Carom Forty PowerPoints for A Level Mathematicians

Activities bridging from sixth form mathematics to university maths

Written and designed by
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Author of the Risps materials

PDF eBook, 2026 edition

www.carom-maths.co.uk

The study of mathematics, like the Nile,
begins in minuteness but ends in magnificence.
Charles Caleb Colton

Never was arte so wonderfull witty, so needfull to man,
as is good geometry. **Robert Recorde**

Power corrupts, PowerPoint corrupts absolutely. **Edward Tufte**

Be the presenter you would want to listen to. **Cath Daley**

I used to feel guilty that I spent all day playing games
while I was supposed to be doing mathematics.
Then, when I discovered surreal numbers,
I realized that playing games IS mathematics.
John H. Conway

This eBook and all the Carom materials are dedicated
to those who were my immediate line managers
in mathematics departments across the years:
Roger, Hannora, David, Patrick, Krysia, Sue, Ian, Jackie, Harry,
Rachel, Pete, Sandra, Julia and Russell

Contents

If you spot an error or typo anywhere in these pages, please let me know at

hello@jonny-griffiths.net

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Introduction

Carom: the story of an A Level extracurricular maths group

It's Thursday lunchtime, and my classroom is hosting a *Carom* session. We're not a large group, but each week we meet to discuss beautiful bits of pure maths that the A Level syllabus in its wisdom decrees are less essential than The Really Useful Stuff like partial fractions, differentiating a quotient and the sine rule (although, of course, we do realise that these these things are beautiful too in their own way).

I look on amazed. My fellow Caromites are leaning back in their seats, howling with laughter. 'So it doesn't matter!' they are screaming. 'Brilliant! It doesn't matter!' So how had I provoked my group into this ribaldry?

'Today's topic is infinity,' I'd started, innocently enough.

Ten minutes later. 'Ah! So the infinity describing the set of rational numbers and the infinity descibing the set of natural numbers must be the same,' says Beth.

Five minutes on. 'Ah! So the infinity representing the set of real numbers must be a bigger infinity than this,' exclaims Stephen.

Breathlessly I ask, 'Might there be an infinity BETWEEN these two infinitites? Kurt Godel showed in 1940 that, given the normal axioms for set theory, it was impossible to prove that such an infinity exists…'

My voice becomes reverential. 'Then in 1963, Paul Cohen showed that, given the normal axioms for set theory, it was impossible to prove that such an infinity does NOT exist! Mathematics works perfectly well, that's without contradictions, either way! So you can't decide, given the normal axioms for set theory, if this middle infinity exists or not – it doesn't matter, you can assume it does or it doesn't!'

My words were clumsy here, I will concede. But somehow, the idea that the crowning achievement of your mathematical life should be the phrase 'It doesn't matter!' had struck my disrespectful proteges as completely hilarious. 'What a good day's work that was! Ha, ha, ha!' said Stephanie.

In my early years teaching at Paston College, I often helped out the Theatre Studies department with music for their shows. It was clear to me

that contributing to these shows would leave a student with powerful memories, memories stronger than those provided by any funded exam course run strictly along syllabus lines. I asked one of the theatre directors once, ‘Which is more fundamental, curricular work or extra-curricular work?’

He smiled and said, ‘Extracurricular work is more important. The relationships you form with students there are deeper than the ones you form during curriculum work. ‘

Was he right? Maybe he was. And of course, those warm extracurricular relationships then come back into the classroom, with hugely positive effects.

What can a maths teacher do, then, to foster life with his students outside the classroom? It’s not easy to put on a play, as the Theatre Studies department would, or work towards an evening of student coursework videos, as the Media department might. Taking part on a weekly basis in sporting leagues, in the way that the PE department does, could be difficult. My solution was to run a lunchtime maths group called *Carom.*

I ran *Carom* for maybe 20 years across two institutions. Sometimes it was just me and one student, as they tried to learn extra material for a university interview. At other times there were ten of us; the group that started this piece were a case in point.

