



I'm a teacher, get
me OUTSIDE here!



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Learning Ltd

25 Outdoor Maths Games and Activities for All Ages



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To Celebrate Maths Week Scotland 2020**



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Introduction

The aim of this pack is to provide strategy games and challenges from around the world which can easily be played almost anywhere. Most of them have their origins in traditional games and variations can be found in many countries. They serve to demonstrate that a love of strategy, tactics and social interactions are an important aspect of our way of being as a species.

Mathematical reasoning is part of every culture. Valuing the mathematical strengths of all people is important part of acceptance and recognition that world-wide humans can connect through games. It is something to celebrate. If your class has a partnership with a school in another country it could be interesting to share these games and see what other ones you can learn from each other.

Creating an inclusive approach

Strategy games are great fun. They can be played just for the sake of it which means that children of many different ages and abilities can play together. The games can be undertaken as whole school events, e.g. as part of Maths Week Scotland.

If you really want to win, the trick is to look for patterns or moves which can help. This usually involves playing the game lots of times and experimenting with different tactics. This is how to challenge children who have a competitive streak!

Some of the games are less strategic, so that enjoyment of learning maths through a shared experience can happen. Many of the games have been, or can be, adjusted to make them cooperative and rely on people working together to succeed. This works best if a class is already familiar with a game.

Not all children cope with written instructions. Think about how you introduce a game, that engages the non-readers from the outset. For example, you could:

- Organise your groups or pairs so that there is one keen reader, if you want your class to figure out the game through reading the instructions. With this approach, it's important to build in time to stop, check, share ideas and have children demonstrate their understanding.
- Give advance warning that a game will be played outside and ask a group to see if they can find an online video of the game's instructions. If you have internet access outside, this is particularly helpful. This should be possible for most of the games as they are traditional or adaptations of well-known other games for playing outside.
- For some quick games, you can invite an interested group to learn the game and then to teach other children. This can work well with younger classes. By teaching each other, your children are having to recall and remember all the ins-and-outs of a game and to improve their communication.
- Ask an older class or parents to come and spend a session teaching and playing a game.
- Provide the game as a homework challenge to learn. Then when you come together to play outside, you can share ideas and tactics for outdoor versions.

If you have a child who cannot cope with losing, then a useful strategy is to offer that they play by themselves using both counters. Sometimes they may wish to have two toys play against each other.

Why outside?

Most of the games are traditional and many have been around for centuries in one form or another. They have their roots in the grids being etched or scratched on the ground. You are continuing this custom.

You have to move around more. It's a physically more demanding approach as you get up and down from the ground. Being able to move around a game and see it from different angles can help you with the strategy.

Because the games are played on a large scale, what may be a traditional game for two people can easily be adapted to become a game for a group where the teams need to work together and reach a consensus.

It's a chance to get fresh air and engage in practical maths experiences in a context which is unfamiliar to many children. Some children who struggle with maths inside have a more positive experience outside.

Since the outbreak of COVID-19, the emerging evidence is that being outside is safer. Transmission rates appear to be significantly lower outside. Thus taking every opportunity to work and play outside is a proactive approach to a healthier and safer way of learning.



General notes about outdoor games

1. Play the game a few times in advance of trying it with your class or group of children. Each game has quirks and being able to speak from experience is helpful especially when discussing how everyone got on with the game. Also it will help you work out which game is likely to suit your group and the practicalities of creating the board on the ground.
2. Children need time to learn each game. Older children or adult volunteers can assist here. This can be a great approach for using buddies from upper primary to support children moving into P1 or an older class.
3. As quickly as possible, get children playing a game. The discussions about tactics and ways of playing should come later. Once children know a couple of games then you always have a finishing off-activity for a group that finishes other outdoor work early. In the winter, it is better to go for mazes and games that involve moving around.
4. The counters can be found objects. Your class may prefer to develop a collection, especially if there is not much in your concrete jungle. Put together bags of cones, shells, stones, wood cookies so that it's all ready to go.
5. A small and simple enterprise is to hold a school outdoor maths games competition where children pay a small entry fee to play. This can be a wee fund raiser for a charity or for outdoor equipment. Another activity that works well is having a puzzle afternoon where children invent puzzles and then have fun playing them. This handout can give children ideas that do not involve complicated board games, etc. For younger children, simple games such as skittles are just as much fun as a strategy game and plenty of number skills can be learned through playing the game.

6. If a game becomes very popular, then consider getting the board outline painted on your playground. Many companies will offer a bespoke service provided they are given a design and its dimensions. Don't do this until you know a game is much-loved and where it is best situated outside.

7. The Jo Walter Trust offers small scale maths grants – closing date is usually in June each year for projects that happen the following year. It may be a helpful source of match funding.

<http://www.jowalterstrust.org.uk>

Increasing the challenge and mathematical learning

1. Encouraging children to make the board game

It can be a useful problem solver in that they will need to consider an appropriate size and an accurate layout. It helps develop their spatial awareness and understanding of geometry.

