



#MC2017

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3rd & 4th March 2017

Maynooth University

Engaging Teachers in Lesson Study

Maths Counts 2017

"The Most Dynamic Maths Education Event of the Year"

Official Opening by
Minister for Education and Skills,
Mr. Richard Bruton, TD.

A National
Conference
for all post-primary
maths teachers

4th
ANNUAL
CONFERENCE

A Conference for:

- Newly qualified maths teachers
- Prospective maths teachers
- Maths educators

Observe live
structured problem
solving lessons taught
by an internationally
acclaimed expert

Receive a digital pack
of problem solving
lessons developed by
250 Irish teachers from
over 100 participating
schools

Unique Features
Interactive problem
solving workshops and
live lessons taught by
teachers involved in
Lesson Study

Register online at www.projectmaths.ie/mc2017



Maths Counts 2017

"The most dynamic maths education event of the year."

Maths Counts is back for its fourth consecutive year and this year's conference **promises to be the biggest and best yet**. It will provide a new and unique opportunity for participants to meet with other teachers and learn about the art of *structured problem-solving* for Junior and Senior Cycle. This conference will showcase the work of teachers who have engaged in *Lesson Study* with the **Maths Development Team**.

Professor Takahashi: Live Demonstration Lessons



Professor Takahashi returns to teach geometry live to students from Maynooth Education Campus incorporating Maynooth Post Primary School and Maynooth Community College, with structured-problem-solving lessons focusing on *"Hands-on Open-ended Approach for Developing Geometrical Concepts through Investigation"*.

Mathematics educator Dr. Akihiko Takahashi is an Associate Professor of mathematics education at DePaul University in the United States and a Specially-Appointed Professor at Tokyo Gakugei University in Tokyo, Japan. At DePaul University he lectures in mathematics teaching and learning. He was a teacher in Japan before becoming an educator of mathematics teachers. During his teaching career, he was nationally active in mathematics lesson study in Japan. He received his Ph.D. from the University of Illinois at Urbana-Champaign. He has published over 45 journal articles and given presentations and keynotes at international conferences and workshops.

Address by Dr Anne Brosnan



Lesson Study: Maximizing the Impact of Problem Solving in the Classroom. As maths teachers, we attempt to provide students with exposure to, exploration in and reflection about the many skills and concepts that make up the five strands in the maths syllabus: statistics and probability, number, algebra, geometry and trigonometry and functions.

Even with a deep understanding of this content, students may lack problem-solving skills. They must learn how to problem solve, communicate their ideas, reason through maths situations, prove their conjectures, make connections between and across concepts and represent their mathematical thinking. As we strive to develop effective mathematicians, as teachers we are challenged to develop both students' content understanding and problem solving skills. This talk focuses on how the Maths Development Team has implemented *structured-problem-solving* in the classroom in Ireland through engaging teachers with *Japanese Lesson Study*. During this address the rationale and success to date of *Lesson Study* will be detailed. Over the duration of the conference the promise and potential of *Lesson Study* will be showcased and experienced first hand through the live *Research Lessons*.

Live Research Lessons



Teachers engaged in *Lesson Study* will teach live *structured problem-solving* lessons focusing on various topics at Junior and Senior Cycle. During these lessons teachers involved in drafting the lesson proposal will conduct a lesson observation followed by post-lesson discussion with a *knowledgeable other*.

These lessons will highlight how to develop a problem-solving disposition amongst students. Engagement in *Lesson Study* supports teachers in meeting the challenge of teaching through *structured problem solving* and motivates students in productive problem solving strategies.

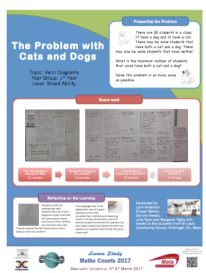
Interactive Workshops



A teacher who participated in *Lesson Study* will facilitate each interactive workshop. The facilitator will start the workshop by inviting attendees to discuss common approaches to teaching the mathematical topic their *Lesson Study* addresses and to work on the mathematical problem developed to support the lesson proposal.

The facilitator will then share their experience of teaching this lesson to their own students. The workshop will conclude by discussing the merits of *Lesson Study* as a form of professional development for maths teachers.

Lesson Study Poster Presentations



The posters will give an account of the 52 *Research Lessons* taught throughout the country in 2016-2017 involving 250 teachers from over 100 post-primary schools. The posters give insights into this work and link to the complete lesson proposal giving full details of the research lesson and the reflection on the learning on the Maths Development Team's website.