The word ‘carom’ is defined as ‘a rebounding’, for example, on a billiard table. As an acronym for us, *Carom* stood for ‘Creative Activities Resulting in Offbeat Mathematics.’ The word ‘offbeat’ stood for ‘off-the-beaten-track’ – this was stuff that syllabuses wouldn’t necessarily cover. The goal was simple – to broaden our minds mathematically by looking at sweet mathematics that we wouldn’t otherwise have time for. We would gently bounce (carom) ideas off each other, freed from the constraints of syllabus rubric.

How did it work? Each Monday morning I would send out preparation material in the form of (hopefully) imagination-busting questions. Then we would get together eachThursday lunchtime (maybe 50 minutes) and while munching our sandwiches we’d see what people had managed on these. Every *Carom* session included a chance for students to actually do some maths – without this, *Carom* became a straight lecture and few

(quite rightly) would welcome this. Then I would gather up our thoughts and explore further theory, using the PowerPoint as a handy crutch for our thinking. It was important that the PowerPoint worked as our servant rather than the other way around. I sent the file out afterwards to anyone that wanted to have a look at it.

A good *Carom* session turned into the best classroom fun I had all week. The material sometimes allowed unexpected people to shine, and since none of it was examined, we had a chuckle along the way. The tension was off, so students learnt in a more relaxed and confidence-building fashion.

I know that teachers are up against it timewise. I could only find the time for *Carom* relatively easily because I was part-time. A lunchtime a week is precious, I know, but if you can find this space from somewhere, you and your students will be amply rewarded.

Jonny Griffiths, April 2026

List of Carom PowerPoints from 1 to 40

Difficulty: * = easy for A Level, ** = hard for A Level***

Carom 1: Geodesics *	**Topic area: Geometry**
Carom 2: Inequalities **	**Topic area: Algebra**
Carom 3: Coincidences *	**Topic area: Probability**
Carom 4: The Least Road Problem **	**Topic area: Optimisation**
Carom 5: Kites and Darts ****	**Topic area: Geometry**
Carom 6: Perfect and Mersenne Numbers **	**Topic area: Number Theory**
Carom 7: The Overlapping Circles *	**Topic area: Geometry**
Carom 8: Repunits ***	**Topic area: Number Theory**
Carom 9: Siders ***	**Topic area: Geometry**
Carom 10: Buffon's Needle **	**Topic area: Probability**
Carom 11: Curves of Constant Width ***	**Topic area: Geometry**
Carom 12: Multiple-free Sets **	**Topic area: Number Theory**
Carom 13: Descent ***	**Topic area: Number Theory**
Carom 14: Wallpaper Patterns ****	**Topic area: Geometry**
Carom 15: Adding again and again... ****	**Topic area: Ergodic Maths**
Carom 16: The Distribution of Prime Numbers ****	**Topic area: Number Theory**
Carom 17: Infinity ****	**Topic area: Set Theory and logic**
Carom 18: Hyperbolic Geometry *****	**Topic area: Geometry**
Carom 19: The Propositional Calculus *****	**Topic area: Logic**
Carom 20: The Mandelbrot Set ****	**Topic area: Complex Numbers**
Carom 21: The Game of Life ***	**Topic area: Dynamical Systems**
Carom 22: Mapping a set to itself **	**Topic area: Sequences**
Carom 23: Pearl Tilings *	**Topic area: Geometry**
Carom 24: Tangles ***	**Topic area: Algebra**
Carom 25: What are you implying? ***	**Topic area: Logic**