If you have number tiles, outdoor seats or other moveable squares or rectangles, then this is usually the quickest way to create an accurate layout. Your class may even want some ready cut out cards and stones (to place on top of the card on a windy day) so they can quickly chalk an accurate layout. For a large group grid, using silicone number squares can be very helpful.

Chalk can be used instead of a stone to scratch a pavement or sticks or lines drawn in sand, grit, mud and other soft surfaces. For slightly longer lasting yet temporary grids, use classroom paint. Sticks can also be used for games where the objects are not placed on intersecting lines.

2. Setting specific investigations

With older classes, you can set specific investigations, e.g. Is it an advantage to begin first in this game and how can you prove this? What happens if three people play a game instead of two?

3. Changing the rules

This is a particularly helpful strategy if a game isn't going well or a group or child is not really engaging with a game. Ask children for their ideas about making it better. What rules could be adapted or changed? How can they make the game more exciting? This type of creative thought helps children to:

- See how small changes can make a significant difference. It is a useful skill to acquire for algebraic reasoning – making a change and seeing the outcome of this change.
- Look for patterns and to use these to predict outcomes
- Learn how to record such changes in a mathematical way. Encourage children to use equations (maths sentences) to explain what happens. The use of a maths journal can help document this.
- Share ideas collectively to improve understanding. It's much more fun if everyone is working together for the greater good.

4. Going life-sized

It can be fun if the games are created on a large-scale and children become the actual pieces in the game. Use bibs to identify teams. This works best if children have had prior experience of the game in using traditional board style approaches. It is great for outdoor work in that there is space and children are moving about. However, it does mean that the emphasis may change to the challenge being more about working as a team rather than the mathematics of the game. The advantage is that for children who are

less secure in their mathematical vocabulary the position and movement instructions from others will really help.

5. Introducing algebraic notation

When using grids, show your class how to describe the positions of different pieces on the board using standard notation. A chess board traditionally uses the lower-case alphabet along the x-axis and numbers along the y-axis. Each piece is assigned an uppercase letter. This can be useful for describing tactical moves. For more information, see [https://en.wikipedia.org/wiki/Algebraic_notation_\(chess\)](https://en.wikipedia.org/wiki/Algebraic_notation_(chess))

For some of the other games, encouraging children to demonstrate successful strategies and recording them can be helpful. For example, the Game of Nim works well if strategies are written as a series of maths sentences. This enables a visual representation of the patterns to be seen.

6. Using artificial intelligence

Some of these games can be played on a computer. This is where the children pit themselves against the computer and becomes artificial versus natural intelligence. This can be a good follow up for motivated children after an outdoor session. The reasons for playing large scale games outside are the health and social benefits of being physically active, access to fresh air, time away from a screen and thus greater movement and exercise for the eyes as well as moving around.

1. Noughts and Crosses

Perhaps the best-known game of all!

Aim of the game: to make a line of 3 pebbles, vertically, horizontally or diagonally

Materials needed: chalk, 5 stones for Player 1, 5 cones for Player 2.

Instructions

- 1) Draw a 3x3 grid on the ground with the chalk.
- 2) Each player takes turns to put a stone on the grid.
- 3) The first player to make a line of pebbles in their colour wins.



Notes

- Use sticks instead of chalk to make a grid
- Put a white sheet underneath to see the objects more clearly.
- You can just use chalk but this means you will use up a lot of chalk with a large class.
- Sometimes the game results in a draw. Have a think about ways of winning, e.g.
 - Does it matter where the first counter is placed by either player?
 - Are there any patterns that can be created to ensure one player wins?
 - What happens if you use a 4x4 grid?
 - How could you create a 3D equivalent game?

2. The Game of Fifteen

This is a counting strategy game for two players based upon a noughts and crosses grid.



Aim of the game: To be the first player to make a straight line of three numbers total 15 be this vertically, horizontally or diagonally.

Materials needed: Instead of chalk you need a set of numerals from 1 through to 9. These could be bean bags, number pebbles, wooden cookies, Numicon or anything else you have to hand that is a manipulative.

Instructions

Players take turns to place a numeral onto the grid. The first numeral may not be placed in the centre square. The first person to make a line that totals 15 wins.

Notes

- Sticks can be bundled into groups of five. For numbers 5 or larger, the sticks can be used to represent the numbers. It is useful to help children who are learning to count on, e.g. 6 = 1 bundle of 5 sticks plus 1 loose stick. It's also helps children understand how numbers can be partitioned.
- More than two people can play this game.
- It can be a good challenge for younger classes to see if they can create a magic number grid before playing the game. Each line of numbers - vertically, horizontally or diagonally must total 15. Is there more than one way of doing this?

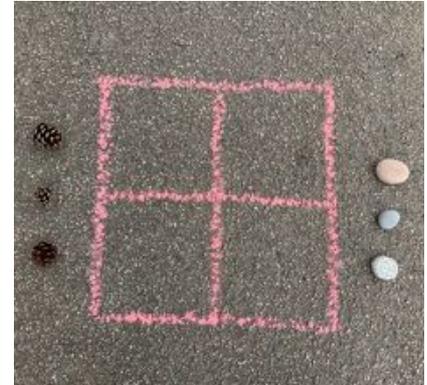
3. Nine holes

This is a useful game for young children to learn before Nine Men's Morris. It is a good next step from learning Noughts and Crosses.