Exhibitor Stands

Explore and spend time in our exhibition area showcasing excellent maths teaching and learning resources. Thank you to all our exhibitors for supporting our conference.



Celebrating Japan Ireland

2017 marks the 60th Anniversary of the establishment of diplomatic relations between Japan and Ireland. It is fitting to welcome back Professor Akihiko Takahashi to Maths Counts 2017 as we celebrate our teachers' engagement in *Japanese Lesson Study*.

Lesson Proposals for Senior Cycle

- 1. How to take the Perfect Selfie** - By drawing on information from a graphic representation, students will be able to identify the various methods required to establish the distance between two points and discover its relationship between the associated slope or angle (5th Year).
- 2. Developing Freda's Field** - Students will expand on and adapt their understanding of the $\frac{1}{2}$ base x perpendicular height formula using trigonometric ratios to find the area of a non-right-angled triangle (5th Year Mixed Ability).
- 3. Area of in-circle of an equilateral triangle** - Given an equilateral triangle students will be required to find the area of its incircle using different methods. Using a real life example of a round clock in a triangular frame students will problem-solve to find the area of a clock face in multiple ways. (5th Year HL).
- 4. What makes a parallelogram?** - Students will deduce the properties of parallelograms through problem solving using multiple approaches from trigonometry and geometry (5th Year OL).
- 5. The mathematical way through an ash cloud** - A plane has to make it through a circular ash cloud, there are certain restrictions which require the use of coordinate geometry and algebra. The tasks allows for different levels of solutions and the opportunity for students to discuss the relative merits of each approach (5th Year HL).
- 6. Coordinate Geometry involving a rectangle** - Finding the centre of symmetry of a rectangle using as many methods as possible (5th Year OL).
- 7. Seeing through the "Dab"** - Students are required to find the dimensions and angles of triangles in order to find the area of a triangle (Transition Year).
- 8. Enter the Matrix** - Problem Solving: Simultaneous equations using 3 different shapes representing 3 different variables in a 4x4 grid box. Students are presented with the task of finding the value of each shape (Transition Year).
- 9. Heading for Trouble?** - Students will tackle a contextualised problem which requires understanding simultaneous equations. They will use a variety of approaches to solve the problem (5th Year OL).
- 10. The Polygon Predicament** - Derivation of a general formula to ascertain the number of diagonals in any polygon (6th Year HL).
- 11. The Problem with the Water Rocket** - Interpreting Quadratic Functions, using students' prior knowledge of solving quadratic equations algebraically and geometrically now apply it to a real-life problem-solving context. (5th Year HL).
- 12. Finding the general term of a quadratic pattern** - A problem solving lesson involving triangular shapes, patterns and the general form of a quadratic function $an^2 + bn + c$ (5th Year OL).
- 13. Decoding de Moivre** - Students are introduced to De Moivre's Theorem in terms of scaling and rotating complex numbers (5th Year HL).
- 14. Introduction to Differential Calculus** - How to use secants to best approximate the rate of change of a non-linear function, followed by students discovering that the slope of a tangent at the point of interest gives the exact rate of change at that point (6th Year OL).

