing a thesis under the supervision of Martin Powell, giving "odd characterisations" of the Janko group and of the Suzuki groups. This developed later into studies of the

representations of the Suzuki groups, the splitting of group representations, and how groups of automorphisms affect the structure of a group.

Patrick's writing was clear and austere, at the right level of abstraction. (One reviewer notes that "the ideas used are so clear and simple that this paper could be read with benefit before the many other papers on the subject".) In his lecturing and teaching Patrick adopted the same clear style. But he brought also a real concern that all his students should make the transition to real mathematics, while tolerating no nonsense when he suspected that someone was in danger of squandering their talents.

Wadham chose Patrick as the University's Junior Proctor for 1975–76. His colleagues then elected him Estates Bursar in 1977; from then on he devoted his time and energy to strengthening the finances of the

college. The wider university also benefitted, especially during his tenure of the secretaryship and then the chairmanship of the Estates Bursars Committee. Although inclined to play his cards close to his chest, fledgling bursars were assisted by frank (but unattributable) advice.

Patrick's last few years were dominated by the illness that had led to his retirement in 2004. But occasionally the old Patrick sparked into life: during a chance meeting last year on my way to lecture I was given a two-minute tutorial on how to treat the adjoint "so that those in the Last Chance Saloon will understand you, Brian".

Patrick is survived by his wife Sylvia, and their twin children Karen and David. ■

*[A version of this obituary appeared in the London Mathematical Society Newsletter, issue 398 (December 2010), and is reproduced with permission.]*

## Invariant Society 75<sup>th</sup> anniversary

The Invariant Society, the University's undergraduate mathematical society, was founded by three Balliol men – J. H. C. (Henry) Whitehead (Balliol's mathematics tutor and a distinguished topologist who became Oxford's Waynflete Professor of Pure Mathematics in 1947), Graham Higman (a second-year undergraduate who succeeded Whitehead in the Waynflete Chair in 1960), and Jack de Wet (a Rhodes Scholar from South Africa who was later one of Oxford's most admired lecturers and greatly loved tutors).

The opening lecture, on 'Round numbers' was given by G.H. Hardy in

Hilary Term 1936. Seventy-five years on, the 75th anniversary was celebrated with a number of memorable events, including lectures by Leonhard Euler (paying a fleeting visit from the 18th century) and Sir Roger Penrose. ■



*Leonhard Euler with Rosie Cretney, Invariant Society President*

### MISCELLANEA

#### Some Finals questions from 1828

1. What decimal of a week is 1 hour 7 minutes and 14 seconds?
2. Find  $\tan\left(\frac{1}{4} - \frac{\theta}{2}\right)$  in terms of  $\tan \theta$ .
3. The altitude of the sun was observed to be half of his declination at six o'clock. Prove that twice the sine of the latitude of the place = the secant of the sun's latitude.

#### Some Finals questions from 1849

1. Extract the square root of .313487, the cube root of 8242408 and the fourth root of  $x^4 - 2x^3 + \frac{1}{2}x^2 - \frac{1}{2}x + \frac{1}{16}$  explaining the processes; and show that if the square root of a whole number has any decimal figures they neither terminate nor recur.
2. Under what conditions will the diametral planes of surfaces of the second order intersect in a point?



## Mathematical Institute garden parties

Last year's Mathematical Institute Garden Party was held at St Anne's, and was preceded by lectures on *Maths in and out of the zoo* by Prof. Chris Budd and *The mathematics of visual hallucinations* by Prof. Paul Bressloff.

This year's event will take place on **Saturday 16th July**, with a lecture at 4 pm in the Martin Wood Lecture Theatre, Clarendon Laboratory, followed by the



Garden Party at St Anne's. The lecture will be given by Prof. Caroline Series on *Indra's pearls*, and there will also be an update on the new building.

## St Anne's student on Big Brother (C4)



Andrew with Titan

**Andrew Edmonds**, a second-year mathematics student at St Anne's who took his A level maths exams at the age

of 13, spent seven weeks last summer in the Big Brother house with fourteen other people, making it to the final show of Series 11 and coming fifth. He recalls: "As the mathematician in the house I'd try to analyse the game in order to give my mind something to do. In the house everyone gets two votes to nominate someone and the nominated housemates are those with the most votes, so if you find yourself nominated, how many housemates can you guarantee voted for you? – this wasn't too bad to work out without a pen and paper. I'd definitely recommend auditioning for it, as you'll find out how you fare in an environment of extreme pressure and paranoia, but it's also a great excuse to let your hair down and have a really good time."

## Rubik's cube master solves ten cubes while blindfolded



**Daniel Sheppard**, a fourth-year mathematics student at Trinity College, finished third in the multiple blindfolded challenge at the European Rubik's Cube Championship in Budapest.

For this event, he memorized 11 cubes before being blindfolded and solving 10 of them correctly within one hour. He can solve a normal  $3 \times 3 \times 3$  cube in about 15 seconds and his fastest time for one cube is 9.66 seconds. He is ranked seventh in the world for the  $5 \times 5$  blindfold event.



Photo by Rob Judges

## Mathematics and music debate

Every year the Vice-Chancellor's Circle meets for dinner and a debate. This year's topic was: *Is music the act of sounding mathematics?*

Proposing the motion were Marcus du Sautoy, Simonyi Professor for the Public Understanding of Science, and Eric Clarke, Heather Professor of Music. Opposing it were Edward Higginbottom, Director of Music and Choral Professor of Music at New College, and Robin Wilson, Emeritus Professor of Pure Mathematics at the Open University (now teaching at Pembroke College). The motion was defeated by a substantial majority.