Aim of the game: To make three-in-a-row – but diagonal rows are not allowed!

Materials needed:

- Chalk for making the grid, as shown in the photo
- 3 objects for each player, e.g. stones for one player and cones for the other



Instructions

1. Take turns to place an object on the grid at any of the points where two lines meet or intersect. Take care not to let your opponent get three in a row.
2. The play then continues by players taking turns to move an object into an empty point until one person manages to get three-in-a-row.

4. Tapatan

This is similar to noughts and crosses in that it's all about making three-in-a-row. It's from the Philippines. It's for two players.

Aim of the game: To make three-in-a-row.

Materials needed:

- Chalk or sticks for making the grid, as shown in the photo
- 3 objects for each player, e.g. stones for one player and cones for the other

Instructions

- Players take turns to put an object onto the grid, taking care not to let their opponent get three-in-a-row
- Once all six objects have been placed, the players take turns to move an object to an adjacent empty spot. No jumping allowed.
- Sometimes a stalemate is reached where moves are repeated but the game can't move on. This is a draw.

Notes

- You can change a rule. For example, what happens if you can move any counter into any empty spot, i.e. jumping is allowed.



5. Slide Fifteen

This game is an adaptation of the pocket money game where the numerals 1 to 15 have to be moved around a 4x4 grid into the correct order... but there's a catch.

Aim of the game: To move the numerals into the correct sequence in a 4x4 grid. It can be played by two or more players. It is a cooperative not a competitive game.

Materials needed: The numerals 1-15. These could be bean bags, number pebbles, wooden cookies, Numicon or anything else you have to hand that is a manipulative.



Instructions

- The numerals are “shuffled”. They are placed randomly on the 4 x 4 grid. There should be one space that does not have a number.
- The players take turns to move the numerals, one at a time. The numbers may only be moved into the blank space from an *adjacent* space vertically or horizontally. No diagonal moves allowed.
- When the numerals are in the correct order, you have collectively won.

Notes

- The game can be played with less numerals on a smaller grid.
- Is there a system or pattern to make the numbers move into order?
- Adults and children playing together can be good way of helping children sort numbers into their correct order.



Shuffled



Sorted

6. The Game of Nim

An ancient strategy game for two players. It may have originated in China.

Aim of the game: To ensure your opponent is left with the last pebble to pick up

Materials needed: 20 pebbles

Instructions

- Put the 20 pebbles on the ground.
- Taking turns, each player chooses to pick up 1, 2 or 3 counters. The player who picks up the last counter loses the game.

Notes

- There is a trick you can use to ensure that you do not lose. See if you can discover it!
- What happens if three people take turns to play instead of two? How can one apply the secret strategy?
- What happens if you change the number of pebbles used?
- Record the pattern of the game using maths sentences so that specific moves can be investigated, e.g. P1 = Player 1, P2 = Player 2

$$\text{P1: } 20 - 3 = 17$$

$$\text{P2: } 17 - 2 = 15$$

$$\text{P1: } 15 - 1 = 14$$

$$\text{P2: } 14 - 1 = 13$$

$$\text{P1: } 13 - 3 = 10$$

$$\text{P2: } 10 - 2 = 8$$

$$\text{P1: } 8 - 3 = 5$$

$$\text{P2: } 5 - 3 = 2$$

$$\text{P1: } 2 - 1 = 1 \quad \text{Player 1 wins in 5 turns}$$

7. Fives

A strategy game played on a 5x5 grid. I'm not sure of its origins but it's harder than first appears.

Aim of the game: To create a line of 5 objects on the grid before your opponent does.

Materials needed: 5 cones for one player, 5 stones for the other player.

Instructions

- Take it in turns to put your objects into the squares on the grid.
- Continue the play by moving one object to an adjacent square in turns. You can move in any direction.
- The winner is the first person to make a line of 5 objects horizontally, vertically or diagonally.



Notes

- This game could be simplified by playing on a 4x4 grid with 4 objects for each player.
- The 3-in-a-row game is Noughts and Crosses
- What happens if the grid is changed from a square to a rectangular array, e.g. 5x4?

8. Dara

This game from Nigeria requires two players or teams. It is played with stones or sticks in the ground. It's great for sessions where children finish at different times and need something to do, or as an impromptu family game when on holiday.

Aim of the game: To stop your opponent from making three in a row with their pebbles

Materials needed:

- 12 pebbles for each player; each player needs a different colour
- Chalk to make the grid

Instructions

1. Make the game board. Using chalk, make a 5x6 grid as a game board. If you are on a beach or other suitable surface this can be drawn on the ground with a stick.

2. Take turns to place a counter anywhere on the game board until all counters have been put there. Whilst this is happening neither player can remove each other's counters. Neither side can have more than three counters in a row at any one time. This is illegal!