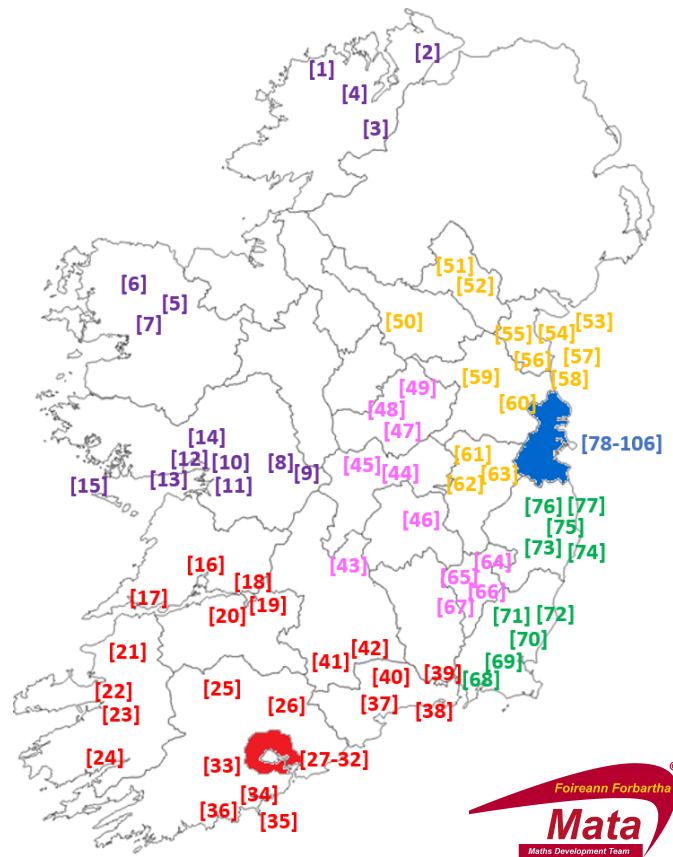
Lesson Proposals for Junior Cycle

- 15. Rich, Happy, Famous or Healthy?** - Using Census@School, students will present collected data graphically in multiple forms and discuss the merits of each (1st Year).
- 16. An Alternative approach to Alternate Angles** - After completion of Geometry from the Common Introductory Course, students are presented with a geometrical problem and asked to apply their prior knowledge to find a missing angle in as many ways as possible (1st Year).
- 17. Are you Snookered?** - This lesson proposal builds on students' prior learning of synthetic geometry, angles and lines in particular. Using a contextualised problem students solve in as many ways as they can the size of the missing angles (1st Year).
- 18. Relationships between angles formed by parallel lines and a transversal-** Using prior knowledge of triangles and measuring angles students are set a problem to determine that all alternate and all corresponding angles are equal in measure (1st Year).
- 19. It's a Tough Climb** - Students explore the concept of slope throughout an investigative manner. Students will be provided with three unique slopes as part of a Mountain and asked to problem solve to conclude which is the steepest slope (1st Year).
- 20. The Problem with Cats and Dogs** - Students investigate a problem so that they can recognize that Venn diagrams can be used as a problem solving tool (1st Year).
- 21. Let's think about BIMDAS** - Investigate order of operations and the number sets N, Z and Q. (1st Year).
- 22. Perfecting Percentages-** Using the equivalence of fractions, decimals and percentages students order the results in a school report in ascending order (1st Year).
- 23. The Chocolate Challenge** - Using fractions to optimise my consumption of chocolate. Students are asked to choose a table to sit at. Each table has varying numbers of people and bars of chocolate, the problem is which table should I sit at (1st Year).
- 24. Finding the perimeter of an irregular shape-** Students are given an irregular shape and asked to write the length of the perimeter in its simplest form. The shape will be drawn on grid paper, the dimensions of each square in the grid will not be given. Students will be asked to present and explain their solution(s). to the class group (1st Year).
- 25. Home and Away: Interpreting Distance - Time Graphs-** The lesson develops around a card matching activity involving distance - time graphs. (1st Year).

