



This resource is part of a suite of materials and activities created to inspire entrants, and support teachers, and parents to enter *maths inside*: a photo competition open to everyone in Scotland.
maths inside: see different, make connections, celebrate!

Discovering and documenting the *maths inside* penalty shootout

What is this?

This is an example to inspire and support Second Level practitioners to design an interdisciplinary learning (IDL) activity based on the *maths inside* photo competition and leads learners towards the creation of an entry. This activity is based on Second Level experiences and outcomes (Es+Os) and complements the [Goal? example journey](#), its [displayed final submission](#), and [Image Bank 1](#) for Early Years to Fourth Level (Pre-school–S3).

CfE experiences and outcomes: Second Level

- I have worked with others to explore, and present our findings on, how mathematics impacts on the world and the important part it has played in advances and inventions [MTH 2-12a](#)
- I can conduct simple experiments involving chance and communicate my predictions and findings using the vocabulary of probability [MNU 2-22a](#)
- I understand the operation of a process and its outcome. I can structure related items of information [TCH 2-13a](#)
- I enjoy creating texts of my choice and I regularly select subject, purpose, format and resources to suit the needs of my audience [LIT 2-20a](#)
- By considering the type of text I am creating, I can select ideas and relevant information, organise these in an appropriate way for my purpose and use suitable vocabulary for my audience [LIT 2-26a](#)

Purpose of the activity

To explore basic mathematical game theory, logic and ideas leading to probability through a familiar and engaging activity, which is not typically considered from this viewpoint. To provide opportunities for those with mathematical skills which are not always recognised as such to relate those skills to more conventional mathematics, through the lens of an activity they may be more familiar with. To embark on a creative journey to record the discoveries made in an engaging piece of writing and in a visually appealing photograph. To encourage the development of digital literacy skills.

Learning activity

- In a whole class discussion, think of as many types of games as possible (for example, chess, cricket, racing, games console, rock-paper-scissors, noughts-and-crosses, etc.)
- As a group, consider what makes a player more likely to win a certain game, and how a player comes up with a good strategy
- Invite the class to consider what makes a game. That is, what are the essential components for something to be a game (rules, point scoring, winners/losers, etc)
 - Discuss the game-theory definition of a game: “Any set of circumstances that has a result dependent on the actions of two or more decision-makers (players)”
 - Use this definition to guide the discussion to other scenarios which might not be obvious games (for example, negotiating to buy something, deciding what time to go somewhere, auctions, war strategies, traffic congestion, whether to advertise a product, etc)
 - for more information about game theory see [What exactly is “game theory”? \(BBC\)](#) and for further examples of game theory being discussed see, for example, [The Prisoner’s Dilemma - The Open University](#) and [Winning at Rock Paper Scissors - Numberphile](#)
- Using the questions in [Image Bank 1](#) or the [Goal? example journey](#), invite pupils individually or in groups to think of times when they are playing these hidden games
- Ask children to write down their discoveries in a commentary, either individually or in groups
- Have each individual or group take a photo of the game being played, or some representation of it (Lego, drawing, board game equivalent, etc), and discuss what makes a visually appealing and engaging photograph
- Digitally add the *maths inside* sticker ([how to guides](#) available) and [submit](#) to the competition

Extension activity

- Have pupils devise strategies to play the games they identified, invite them to consider why any of these strategies makes them more likely to win
- Re-enact the scenarios and put the strategies to the test, or use some classic examples from game theory, such as the prisoners’ dilemma, to develop the pupils’ strategic thinking

National benchmarks

These activities provide learners opportunity to engage in further thinking and to integrate skills from across the curriculum in a context. Observation and feedback from these learning activities could contribute towards overall assessment of learners progress.

Open to all ages with prizes in each level. You only need a mobile, the internet & curiosity! Enter on your own or as a team, mind to add the maths inside sticker, and submit in one, or in as many categories as you like. The photo should be your own, without changes, and for a chance to win, cannot be shared anywhere else. View the [T&C](#) for more information, and please do get in touch if you have any questions.

credits

This [suite of resources](#) are the fruit of a collaborative project between undergraduate and postgraduate students from the [University of Glasgow — School of Mathematics & Statistics](#), [Education Scotland](#), and [Dr Andrew Wilson](#) (*maths inside* Founder and Director)

The authors are Jordan Baillie, Nanette Brotherwood, Tanushree Bharat Shah, Lucas Farndale, Emma Hunter, Christopher Johnson, Harkamal Kaur, Christian Lao, Samuel Lewis, Kathleen McGill, Megan Ruffle, Yvonne Somerville, Andrew Wilson, and Yuanmin Zhu