3. Take turns to move a counter into an adjacent empty square. The counters cannot be moved diagonally but can be moved up, down or sideways. The aim is to make three counters sit in a row (but not a diagonal one).

4. When a player manages to make three counters in a row, they can remove one of their opponent's counters. A player can only remove one counter from their opponent in any one go, even if more than one row of three counters is created in a move.

5. The game is over when a player is unable to make three in a row with his or her counters. Their opponent wins when this happens.

Notes

- How important is the placing of each pebble to begin the game?
- Is it easy to cheat? If so, how can this be prevented?



9. Leopards and Tigers (Len Choa)

This is a traditional game from Thailand that is similar to draughts (checkers) in that players may move their objects into adjacent intersections or can jump an opponent's piece to capture it.

Aim:

The way to win is different for the leopards and tigers.

- For the leopards to win, they have to surround the tiger so it cannot move.
- For the tiger to win, it must jump over a leopard.

Materials

- Chalk
- 6 objects to be the leopard, one different object to be the tiger. In this photo, the tiger is a stone.

Instructions

1. Draw the board on the ground. It's an isosceles triangle grid as seen in the photo.
2. The tiger starts first and is put on the grid at the apex of the triangle.
3. A leopard is put onto the grid.
4. The tiger moves into an adjacent space
5. Another leopard is put onto the grid (taking care not to be in a position where the tiger could jump over it)
6. The tiger keeps moving into a space and the leopards continue to be placed onto the grid. Once all the leopards are on the grid, the play continues until either the tiger or the leopards win.



10. Nine Men's Morris

This is an old game dating back to Roman times or possibly earlier.

Aim: To make “mills” which is either a vertical or horizontal three-in-a-row line and to prevent the opponent from playing.

Materials

- 9 black pebbles
- 9 white pebbles
- Chalk

Instructions

1. Draw the board as shown in the photo. Make sure there are 24 points where the pieces can be placed. These are the corners or where the lines intersect.
2. The board is empty to begin with. The person with the white pebbles goes first and places one pebble on the board at one of the points. Continue taking turns until all eighteen pebbles (sometimes called pieces) have been played.
3. Next, each player takes a turn to move one piece along a line to an adjacent point. If he or she makes a “mill” – a line of three of their pebbles, then one of the opponents pebbles can be removed, providing it is not already part of a mill.
4. If all of the opponent’s pieces are in mills, then the player can capture and remove one of the opponent’s pebbles. Once a pebble has been removed, it cannot be used.
5. The game is over then a player is unable to move or only has two pieces left on the board.

Notes

- Try playing Six Men’s Morris on a smaller board or Twelve Men’s Morris on a larger board.
- Some versions of the game include wild cards. These are special rules in certain circumstances. What wild card rules can you create that makes the game extra interesting?



11. Hyena Chase

This game is believed to have originated from Morocco.

Aim of the game: For players to get their mother from the village to the well and back without being eaten by the hyena

Materials:

- Chalk for drawing the game board – there are 30 circles between the Village and the Well
- A die
- One pebble or object for each player



Instructions

1. Draw the game board on the ground as shown in the photo. The number of smaller circles between the well and the village do not matter. These represent the days it takes to reach the well.
2. Each person must roll a six to leave the village. When they roll the six, they put their counter on the small circle just outside the village.
3. The players move along the small circles in accordance with the number thrown on the die. But to get to the well, the person must roll the exact number.
4. At the well, the person washes their clothes until they roll a six. Then they may move to the small circle just outside the well.
5. The first player back to the village is transformed into the HYENA!
6. The hyena may only leave the village once a six has been rolled. But then the hyena can move twice as fast as other players. If the hyena rolls a four, then the hyena moves eight circles.
7. Again, the hyena can only enter the well with an exact roll of the die and leave once a six is thrown.
8. Any player passed by the hyena going back to the village is eaten.

Notes

- Players can share the same circle or space on the board.
- Does the number of small circles drawn between the village and the well affect the success of the hyena?
- What is the impact on the mothers if the hyena can move three times the roll on the die? At what point will all the players get eaten?
- The traditional game leaves the circles blank, but you may want to add in numbers to help with children learning about number order.

12. Line Swap

This game is often played as a team challenge using hoops and each team wearing a different coloured bib lining up on either side of the central empty hoop. It can also be played by one person.

Aim: To for the black pebbles to be moved over to the white side and vice versa in the least number of moves along a line of points.

Materials

Chalk, 5 cones, 5 stones

Instructions

1. Make a line with eleven points clearly indicated as illustrated in the photo.
2. The centre point is left empty. Put the five black pebbles on each point on the left side of the centre point. Put the five white pebbles on the right side, one on each point.
3. The pebbles have to swap sides. This can be done by sliding a pebble into an adjacent space or hopping over one pebble. Pebbles can be moved backwards and forwards along the line. They cannot be stacked up on one point.
4. Once you are proficient and can do this activity, the challenge is to see how few moves it can take.