## Sudoku puzzle corner

Fill in the empty cells in the puzzle below, so that each of the nine letters below the puzzle appears just once in each row, column and  $3 \times 3$  box, and a mathematical word will appear in one of the rows or columns: the hidden word may appear forwards or backwards, down or up.

A	N				L		T	
							O	
				O	E	L		
	B				A			
O				L				U
			N				C	
		E	U	N				
	T							
	C		T				N	B

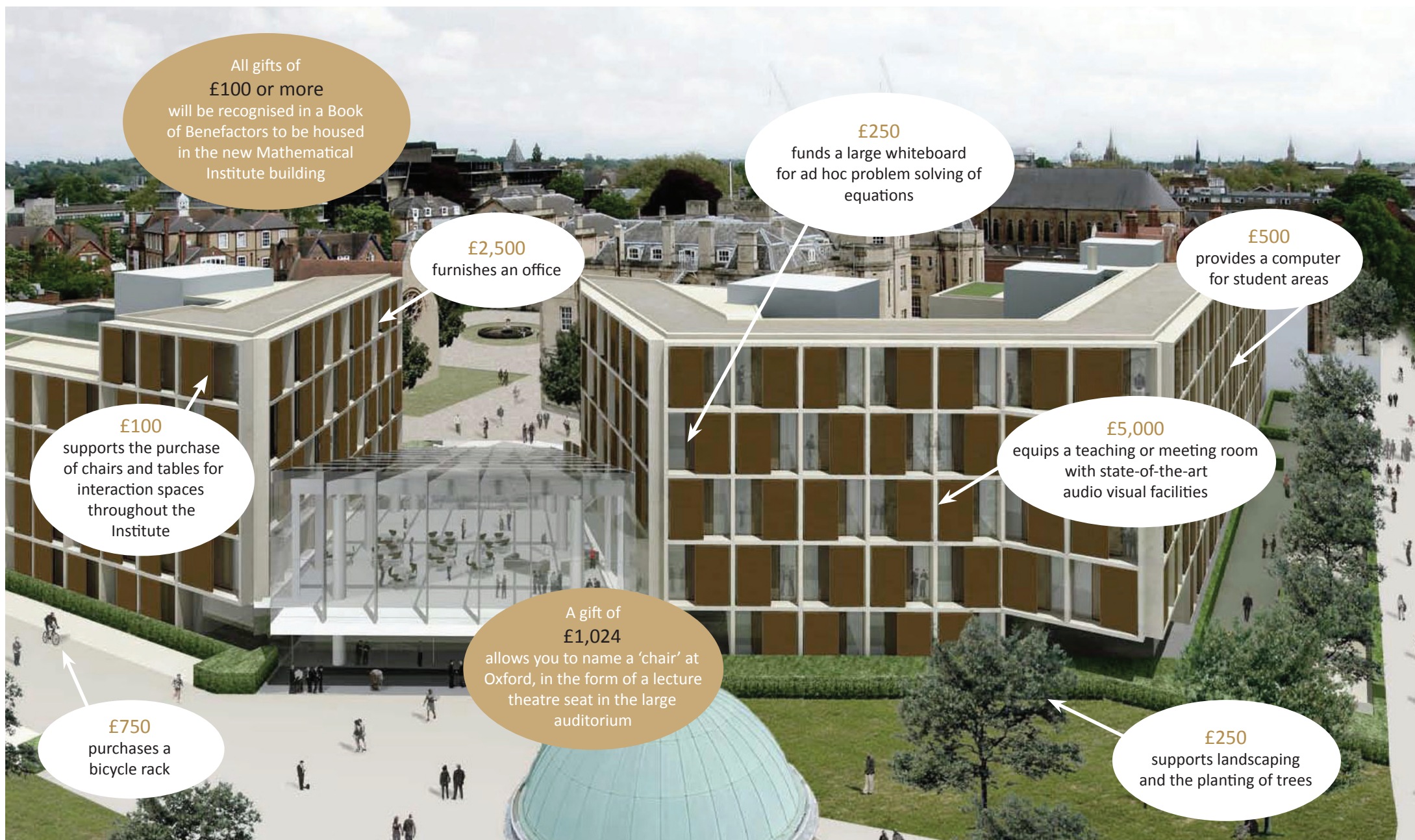
A B C E L N O T U

**Solution to last year's puzzle:**  
**CONVEXITY** (column 5 upwards)



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A gift to the Mathematical Institute will help to create a new home for mathematics at Oxford.  
Help us to realise this exciting future for mathematical excellence by filling out the gift form overleaf.



Thank you for considering a gift to the  
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The Campaign for the University of Oxford



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☐ Please tick here if you do not wish to appear on our public honour roll

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I would like to make a single gift of: ☐ £50 ☐ £250 ☐ £500 ☐ £1,024 to name a lecture theatre seat ☐ Other amount \_\_\_\_\_

☐ I enclose a cheque made payable to University of Oxford Development Trust Fund ☐ I enclose a Charities Aid Foundation (CAF) voucher

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### It is possible to make a gift over a number of months or years

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*giftaid it*

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