Mathamazing Exhibit Themes, Descriptions and Curriculum Links

Questacon's *Mathamazing* is a touring hands-on maths exhibition which is suitable for visitors aged 12 years and older. This document lists *Mathamazing* exhibit names, descriptions, key themes and subject areas as well as how Mathamazing links to the Australian National Curriculum.

The complete *Mathamazing* exhibition contains:

- 22 hands-on exhibits with 28 interactive maths experiences
- 5 Mega Maths Puzzles (available separately, or as part of the whole exhibition) and
- 60 Puzzle Placemats (available separately, or as part of the whole exhibition).

These all cover hands-on, mathematically-rich topics such as conics, topology, number theory, probability and statistics, logic and problem solving.

Mathamazing Exhibit Name	Exhibit Description	Key themes	Subject Areas
Balanced Ternary	Work out the mass of an unknown object by comparing it to a series of known masses using a novel counting system known as balanced ternary. While we are more familiar with our traditional counting system of base ten, this exhibit shows how a counting system based on threes (ternary) can be used as an alternative.	mathematics, maths, counting, base ten, ternary, mass, puzzle	Mathematics – numbers, fractions and operations
Catenary	Balance building blocks on an arch-shaped template, then remove the template and test whether the building blocks stay in place or collapse. The shape formed by the building blocks is a catenary arch, typically used in architecture for strength.	mathematics, maths, geometry, catenary, shape, arch, structures	Mathematics – geometry & topology
Chances Are	Drop a ball through a series of pegs that are arranged in Pascal's triangle formation and watch where the ball lands at the base. Check a distribution graph on the screen to see the pattern of where each ball has travelled and landed over time.	mathematics, maths, probability, chance, Pascal's triangle, statistics, statistical distribution, Law of Large Numbers	Mathematics – statistics, probability & chance
Conic Sections	Hold various panels printed with the graph of a circle, hyperbola, parabola or ellipse over a spinning light and see how each curved shape can be found within the cone of light.	mathematics, maths, conics, shapes, geometry, parabola, hyperbola, ellipse,	Mathematics – geometry & topology
Cycloid	Race two balls down two separate tracks: one straight track (which appears to be shorter) and one curved or cycloid track (which appears to be longer). Which ball will 'win the race' to reach the end first?	mathematics, maths, cycloid	Mathematics – geometry & topology
Data Gathering	Enter your details about hair colour, age, even pet preference on a	mathematics, maths,	Mathematics – statistics,

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	screen, then take the reaction timer test and see how you compare to people who are similar or different to you. Which group had the fastest and slowest reaction times and what relationships do you notice within and between groups? Are all relationships important, or are some relationships coincidental?	data, statistical distribution, graphs, correlation, causation	probability & chance
Divergent Series and Convergent Series	**Divergent Series:** Stack four loose blocks on top of a fixed block, so the top block overhangs to reach a line one block length away. You could use an infinite number of blocks in an attempt to reach a line several block lengths away. **Convergent Series:** This is a thought experiment which challenges you to cover up a square, then a rectangle, by half its area each time. Can the area ever be truly covered?	mathematics, maths, series, sum, fractions, area, length	Mathematics – geometry & topology
Ellipse	Release a ball so it rolls down a ramp and around an elliptically-shaped billiard table. The ball will roll into a hole at the other end of the table if it rolls over the ellipse's focal point.	mathematics, maths, ellipse, focal point, reflection	Mathematics – geometry & topology
Flip Flop and Digital Counter	Drop a disc down through a series of flip flop gates that are stacked one above the other. Notice how the flip flop gates are labelled '0' and '1' to model a binary counting system. Binary is used in electronic circuits and software programs to signal switches to turn 'ON' and 'OFF'.	mathematics, maths, series, binary, logic	Mathematics – numbers, fractions and operations Physics – information & communication technology
Logic Goats	Press a series of hoof-pedals to make three goats nod their heads in various patterns. Pressing different combinations of pedals creates a series of logic gates representing: 'AND', 'NOT', and 'Exclusive OR' signals in the nodding goats.	mathematics, maths, binary, logic, logic gates,	Mathematics – numbers, fractions and operations Physics – information & communication technology