Notes

1. This challenge takes a bit of practice. If you are getting in a pickle, then create a seven-point line and work with three black and three white pebbles. This is easier.
2. Look for patterns in the number of moves required. What is the difference when working with smaller and larger lines of pebbles? What is the largest line you can successfully complete?
3. Transfer your skills to working with people lined up. This can be interesting in itself. A team challenge can be made harder by completing this on a low gym bench where a team will have to begin again if someone falls off the bench.



13. Lines and Boxes

This is a bigger version of the well-known computer game. It can be played on square flagstones. It is for two players.

Aim: To make as many boxes as possible within a 4x4 grid

Materials:

- Lots of chalk for each player
- 25 pebbles to mark out the grid

Instructions

1. Make a 4x4 grid using the pebbles as illustrated below.

2. Take turns to draw a line to connect two adjacent pebbles either vertically or horizontally. When a player makes the fourth line to make a closed box, then mark this with the player's initial letter. The same player an extra turn.

3. If a player keeps making boxes, then he or she keeps getting an extra move and until no more boxes can be made.

4. The winner is the player with the most boxes.

Notes

- Make the grid using stones as the dots and cut sticks for the lines. The sticks all need to be the same size and you need lots, e.g. 32 x 30cm sticks for a 4x4 grid. Put stones at the corners, then remove the sticks. Take turns to replace them as the game progresses
- Try bigger grids
- Invite friends to play. Is it easier with more players? Could you work in pairs, but both take a turn?



14. Four-in-a-row

This game is a ground version of “Connect Four” and is for two players.

Aim: To be the first player to make four in a row.

Materials

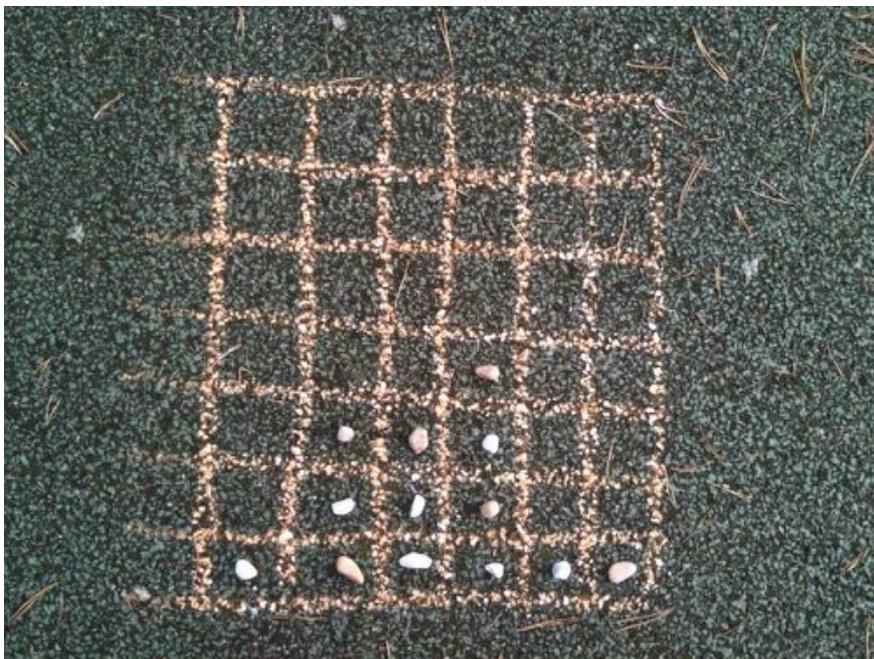
- Chalk to make the grid
- 20 stones
20 cones (in the photo, it is 2 different colours of stones that have been used)

Instructions

1. Create a 6x6 grid on the ground, using chalk
2. Both players need to be facing the same way when looking at the grid. Begin at the edge of the grid nearest to both of you. This is the baseline and all pebbles can only be added from here.
3. Take it in turns to place a pebble on the grid. You may only build up from the baseline.
4. As soon as a player has four pebbles in a row, then the player has won and the game is over. The line of pebbles can be horizontal, vertical or diagonal.

Notes

How does this game compare to the vertical version?



15. Five Field Kono

This is a strategy game from Korea – a simplified game of checkers that takes less time to play.

Aim: To cross the board and have your counters on the opposite side of the array from where you started but in the same layout.

Materials

- 7 stones
- 7 shells
- Chalk to create the grid

Instructions

- Set up 5x5 array with the counters in place as illustrated in the photo.
- The players take turns to move one of their counters. Each counter may move **diagonally** one point at a time to an empty point. No vertical or horizontal moves allowed. Counters can move **forwards or backwards**.
- You cannot capture or jump any other counter or move to a point that is already occupied.

Notes

Is it possible to reach a point in the game where neither player can move? In which case what happens next?



16. Butterfly

This is a traditional game from Mozambique and its name probably comes from the shape of the board. It is for two players.