List of Carom PowerPoints by Topic

Algebra

Complex Numbers

Dynamical Systems

Ergodic Maths

Geometry

Geometry/Complex Numbers

Logic

Number Theory

Optimisation

Probability

Sequences

Set Theory

Topology

List of Carom PowerPoints by Difficulty

*	Carom 1	Geodesics	Topic area: Geometry
*	Carom 3	Coincidences	Topic area: Probability
*	Carom 7	The Overlapping Circles	Topic area: Geometry
*	Carom 23	Pearl Tilings	Topic area: Geometry
*	Carom 28	V, S and E	Topic area: Geometry
**	Carom 2	Inequalities	Topic area: Algebra
**	Carom 4	The Least Road Problem	Topic area: Optimisation
**	Carom 6	Perfect and Mersenne Numbers	Topic area: Number Theory
**	Carom 10	Buffon's Needle	Topic area: Probability
**	Carom 12	Multiple-free Sets	Topic area: Number Theory
**	Carom 22	Mapping a set to itself	Topic area: Sequences
**	Carom 26	Conics	Topic area: Geometry
**	Carom 27	The Four Colour Problem	Topic area: Topology
**	Carom 33	Triangle Centres	Topic area: Geometry
***	Carom 8	Repunits	Topic area: Number Theory
***	Carom 9	Siders	Topic area: Geometry
***	Carom 11	Curves of Constant Width	Topic area: Geometry
***	Carom 13	Descent	Topic area: Number Theory
***	Carom 21	The Game of Life	Topic area: Dynamical Systems
***	Carom 24	Tangles	Topic area: Algebra
***	Carom 25	What are you implying?	Topic area: Logic
***	Carom 32	H-Triples	Topic area: Number Theory
***	Carom 36	Triominoes	Topic area: Complex Numbers
***	Carom 39	Could π be 3?	Topic area: Geometry
****	Carom 5	Kites and Darts	Topic area: Geometry
****	Carom 14	Wallpaper Patterns	Topic area: Geometry
****	Carom 15	Adding again and again...	Topic area: Ergodic Maths
****	Carom 16	The Distribution of Prime Numbers	Topic area: Number Theory
****	Carom 17	Infinity	Topic area: Set Theory and logic
****	Carom 20	The Mandelbrot Set	Topic area: Complex Numbers

Carom Musings

For whom are these Carom PowerPoints intended?

First and foremost, A Level Maths teachers, and their students, especially those considering a degree in maths at university. They have worked well for students wanting to broaden their mathematical knowledge, whether in maths study groups or by studying on their own at home. My risp activities proved surprisingly useful to those on (and putting together) teacher training courses; maybe the same will be true here. It may be that people outside the educational system who want to extend their general maths knowledge will find them useful too. I did once use them profitably while tutoring a very able GCSE maths student who wished to work on off-the-syllabus material.

Can I use this material as I like?

If you are a teacher, you are completely free to take each PowerPoint here, make it your own, and customise it for your own situation. Only you know your learners and the context in which you teach them. If you do use a *Carom* PowerPoint, I'm always keen to get feedback on how it went (to know what goes wrong as much as what goes right!)

There's a notice I have to include…

Carom: the legal side

Carom and Technology

Virtually whatever I type about technology will be out of date within a week. **AI's** mathematical march moves on in leaps and bounds, much faster that I was expecting it to. But I'll try…

Named below are the packages that I think might be useful for extending or exploring the *Carom* tasks. Lots of these will have a free version that you can track down on the net to download onto your machine, while some others may be harder to find and will need to be paid for. If you are at a university or college, you may find that their license covers you. There may be web versions too, some of which can be utilised on a smartphone. Remember that many of the tasks here are simply pen and paper activities and won't need the heavy artillery of computing packages. Be aware too that using a computer can be a way to avoid thinking hard about a problem – for example, it is good practice to predict what a graph will look like before one presses 'Enter'.

Graphing programs
- Autograph (my graphing program of choice)
- Desmos
- GeoGebra
- Omnigraph

Computer algebra systems
- Derive
- GeoGebra (currently embryonic)
- Maple

Calculators Graphical calculators will allow you to plot curves and run simple programs.

Programming
- VBA within Excel
- Python

Spreadsheets
- Excel
- GeoGebra

Dynamic geometry
- GeoGebra

Online Engines
- Wolfram Alpha
- ChatGPT

I've spent my entire career working within a Windows environment; I hope that Apple fans out there can adapt what's here happily. This eBook is designed primarily for use on a desktop or laptop computer, but it will download onto a smartphone and the navigation links should still work.

Associated Computer Files - available at www.carom-maths.co.uk

Some of the *Carom* activities are supported by a computer file of some kind. There's a list of these below, with links; please read the ***Security Advice*** section, especially regarding the Excel files with macros.