- 26. Finding Mary's Age** - Students are encouraged to understand and identify patterns. Through problem-solving (1st Year).
- 27. The Great Hall** - A first look at developing linear patterns. Students will be given the start of a pattern using tables and chairs and asked to continue the pattern as it grows in complexity.(1st Year).
- 28. To find the general term of a pattern** - Students use a contextualised problem to establish a formula for any term (1st Year).
- 29. Working with Fred Pattern-son** - Diagrammatic presentation of patterns using the matchstick character "FRED" culminating in the formation of a general formula for an arithmetic pattern. Using this approach, the group aims to create a better understanding of patterns in both a visual and mathematical way that can aid the introduction of quadratic patterns in subsequent years (1st Year).
- 30. An introduction to algebraic & word equations** - This lesson builds on students' prior knowledge of money and arithmetic to develop an understanding of word equations (1st Year).
- 31. Describing word problems algebraically**- Students think about the various ways to express word problems using mathematical language. (1st Year)
- 32. Solving linear word problems** - An end of topic problem to determine students' understanding of how to form and solve linear equations (1st Year).
- 33. The Average Problem** - Students will be provided with a data set and asked to select the most suitable measure of central tendency. The task requires students to analyse data and report on their findings (2nd Year HL)
- 34. Gazelles on the Move**- Investigating Pythagoras' Theorem using areas of semi-circles (2nd Year HL).
- 35. Investigating equivalent fractions** - Students graphically represent equivalent fractions in a variety of ways (2nd Year OL).
- 36. More Pizza for Me** - Students use various strategies to compare the division of different-sized pizzas amongst different numbers of people (2nd Year Mixed Ability)
- 37. Shaded Area in a 2D Shape** - What approaches can be used to find the area of part of a shape? (2nd Year HL).
- 38. Into the Next Dimension** - Students realise the relationship between area and volume, and using this relationship calculate the volume of a uniform shape (2nd Year OL).
- 39. The Tin of Beans Challenge** - Students discover for themselves the volume of a cylinder(2nd Year HL).
- 40. Pragmatic Quadratic** - The lesson aims to enable students to form an algebraic equation (quadratic) from a word problem with a given diagram (2nd Year HL).
- 41. Roots and Shoots: Factorising Quadratic Trinomials** - Students find the length and width of a garden in terms of x - (2nd Year HL).
- 42. Anyone for Pizza? Solving Simultaneous Equations** - Students are posed with a real life problem in a written, verbal and visual format. Students develop multiple ways of solving this problem. (2nd Year HL).
- 43. Coffees, Teas and simultaneous equations** - Students are presented with the costs of two different café orders of teas and coffees. The challenge involves finding different routes to the solution, using prior learning in this new context (2nd Year HL)
- 44. The Window Maker** - A window maker costs the price of a window based on the length of frame and area of glass he uses. Drawing on students' prior knowledge of linear equations in one variable, students generate a pair linear equations in two variables to solve how much should he charge (2nd Year HL).
- 45. Bisector of an Angle** - using investigative methods students justify why construction works (3rd Year HL).
- 46. What's Your Angle?** - Through problem solving students will discover that various methods and approaches can be employed to solve a problem (3rd Year OL).
- 47. Transformation Trickery** - Drawing on students' prior knowledge of reflections and transformations, students are posed with a problem to find the correct sequence of translations to transform one line into another (3rd Year HL)
- 48. 3-D Cubes** - Using Trigonometry to interpret 3-dimensional shapes. By engaging with a problem, students will become more confident dealing with three-dimensional shapes. (3rd Year HL)
- 49. Percentages, Fractions and Decimals** - Students will have to calculate a percentage and fraction of a given number in a problem-solving context (3rd Year OL).
- 50. Coordinate Geometry meets Synthetic Geometry** - Students are presented with a parallelogram, the four corners of which are on a circle. They are asked to find as many different approaches as possible to show that a parallelogram is a rectangle (3rd Year HL).
- 51. Cookie Crumble** - Students are asked to compare the area of different sized cookies and then asked to use their understanding to calculate the volume of a cylinder (3rd Year OL).
- 52. Picture This! Exploring Quadratic Functions through Images** - To help students understand the connection between the roots of a quadratic graph and the quadratic function itself (3rd Year HL).