Aim: To capture your opponent's pieces

Materials

- 9 pebbles and 9 shells (referred to as 'pieces')
- Chalk

Instructions

1. Draw the board as illustrated in the photo.

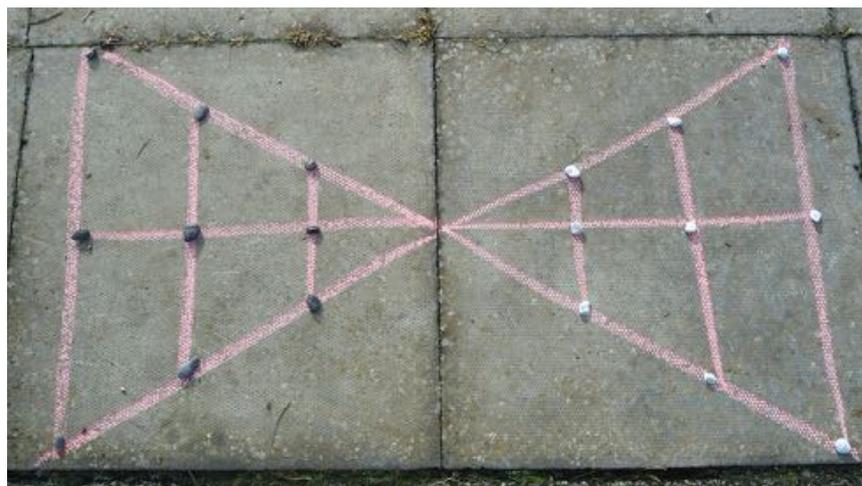
2. Put the pebbles and shells on the board. The pebbles are placed on the intersections on one side. The shells go on the opposite side of the board. The centre intersection should be empty.

3. In turn the players move one of their pieces along a line to an adjacent space. Alternatively, a player may jump over an opponent's piece and remove it. If there is another opportunity within the same move to jump over another adjacent piece belonging to the opponent, then this can happen. If a player fails to jump, then his or her piece is lost to the opponent.

4. The winner is the person who captures all of his or her opponent's pebbles.

Notes

The game can be played on a smaller board with each player having just six pebbles. This is a good way to learn the game.



17. Alquerque

This game may have its origins in the Middle East and is believed to be the parent of draughts. It is for two players.

Aim: To capture and remove all your opponent's pebbles

Materials

Chalk, 12 black pebbles, 12 white pebbles

Instructions

1. Create a playing board as illustrated below
2. Players face each other and put their colour of pebbles on the first two rows nearest them. Two pebbles from each player go to the right of the centre point which is left empty.
3. Players take turns to move one of their pebbles into an adjacent empty point. Alternatively they can jump over an opponent's pebble providing it is adjacent and the point beyond it is empty. When this happens the opponent's pebble has been captured and is removed from the board.
4. A player can jump over and capture as many of his or her opponent's pebbles as become available. If a player must capture a pebble when the opportunity arises, otherwise the opponent may remove the pebble.
5. A draw happens when neither opponent can move.

Notes

The rules for draughts differ considerably across the world. Try playing the draughts rules you know on an Alquerque game board to see if there is any difference. It may be easier to use draught pieces too.



18. Nature Bulls and Cows

This game is the predecessor to Mastermind. It can be played as a whole class prior to children working in smaller groups of pairs. This version uses natural materials whereas the traditional approach was to use numbers which is also a useful alternative. For getting children talking it's good to have a group play together against an adult, so they can share ideas.

Aim: To break the code - that is to work out the pattern of the hidden natural materials

Materials

- White cloth or chalk rectangle
- 4 sets of at least 20 small natural objects, e.g. 20+ stones, 20+ shells, 20+ cones, 20+ little twigs. The more varieties you have, the harder the challenge, so begin with 4 sets or possibly even just build up from three with young children.
- A score card or chalk
- Something to cover up or hide a line of 4 objects

Instructions

1. Create a line of 4 natural objects. Do not let the children see this pattern. Put the pattern in a box or hide it somehow.
2. On top of the white cloth, the children take turns or work in small groups to take turns to put a line of 4 stones or shells onto the cloth facing you and the hidden pattern.
3. For every object correctly placed, then you say it is a "bull". For every correct object but in the wrong place, then this is a "cow." This can be written down beside the line using chalk so that the person can try and deduce the next line or row of objects they are making.
4. The games continues until a group or individual has worked out the code.

