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| **Magic square puzzles** |
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| Practical investigation to create ‘magic squares’ in the playground |
| **Subject(s):** Maths**Approx. time:** 35 - 60 minutes |  | **Key words / Topics:** * Row
* Column
* Diagonal
* Magic number
* Magic square
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| **Suggested Learning Outcomes**  |  |  |
| * To be able to solve Magic Square problems using addition.
* To be able to add small numbers by mental arithmetic.
* To be able to create Magic Square grids of varying size and difficulty from 3x3, 4x4 to 5x5.
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| **Introduction** |  |  |
| This is one of a set of resources developed to support the teaching of the primary national curriculum. They are designed to support the delivery of key topics within maths and science. This resource focusses on developing ability to add numbers by using Magic Square grids.This activity could be used as a starter or main activity to introduce maths problem solving using addition.  |
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| **Activity** |  | **Teacher notes** |
| **Introduction (5 minutes)**Teacher to explain that learners are going to perform a magic square activity. Learners will then challenge each other to create their own magic squares.**Magic Squares – What are they? (10-20 minutes)**Show the presentation, explaining what magic squares are and the way they work. As a class, learners practice working out the magic square problems.Learners can then collect chalk and put on coats etc. so that they are ready to go outside to the playground. |  | This activity could be done in pairs or in small groups. Although this activity is designed to be carried out in a playground (which has advantages of scale and also allows chalk to be removed), it could equally be done on paper in a classroom.When outside the teacher should demonstrate the size required for a chalk 3x3 grid. The magic number for a 3x3 grid with numbers 1-9 is 15; for a 4x4 grid with numbers 1-16 it is 34; and for a 5x5 grid, numbers 1-25, it is 65.An interesting point to raise in the plenary is the relationship between the centre number and the magic number. |
| **Magic Squares Outside Activity (15-25 minutes)**Learners with their partner should:* Draw the 3x3 grid with chalk
* Add their own numbers
* Get their partner to check their magic square works
* Change over and allow the other partner to create their own magic square.

Once learners have successfully created a 3x3 magic square they could try chalking 4x4 grid magic squares.**Discussing the results of the activity (5-10 minutes)**Learners share their grids with other members of the class. Are all the grids unique? Are there any common features? |  | For more information on how magic squares work, refer to Dr Mike’s Maths Games for Kids – Magic Numbers of Magic Squares: <http://www.dr-mikes-math-games-for-kids.com/magic-square-magic-number.html> |
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| **Differentiation** |  |  |
| **Basic** |  | **Extension** |
| Learners could be given partially completed magic squares (at minimum, with the central number).They could also watch the YouTube video listed in the additional websites. |  | Learners could create 4x4 and 5x5 magic squares.Print off and try **Math Salamanders** – Magic Square Worksheets listed in the additional websites. |
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| **Resources** |  | **Required files** icon-docicon-pdficon-ppt |
| * Projector/Whiteboard
* Chalk
 |  |  Presentation – Magic square puzzles |
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| **Additional websites** |  |  |
| * **Math Salamanders** – Magic Square Worksheets: <https://www.math-salamanders.com/magic-square-worksheets.html>
* **YouTube** - Any Size Magic Square - Simple Three Step Method: <https://www.youtube.com/watch?v=CzKJmyLxpFQ>
* **TES** - Magic Squares Puzzle Worksheet: <https://www.tes.com/teaching-resource/magic-squares-puzzle-worksheet-6192072> (free download)
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| **Related activities (to build a full lesson)** |  |  |
| **Starters** (Options) * Watch video **YouTube** - Any Size Magic Square - Simple Three Step Method: <https://www.youtube.com/watch?v=CzKJmyLxpFQ>
* Print off the free worksheet from TES, listed in the additional websites. Use the 3x3 grid examples.
 | **Extension** (Options)* Learners could create 4x4 and 5x5 magic squares.
* Print off and try Math Salamanders – Magic Square Worksheets listed in the additional websites.

**Plenary*** Learners share their grids with other members of the class. Are all the grids unique? Are there any common features?
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| **The Engineering Context** film |
| * Engineers need to solve several puzzling problems when designing products. For example, chemical engineers have to work out what amount and combination of ingredients are needed to create really tasty and effective toothpaste.
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| **Curriculum links**  |
| **England: National Curriculum**MathsKS1 Year 2 addition and subtraction.* solve problems with addition and subtraction: using concrete objects and pictorial representations, including those involving numbers, quantities and measures
* applying their increasing knowledge of mental and written methods
 | **Northern Ireland Curriculum**KS1 NumberPatterns, Relationships and Sequences in Number.* explore patterns in number tables;
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| **Scotland: Curriculum for Excellence**Numeracy and mathematicsNumber and number processes.* MNU 2-03a
 | **Wales: National Curriculum** Mathematics – Using number skillsCalculate using mental and written methods* solve one- and two-step problems that involve addition and subtraction, multiplication and simple division including missing number problems, e.g. 40 – = 19
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| **Assessment opportunities** |
| * Informal teacher assessment of the activity through observing the task and Q&A.
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