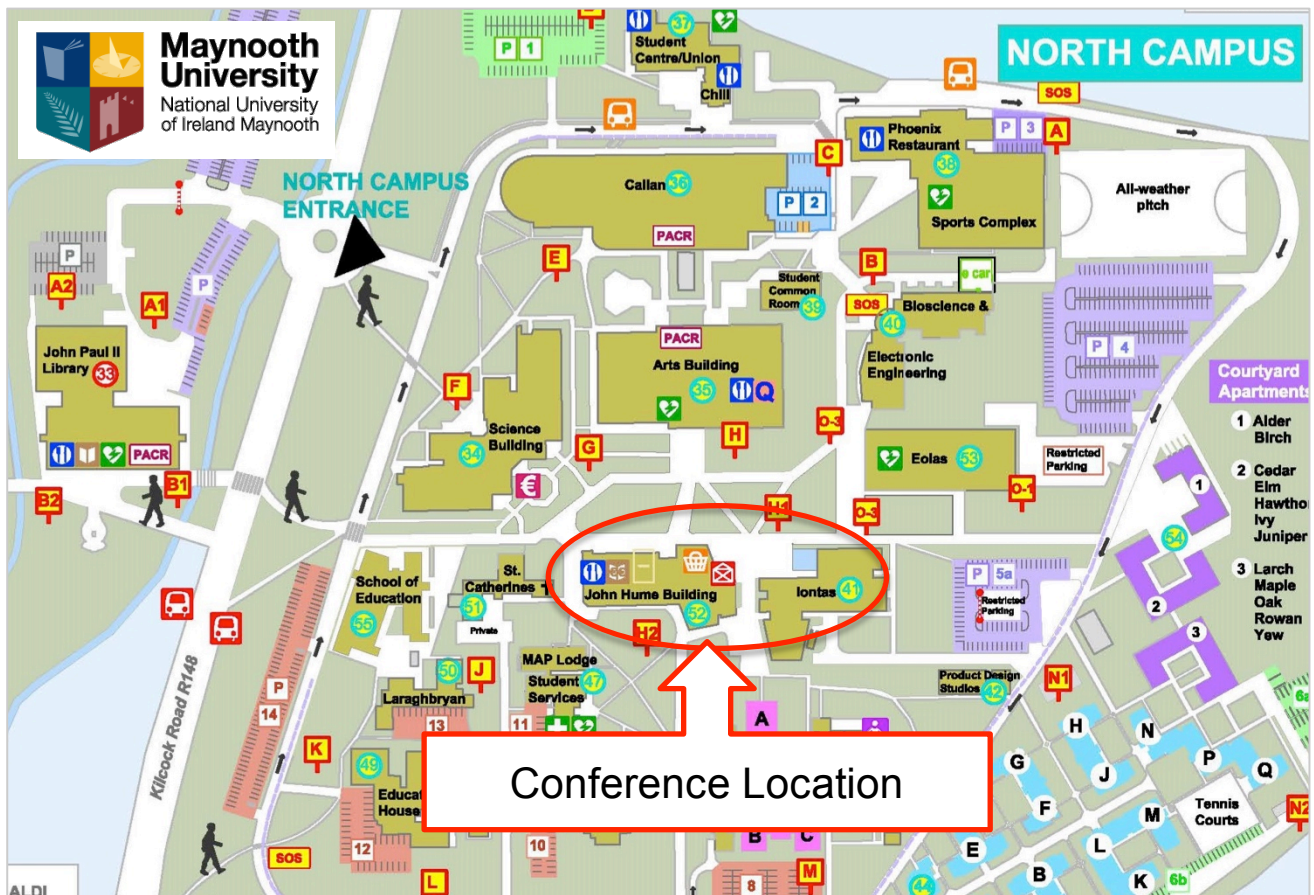
Lesson Study - an Irish success story

In 2014 the (Project) Maths Development Team introduced Japanese *Lesson Study* nationally to post-primary maths teachers. Lesson Study captures and promotes individual, teacher and school group collaborative planning, observation and analytic reflection on classroom practices and student engagement in *structured problem-solving* lessons. Since its introduction participation in *Lesson Study* has grown to over 100 schools as teachers all over the country have embraced and acknowledged it to be a practical and worthwhile professional development programme. Join our growing number of *Lesson Study* groups and put your school on the map next year.