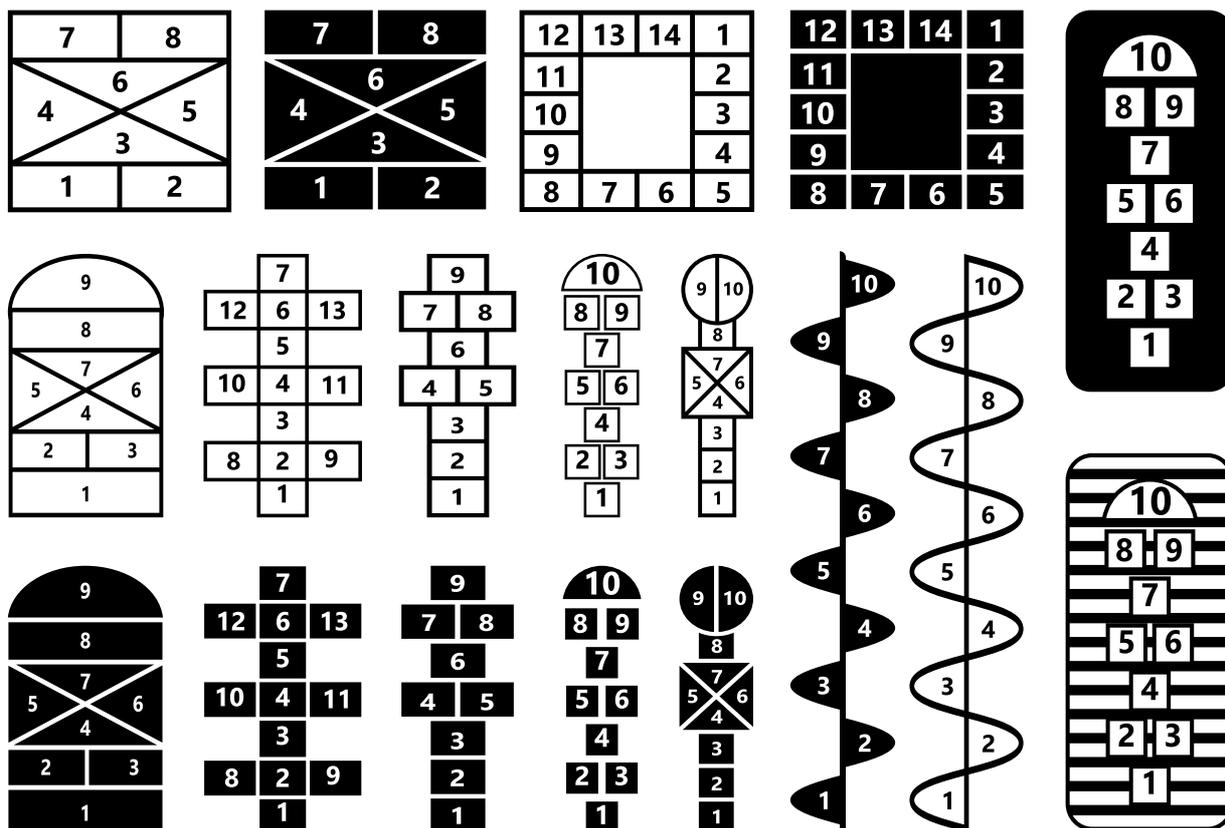
Notes

- I blogged about this game and the photos may be helpful: <https://creativestarning.co.uk/maths-outdoors/nature-mastermind/> so you can see how it works.
- It is a challenging game - not for very young children. However, it can be simplified by using only three objects.

19. Hopscotch and similar jumping games

Hopscotch is played world-wide. It has lots of different names and variations even within the United Kingdom. As a result it has intergenerational appeal. It can be played in groups or alone making it highly versatile. It is also easy to invent your own or adapt a known pattern. For this reason it is a good theme for maths celebrations such as Maths Week Scotland.

Here's some examples of hopscotch patterns:



The chances are that someone in your group will know the game and have a grid in mind. Often it is good to start using the rules and layout that someone already knows who can then explain how to play it to others.

Mathematically, it is good to encourage children to make small, discrete changes to the rules, one at a time to observe the impact on the game. Here's some possibilities:

- Change the grid pattern – pick one of the above or make up your own.
- Change the numbers within the grid. This can help children practice counting in different multiples, e.g. if you chalk the multiples of three. It's extra good as children learn to count backwards as well as forwards.
- Change the jumping rules. For examples, it's common to hop on single tiles, jump on double tiles. What happens if you jump feet together on the single tiles and feet apart on the double tiles?
- Create new parameters altogether, such as the Wonky Hopscotch Challenge.

20. Wonky hopscotch

Have a look at any hopscotch playground marking your school may have outside. Ask children to comment on the layout, numbers and angles used. Find out if any children use this game at playtimes and discuss the rules. Do any of them ever change the rules and make up new hopscotch games or variations? What makes hopscotch a good game or what would make it even better?

Using grid paper, encourage your class to design their own hopscotch layout. Put in place some clear mathematical criteria, such as:

- No right angles allowed
- Must be symmetrical
- Should face north
- Needs between ten and twelve spaces
- Must not use the numbers one to ten

Once children have sketched their design, they should consider how to scale this up outside.

- What tools will they need?
- How will they ensure accuracy?
- Do they need to adjust their design?
- What jobs are needed and who will do what?
- What happens if they make a mistake: does the initial outline need to be created using ropes or sticks?

Afterwards, ensure children photograph their hopscotch and have time to play the game. It is worth videoing the children and get them to reflect upon how good the hopscotch game was based upon their designs.

21. Escargot

This is a French version of hopscotch. Thus a wonderful opportunity to count in French. The rules are slightly different and are well explained in this post: <https://weefolkart.com/homeschool/play-french-escargot-game/>



Other challenges

Is it possible to create a Fibonacci hopscotch that takes into account the sequence of numbers but represents the increasing quantities visually? For example, could a spiral-based hopscotch demonstrate this?