PDF files

carom-5-bowtie.pdf	*Kite and Dart material*
carom-9-scroll-tile.pdf	*The Scroll Tile*
carom-9-seven-sider.pdf	*Seven-sided Sider*
carom-9-six-sider.pdf	*Six-sided Sider*
carom-14-seventeen.pdf	*The 17 Wallpaper Patterns*
carom-20-grid.pdf	*Mandelbrot Grid*

Autograph files

carom-4-least.agg	*Least Road Simulation*
carom-7-friendly.agg	*Friendly Circle Theorem*
carom-7-sum-circle.agg	*The Sum-Circle*
carom-28-six-cubics.agg	*Six cubic graphs together*
carom-30-concentric.agg	*Invert to two Concentric Circles*

GeoGebra files

carom-26-conics.ggb	*Conics investigation*
carom-35-assoc.ggb	*Associativity for Elliptic Curve Addition*

Excel files without macros

carom-3-coincidences.xls	*Birthday Problem Spreadsheet*
carom-8-repunit-bases.xls	*In which bases are Repunits Prime?*
carom-20-mandelbrot.xls	*Which points are in the MS?*
carom-34-abc.xls	*ABC Conjecture Spreadsheet*
carom-37-markov.xls	*Multiplying Matrices*
carom-29-logistic.xlsx	*Logistic Function explored*
carom-35-two-cubes.xlsx	*The Sum of Two Cubes*

Excel files with macros

carom-6-perfect.xlsm	*When is s(n) > n for Odd Numbers*
carom-15-ergodic.xlsm	*The Fundamental Ergodic Theorem*
carom-15-prime-aps.xlsm	*Arithmetic Sequences of Primes*
carom-16-prime-list.xlsm	*A list of Prime Numbers up to m*

Security Advice

There are sadly lots of scammers out there who will try to get you to download dodgy files from the internet.

Some file extensions are nearly always safe; it's virtually impossible to make a GeoGebra file malignant.

The same is not true of Excel files that contain macros; there are security issues here.

In the hands of nefarious people, a macro can hide code that could cause you or your institution harm.

You are advised to only download the *Carom* files above direct from www.carom-maths.co.uk or this eBook where they should be pretty much 100% safe.

If you're working for an educational establishment, your IT Department may well give you advice on how to make these files usable in your classroom. They may be wary about Excel files containing macros, and you may have to make a case.

At my last college, I was given a special folder on the college network; any file inside the folder could run without a problem.

This might work for you: create a new folder called ***Carom Downloads***. Open a blank Excel file and now click on

File – Options – Trust Center – Trust Center settings – Trusted Locations

and make ***Carom Downloads*** a trusted location. Download the *Carom* file and find it in your **Downloads** folder (you may have to encourage your security not to reject the file). Copy the file into your ***Carom Downloads*** folder, and it should run without problems from there.

Or else, to enable a particular Excel file you could try this: download the file and find it in your **Downloads** folder. Open it with Excel's restrictions and warnings in place. Now go to

File – Options – Trust Center – Trust Centre - Settings – Macro Settings – Enable VBA macros

If you have trouble with this issue, searching on the net for 'Security and Excel Macros' will yield helpful advice which should be up to date.

All my code for macros in these *Carom* files is protected with a password.

With thanks to…

These PowerPoints include a vast number of contributions and images from the internet and elsewhere. They come from many sources, sadly more than I can now remember or name individually. When I set out to create these PowerPoints, they were for my classroom only, and my record-keeping over where everything came from was non-existent.

I can only thank you, the copyright-holders, for making your work freely available to us on the internet in the first place, and hope that you will be happy for your contributions and images to be borrowed here for the non-profit educational venture that is *Carom.* My input to *Carom* will always be 100% free to teachers and students. If you are unhappy with this arrangement, then do get in touch, and I will do my best to edit the material appropriately. hello@jonny-griffiths.net

Included particularly in my thanks are (and I'm sure I'll have embarrassingly left many people out here) are James Grime for his soap bubbles, John H. Conway, Roger Penrose, George Reese, Pavel Safronov, Evan Ramos (for their Buffon applet), Roger B. Nelsen and Claudi Asina for their input on inequalities, Alexander Bogomolny and his *Cut the Knot* site, Miranda Lundy at *Wooden Books* for her wallpaper group examples, Richard Morris for his wallpaper applet, Joel Castellanos for his NonEuclid site, Nagel and Newman for their Godel book, Nick MacKinnon for his triominoes and Bob Burn for his $\pi = 3$ ideas.