Schools involved in Lesson Study 2016/2017

1 Pobalscoil Ghaoth Dobhair	36 Kinsale Community College	71 Gorey Community College
2 Moville Community College	37 St. Declans Community College	72 Creagh College
3 Deelee College	38 Ardscoil Na Mara	73 Coláiste Chill Mhantáin
4 Loreto Milford	39 Newtown School, Waterford.	74 Dominican College
5 St Josephs Community College	40 Comeragh College	75 Temple Carrig School
6 St Tiernan's College	41 Patrician Presentation Secondary School	76 Loreto Secondary School
7 St Louis Community School	42 Scoil Ruain	77 Woodbrook College
8 Moyne College	43 Our Lady's Secondary School	78 Coláiste de Híde
9 St Killians College	44 Coláiste Choilm	79 John Scottus Senior School
10 Coláiste Na Coiribe	45 Killina Presentation Secondary School	80 St. Mark's Community School
11 St Josephs College	46 Portlaoise College	81 Blessington Community College
12 Seamount College	47 Mullingar Community College	82 St. Raphaela's Secondary School
13 Coláiste Iognáid, Galway	48 Wilsons Hospital School	83 St. Kevin's College
14 St Pauls Secondary School	49 Castlepollard Community College	84 Assumption Secondary School
15 Coláiste Naomh Éinne	50 St. Patrick's College	85 St. Aidan's C.B.S.
16 Coláiste Muire	51 Beech Hill College	86 Ardscoil Ris
17 Kilrush Community College	52 St. Louis Secondary School	87 Fingal Community College
18 Coláiste Nano Nagle	53 De La Salle College	88 Santa Sabina Dominican College
19 Coláiste Mhuire	54 Colaiste Rís	89 Old Bawn Community School
20 Gaelcholaiste Luimnigh	55 Ardee Community School	90 Plunket College
21 St Michaels College	56 Drogheda Grammar School	91 Gaelcholáiste Reachrann
22 Coláiste Gleann Li	57 Ballymakenny College	92 Larkin College
23 Coláiste Chiarraí	58 Coláiste na hInse	93 St Pauls CBS
24 Pobascoil Inbear Scéine	59 O'Carolan College	94 St Davids CBS
25 St. Mary's Secondary School	60 Community College Dunshaughlin	95 St Fintans High School
26 Presentation Secondary School	61 Maynooth Post Primary School	96 St. Benildus College
27 Presentatin Secondary School	62 St. Farnan's Post Primary School	97 St. Laurence College
28 Gael Choláiste Mhuire	63 Naas Community College	98 The Teresian College
29 Cork Educate Together	64 Colaiste Eoin	99 Coláiste Pobalscoil Setanta
30 St Aidans Community College	65 St Leo's College	100 Palmerstown Community School
31 Deerpark C.B.S.	66 St Marys CBS	101 Coolmine Community School
32 Terence Mac Swiney CC	67 Carlow Vocational School	102 Mount Temple Comprehensive
33 Coláiste Na Toirbhirte	68 Ramsgrange Community School	103 Chanel College
34 Carrigaline Community School	69 Loreto Wexford	104 Holy Family Community School
35 Edmund Rice College	70 Colaiste Bríd	105 Hartstown Community School
		106 St. David's CBS



Questions and Answers

1. Who is the Conference for?

It is a national conference for all post-primary, newly-qualified and prospective maths teachers and those interested in maths education.

2. Who is organising it?

The Conference is being organised by the Maths Development Team.

3. Do I have to attend on Friday and Saturday?

No, you can attend on Friday only, or Saturday only, or both days.

4. How much does the Conference cost?

The Conference costs €40 per person which includes admission to all conference events, conference resource pack (including copies of 50 problem-solving lesson plans), wine and canapé reception, lunch, tea and coffee.

5. If I only attend part of the conference, will a different fee apply?

No.

6. How do I register?

You can register for the conference online at www.projectmaths.ie/mc2017. Registration closes 28th February.

7. Do I need to choose which sessions I plan to attend?

No. You can decide this at the conference.

8. If I have any further queries, who can I speak to?

You can contact our Administrator Gráinne Haughney (grainneh@ecdumcondra.ie) or Rachel Dunne (racheld@ecdumcondra.ie) via email or by phone at 01-8576428.



Conference Schedule

Friday 3rd March

18:00 – 18:30 Registration (Iontas Building)

18:45 – 19:00 Opening of Conference

19:15 – 20:15 Professor Akihiko Takahashi live demonstration lesson teaching geometry through *structured problem-solving* to a group of students

20:15 – 22:00 Wine & Canapé Reception

Saturday 4th March

09:00 – 09:30 Registration (Iontas Building)

09:30 – 10:30 Continuation of live demonstration lesson with Professor Takahashi

10:30 – 11:00 Dr. Anne Brosnan: *Introducing Lesson Study to Ireland*

11:00 – 11:30 Tea break & Exhibitions including Research Lesson Posters

11:30 – 13:00 3 Live Research Lessons by teachers engaged in Lesson Study

13:00 – 14:00 Lunch in the Phoenix Restaurant

14:00 – 14:45 Interactive Workshops Part 1

14:45 – 15:30 Interactive Workshops Part 2

15:30 – 16:00 Presentation by the Maths Inspectorate & Close of Conference

A special thank you from the Maths Development Team to the teachers, principals and students who have been involved in Lesson Study with us this year.



Maths Counts 2017

“The Most Dynamic Maths Education Event of the Year”

In a first for Ireland, Maths Counts will see maths teachers teaching live lessons for all to see. Come along and see our intrepid teachers teach their students through structured problem-solving. Here are our groups:



Santa Sabina Dominican College, Sutton

The Polygon Predicament



Ballymakenny College, Drogheda & Coláiste na hInse, Bettystown

The Great Hall



Temple Carrig School, Greystones

Coordinate Geometry meets Synthetic Geometry