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Manacles	Two people put on interlocking manacles or handcuffs. They must work out how they can untangle themselves from each other without removing the manacles from their wrists. This puzzle relies on patience, lateral thinking skills and topology.	mathematics, maths, topology, problem solving, puzzle	Mathematics – geometry & topology Mathematics – puzzles & number tricks
Mechanical Monkey	Move the mechanical monkey's feet to numbers along the baseline and watch the monkey's hands reveal the answer to your chosen mathematical operation. The monkey can perform operations such as addition, multiplication and exponentiation (indices) if it's given enough bananas and time.	mathematics, maths, arithmetic, patterns geometry, monkeys	Mathematics – statistics, probability & chance
Meissner Solids	Roll a square plate on top of different-shaped solids, including Reuleaux tetrahedra and Meissner solids. You can feel which shapes allow the plate to roll smoothly. Although these shapes appear to be irregular, the plate rolls smoothly due to the shapes' constant widths.	mathematics, maths, geometry, diameter, Meissner solids	Mathematics – geometry & topology
Parabola	Drop a ball anywhere onto a parabola-shaped dish and notice how the ball rebounds, then lands each time against a disc suspended above the dish (the focal point).	mathematics, maths, parabola, focal point, focus, reflection,	Mathematics – geometry & topology
Penney's Game	Penney's Game challenges you to consider whether it's best to go first or second in a game of chance. You must predict via touch screen the order in which balls will be sampled from a barrel, then the computer will also predict a sequence before balls are randomly and physically sampled	mathematics, maths, probability, sampling, sequences, Penney's game, chance,	Mathematics – statistics, probability & chance
Range Finder	Find the distance to a suite of targets using two cameras and trigonometry instead of a tape measure.	mathematics, maths, trigonometry, distance, measurement	Mathematics – geometry & topology

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Seven Bridges and Eight Bridges	A classic puzzle which challenges you to trace a continuous route through a town that crosses every bridge exactly once. Try the puzzle with seven bridges first, then with eight bridges. The trick is the number of nodes and edges that can be overlaid onto the map.	mathematics, maths, puzzle, problem solving, networks, nodes	Mathematics – geometry & topology Mathematics – puzzles & number tricks
Tetrahedron	Arrange two identical pieces so they form a solid triangular-based pyramid with four faces (a tetrahedron).	mathematics, maths, puzzle, geometry	Mathematics – geometry & topology
Tower of Brahma	You must relocate a stack of five discs onto another peg, following two rules: move one disc at a time and do not place a larger disc on top of a smaller disc. Can you solve the puzzle in a minimum number of moves?	mathematics, maths, puzzle, logic,	Mathematics – puzzles & number tricks
Trigonometry Trammel	Turn the handle and pointers labelled 'sin' and 'cos' will automatically work out these trigonometric functions. This elegant mechanical device allows you to physically explore angles as the ratio of lengths of triangles' legs.	mathematics, maths, trigonometry, geometry, triangles, measurement	Mathematics – geometry & topology
Four Colour Puzzle (multimedia)	Colour shapes on the touch screen so neighbouring shapes are not the same colour. It sounds simple, but it's surprisingly stumping.	mathematics, maths, puzzle, Four Colour Theorem	Mathematics – puzzles & number tricks
Shapes in Nature (multimedia)	Explore the beauty of fractals on a touch screen and observe how shapes re-appear and repeat, just as they do in the structures of snowflakes and plants.	mathematics, maths, fractals, patterns, Nature	Mathematics – geometry & topology
Shortest Journey	Can you find the shortest path to travel to every city on a map, starting and finishing in Canberra?	mathematics, maths, puzzle, logic	Mathematics – puzzles & number tricks

