

# Mathematics Enrichment Camp 2011

Date: Saturday, 13 August 2011

Time: 9.00 am to 2.00 pm

Venue: Lecture Theatre 25  
Faculty of Science, National University of Singapore

*Registration  
Open!*



Organized by



Department of Mathematics

# Programme

Time	Activity
8.30am	<b>Registration</b>
9.05am	<b>Welcome Address</b> By Professor Chong Chi Tat Head, Department of Mathematics
9.10am	<b>From Triangles to Manifolds</b> By Dr Han Fei
10.00am	<b>P vs NP</b> By Professor Sun Defeng
10.50am	Tea Break
11.20am	<b>The ranks of elliptic curves</b> By Professor Gan Wee Teck
12.10pm	<b>An introduction to dynamical systems</b> By Professor Shen Weixiao
1.00pm	Lunch
<i>End of Programme</i>	

# Abstracts

## **From Triangles to Manifolds** **By Dr Han Fei**

One of the most fundamental theorems in Euclidean planar geometry is that the sum of interior angles of a triangle is equal to 180 degrees, which is deduced from a sophisticated axiom, the so-called parallel axiom. From ancient Greek times, efforts to avoid this axiom failed and in the 19th century led to the discovery of Non-Euclidean geometries, in which the sum of interior angles of a triangle is less or greater than 180 degrees. Modern development of geometry eventually leads to the notion of manifolds, which are models for higher dimensional geometric spaces. We will finally introduce the Gauss-Bonnet-Chern theorem for manifolds, the higher dimensional generalization of the above theorems about the sum of interior angles of a triangle. The talk will be based on an article by Professor Chern Shiing-Shen and in memory of his centenary birthday.

### **About the Speaker**

Dr Han Fei received his Ph.D degree from University of California at Berkeley in 2008. In 2008-2009, he was a Szego assistant Professor in the Department of Mathematics in Stanford University. He joined the Department of Mathematics at National University of Singapore in 2009 as an Assistant Professor. His research interests include Differential Geometry, Algebraic Topology and Mathematical Physics.

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## **P vs NP** **By Professor Sun Defeng**

Each year at Christmas Day children all over the world wait eagerly to receive gifts from Santa Claus. Although Santa has one year's time to prepare the gifts, he has only one day's time to make the delivery with his sleigh and reindeer. It is thus critical for Santa to plot out the shortest route to deliver all the presents on time. Here, we shall demonstrate how modern methodologies of optimization can help Santa to achieve his goal. The mathematical challenge behind Santa's task is P versus NP, one of the seven Millennium mathematical questions with each solution worth US \$1 million.

### **About the Speaker**

Sun Defeng is Professor at Department of Mathematics and Deputy Director (Research) at Risk Management Institute, National University of Singapore. He received his PhD in Operations Research and Control Theory from the Institute of Applied Mathematics, Chinese Academy of Sciences, China in 1995. He completed his post-doctoral training at the University of New South Wales, Australia. His research interests are mainly on Optimization, a subject of studying best decision-making with limited resources, with side interest in financial risk management. He currently serves as editor-in-chief to The Asia-Pacific Journal of Operational Research and associate editor to Mathematical Programming.

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## **The ranks of elliptic curves** **By Professor Gan Wee Teck**

Number theorists are interested in finding integer solutions to polynomial equations (homogeneous in three variables, say). When the degree is 2, the Greeks understood how to find infinitely many integer solutions. As the degree gets large (indeed, bigger than 3), one expects that it will become harder to find integer solutions and this is confirmed by a finiteness theorem of Faltings. The case of a cubic equation in 3 variables is a particularly delicate case, where the issue of whether there are finitely or infinitely many integer solutions is a million-dollar question (literally!) We will look at the rich structures present in this case, some unsolved problems, conjectures and recent breakthroughs.

### **About the Speaker**

Gan Wee Teck did his undergraduate studies at Cambridge University and obtained his PhD at Harvard University in 1998. Since then, he has been a faculty member at Princeton University and University of California, San Diego, before moving to NUS this year. His research interest lies in the areas of number theory and representation theory.

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## **An introduction to dynamical systems** **By Professor Shen Weixiao**

The theory of dynamical systems studies the long term behaviour of evolution of systems. Examples include the mathematical models that describe the swinging of a clock pendulum, the flow of water in a pipe, and the number of fish each spring time in a lake. This talk aims to introduce some of the interesting phenomena (chaos), through examples and pictures

### **About the Speaker**

Prof Shen Weixiao graduated from University of Science and Technology of China in 1995. He obtained his PhD from University of Tokyo in 2001. He joined Department of Mathematics at NUS as a Professor in March 2009, after working in University of Warwick and University of Science and Technology of China. He was a recipient of the S.S. Chern award of the Chinese Mathematical Society in 2009 and is currently a provost's chair professor in NUS.

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# Getting to the Camp

1. Take the MRT and alight at Buona Vista MRT Station.
2. Transfer to SBS Bus Service 95 at the bus-stop opposite the station (across the North Buona Vista Road, in front of the Ministry of Education building).
3. Alight at the bus-stop in front of the Lim Seng Tjoe Lecture Theatre 27 in NUS.
4. Follow the map and walk to Lecture Theatre 25.
5. For an interactive map of NUS, please visit <http://www.nus.edu.sg/campusmap/>



## Mathematics Enrichment Camp 2011

### Registration Instructions

1. The Registration Fee per person is **S\$30 (GST inclusive)** and this includes 1 tea breaks and lunch.
2. Payment is by **cheque only**. Please make cheque payable to **National University of Singapore**.
3. Cancellations are **not refundable** although participants can be substituted.
4. Please send the completed registration form together with the cheque **by Monday 25 July 2011 to:**

Ms Chan Lai Chee  
Department of Mathematics  
Blk S17 Level 4  
National University of Singapore  
10 Lower Kent Ridge Road  
Singapore 119076

5. For further information, please contact Ms Lynette Wong (6516 8322, [matwongl@nus.edu.sg](mailto:matwongl@nus.edu.sg)), or Ms Chan Lai Chee (6516 2762, [matclc@nus.edu.sg](mailto:matclc@nus.edu.sg))

## Registration Form

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### Individual Registration

Name:

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Institution:

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Email:

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Phone:

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Bank & cheque number:

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### Block Registration - Please also complete BLOCK REGISTRATION LIST on page 7

Institution:

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No. of students:

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Name of teacher-in-charge:

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Email:

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## Mathematics Enrichment Camp 2011

### Block Registration List

Complete and return this page together with the registration form (page 6) and payment. Enter the particulars on a new page if necessary.

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