Some of my *Carom* thoughts I've previously published in a range of journals, who receive my grateful thanks: *Mathematics in School, Infinity, Mathematics Teaching, Mathematics Spectrum*, and *The Mathematical Gazette.*

Websites that have been most helpful (thank you) are

Numberphile, Wikipedia, OEIS, Nrich, WorldAtlas, Complete Maths, GeoGebra and *The Encyclopedia of Triangle Centres.*

I would like to say 'Thank you' four final times…

- to those teachers who made A Level mathematics come alive for me when I was a young student at Dulwich College, especially Steve Russ and Ray Payne.
- To my teachers at the University of East Anglia, Professors Graham Everest, Tom Ward and Shaun Stevens. You helped me jump over into university mathematics, and I'm forever grateful to you.
- to my *Carom* students at Paston College, Norfolk and Frome College, Somerset, who worked hard on these activities in their initial and subsequent incarnations. You did this all in your own free time, and you played a vital part in their refinement.
- to Meg, my better half, for making these pages possible in so many different ways. I only hope I can support you half as well when it's your turn to embark on a Big Project.

Wordle


The New York Times
April 10, 2026
No. 1756
Wordle
Get 6 chances to guess
a 5-letter word.
M A T H S
G R O U P
I D E A S
F O U N D
A L I V E
C A R O M

About the Author

Now retired, Jonny Griffiths taught mathematics at Paston Sixth Form College in Norfolk for over twenty years. It was there he was a Gatsby Teacher Fellow for 2005–6 and built the *Risps* and *Carom* websites. He also taught at Frome College in Somerset, St Dominic's Sixth Form College in Harrow-on-the-Hill, St Philip Howard 11-16 comprehensive school in Tower Hamlets, Islington Sixth Form Centre, and Great Walstead School in West Sussex.

He's studied mathematics, computing and education at Cambridge University, Imperial College, the Open University and the University of East Anglia. Possible claims to fame include being a member of *Harvey and the Wallbangers*, a popular band in the 1980s, and playing the character *Stringfellow* on the television programme for children *Playdays*.

He's also worked for *Underground Mathematics, MEI, Integral, Dorling Kindersley, York, HarperCollins* and *Hodder* on creating mathematics resources. He was the originator and first author of the A Level Maths competition *Ritangle* in 2016, which has run every year since. He was for some years a Holgate Lecturer supported by the *London Mathematical Society.* He's written many articles for the *Times Educational Supplement* and other journals on the topics of mathematics and mathematics education. A full list of his published work can be found at ***www.jonny-griffiths.net***

He and his wife Meg now live in Frome, Somerset, where their local food bank ***Fair Frome*** does fantastic work. If you've found the *Carom* resources or any of Jonny's other free resources useful and you generously want to recognise that with a donation, then sending a few pounds in the direction of ***Fair Frome*** would be a great idea and much appreciated.

Jonny's email: ***hello@jonny-griffiths.net***

Jonny's website: ***www.jonny-griffiths.net***

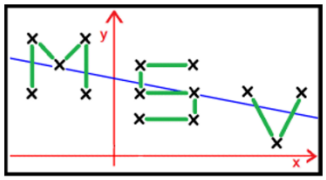
Sister Sites

Sister site 1:

A collection of forty investigative activities for A Level Mathematics.

Click here.

Sister site 2: *www.making-statistics-vital.co.uk*
A collection of A Level Statistics activities.
Click here.

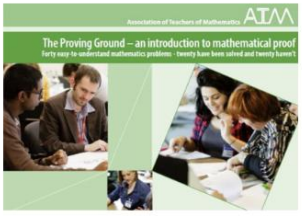


Sister site 3: *www.further-risps.co.uk*
A free ebook of tasks for Further Maths A Level.
Click here.

Further Risps

Rich tasks for the Further Mathematics A Level classroom

Jonny's free ebook on proof
The Proving Ground
is available from the ATM.
Click here.



Back-up link if link on left becomes out of date:

The Proving Ground

Jonny's free ebook of lesson starters
Digitisers is available from the ATM.
Click here.

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