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(multimedia)			Mathematics – measurement (time, size, mass, density, volume)
River Crossing (multimedia)	Use the touch screen to move four robbers across a bridge to the opposite river bank. You must follow certain rules such as only moving one or two robbers at a time, finishing within '15 minutes' and always making sure one robber holds a torch when they cross the bridge. These rules make the puzzle more challenging than you may expect.	mathematics, maths, puzzle, optimisation theory	Mathematics – puzzles & number tricks
Mega Maths Puzzle Name	**Exhibit Description**	**Key Themes**	**Subject Areas**
Giant Cube Dissection	This Soma Cube puzzle's first challenge is to use seven different cube-based puzzle pieces to build a giant cube. You can also try building other suggested structures using the same seven puzzle pieces.	mathematics, maths, puzzle	Mathematics – geometry & topology
Rolling Block Maze	Roll a giant rectangular prism puzzle piece along the maze pathway. This will test both your spatial and problem solving skills.	mathematics, maths, puzzle	Mathematics – puzzles & number tricks
Step Maze	Rotate or 'step' oversized dividers across a maze, ensuring that the feet only step into matching coloured maze discs. What patterns do you notice and how can you plan ahead to reach the other side?	mathematics, maths, puzzle, maze	Mathematics – puzzles & number tricks
Tetrahedron	Two oversized and identical puzzle pieces must be joined so they form a solid shape with four faces (a tetrahedron).	mathematics, maths, puzzle, geometry	Mathematics – puzzles & number tricks
Tower of	You must relocate a stack of four oversized discs onto another peg, following two rules: move one disc at a time and do not place a larger	mathematics, maths,	Mathematics – puzzles &

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Brahma	disc on top of a smaller disc. Can you solve the puzzle in a minimum number of moves?	puzzle, logic	number tricks
Maths Puzzles	**Exhibit Description**		
Sixty maths puzzle placemats	Sixty different maths puzzles have been printed onto placemat-sized panels, so you can sit at a table and solve as many different puzzles as your brain and patience will allow. The puzzles cover a wide variety of topics including: counting; patterns; logic; problem solving; addition; multiplication; subtraction; area; shapes and other magnificently mathematical content	Various mathematical topics including mathematics, maths, puzzles, problem solving, arithmetic, area, patterns	

Australian Curriculum Links

Mathamazing exhibits link to the Australian National Mathematics Curriculum. Core links indicate content that is directly covered within the exhibition, while optional links indicate content that is dependent on how people use and facilitate various exhibits.

Year 6 core links

Statistics and Probability (ACMSP144) Describe probabilities using fractions, decimals and percentages

Statistics and Probability (ACMSP145) Conduct chance experiments with both small and large numbers of trials using appropriate digital technologies

Statistics and Probability (ACMSP147) Interpret and compare a range of data displays, including side-by-side column graphs for two categorical variables

Number and Algebra (ACMNA123) Select and apply efficient mental and written strategies and appropriate digital technologies to solve problems involving all four operations with whole numbers

Number and Algebra (ACMNA124) Investigate everyday situations that use integers. Locate and represent these numbers on a number line

Number and Algebra (ACMNA125) Compare fractions with related denominators and locate and represent them on a number line

Measurement and Geometry (ACMMG140) Construct simple prisms and pyramids

Measurement and Geometry (ACMMG142) Investigate combinations of translations, reflections and rotations, with and without the use of digital technologies

Year 7 core links

Statistics and Probability (ACMSP167) Construct sample spaces for single-step experiments with equally likely outcomes

Statistics and Probability (ACMSP168) Assign probabilities to the outcomes of events and determine probabilities for events

Year 7 optional links

Number and Algebra (ACMNA151) Apply the associative, commutative and distributive laws to aid mental and written computation

Statistics and Probability (ACMSP169) Identify and investigate issues involving continuous or large count data collected from primary and secondary sources

Measurement and Geometry (ACMMG181) Describe translations, reflections in an axis, and rotations of multiples of 90˚ on the Cartesian plane using coordinates. Identify line and rotational symmetries

Year 8 core links

Number and Algebra (ACMNA183) Carry out the four operations with integers, using efficient mental and written strategies and appropriate digital technologies

Statistics and Probability (ACMSP205) Describe events using language of 'at least' exclusive 'or' (A or B but not both), inclusive 'or' (A or B or both) and 'and'

Year 8 optional link

Number and Algebra (ACMNA152) Compare fractions using equivalence. Locate and represent fractions and mixed numerals on a number line

Year 9 core links

Measurement and Geometry (ACMMG220) Use the enlargement transformation to explain similarity and develop the conditions for triangles to be similar

Measurement and Geometry (ACMMG224) Apply trigonometry to solve right-angled triangle problems

Year 9 optional link

Measurement and Geometry (ACMMG223) Use similarity to investigate the constancy of the sine, cosine and tangent ratios for a given angle in right-angled triangles

Year 10 core link

Linear and non-linear relationships (ACMNA267) Describe, interpret and sketch parabolas, hyperbolas, circles and exponential functions and their transformations

Year 10 optional link

Measurement and Geometry (ACMMG275) Solve simple trigonometric equations