Maths Maze Challenges

Mazes are a lovely project that work well for all ages and abilities. There are also mazes which can be found in public parks, historic estates and other places out and about. As a general rule, mazes involve an element of problem solving to walk through. Labyrinths are about contemplation and enable a person to walk a path without needing to work out and or make a choice about which path to take. It's a very efficient use of a piece of ground. Mazes can also be created on streets using chalk. Here are two examples that world expert, Adrian Fisher has developed. Have a look at his website: <https://www.mazemaker.com> and be totally inspired.

It's worthwhile discussing possible strategies. Most children want to jump right in. This trial and error approach can be effective, but perhaps there are other ways of working out the maze...

22. Rook Jumping Maze

Older children can try and create this themselves. In the photo, each square was 30cm x30cm. This meant the total area was 1.5 m x 1.5 m. It's a good practical measuring challenge to create the grid.

2	2	4	1	3
3	3	1	3	2
1	2	♥	2	3
3	2	3	2	4
4	2	1	3	2



Once the entire grid is complete, it's time to find your way through the maze!

- Every player must start on the 1 in the bottom centre square.
- Then, jump 1 space in any direction (up, down, left or right), but *not* diagonal. You must stay in a straight line. You can't jump 2 forward and 1 left to make 3 moves. It must be all in the one direction.
- To continue through the maze, you can jump in any direction **the number of squares indicated by the square you're standing on.**

23. Rope mazes

These are fun for little children. Brown Owl wants to meet her friend White Owl. Which rope line should she follow to find her friend? Only one line will reach White Owl. The other takes you back in a line. Just take care not to trip on the ropes. Using brightly coloured ones can help here.

Rope mazes also work well being created on a beach in the sand – just use a stick or drag your heel to make the lines to follow.



24. Amazing

This is a team-based problem-solving activity. You can have a whole class involved in solving one challenge and then children usually enjoy inventing their own versions, once they have the idea about how it works.

If you have a grid or flagstones that make up a tiling space then this is ideal. If you don't, you can lay out hoops or something similar.

The bigger the grid, the more complex the challenge. Here is a 5x5 challenge.

S				
				F

Next, draw a secret path on a scrap piece of paper that shows the route through the grid. Do not share this with the children, e.g.

S	X	X		
		X		
	X	X		
	X			
	X	X	X	F

The whole class or group works as a team. They should make a circle around grid so that they can see what is happening. Explain that the children may step forwards, backwards, left or right but not diagonally. As a team they have to work out their way across the grid.

The first child steps on the starting square **S**. She then steps onto another square. If this is not on your secret map, tell her that she is "out" and the next child has a go. They now know where not to step and thus move to the correct square. The activity continues until the class have worked their way through your "maze".



This maze has been created on a beach. It can take quite a bit of work to put together.

25. Invent a maze

Part of the fun of mazes are inventing your own.

- If you have a sketchnote app and a tablet that uses a pencil for drawing, then this is the easiest way as erasing mistakes is possible. Alternatively use grid or dotted paper.
- If you can find a place where you have a natural grid outside such as flagstones, then this makes it much easier to draw your maze.
- You may prefer to do alternative mazes. In this blog post, a group of children with additional support needs created a range of different mazes using available props such as sticks, ropes and PE cones. <https://creativestarning.co.uk/developing-school-grounds-outdoor-spaces/amazing-mazes/>
- 3D mazes are a lot of fun and can be made with boxes, play tunnels, etc. It's also possible to create mazes through planting daffodil bulbs or other quick growing plants on a patch of grass.
- Number mazes are very challenging. This one on the NRICH website involves finding the paths that totals 100 exactly <https://nrich.maths.org/91> There is also a money maze which involves adding and subtracting money as you work your way through the maze <https://nrich.maths.org/2648> Finally mazes can also be alphabetical such as this one <https://nrich.maths.org/201> or require you to pass through combinations of different colours.

More outdoor maths games

On my blog I have also provided instructions for many more maths games that work well outside. It's worth browsing the blog posts to discover a range of possibilities, including creating kites, symmetry explorations, logic games and so on. <https://creativestarning.co.uk/maths-outdoors/>

About Juliet

Juliet is an education consultant who specialises in outdoor learning and play. Juliet has worked at a national level since 2008 writing case studies, documents and doing behind the scenes work to help shape strategy and support for schools and ELC establishments. This includes heading up the team that wrote the Education Scotland document, *Outdoor Learning: A Practical Guide for Scottish Teachers and Practitioners* (2011), co-authoring *Loose Parts Play – A Toolkit* (2016 & 2019) and being part of the Scottish Government strategy group that created *A Play Strategy for Scotland* (2013). Most recently, Juliet contributed to *Out to Play* (2018), a Scottish early years document supporting practitioners to develop off-site provision in local greenspace.

She is the author of two award-winning and best-selling books: *Dirty Teaching: A Beginner's Guide to Learning Outdoors* (2014) and *Messy Maths: An Outdoor, Playful Approach for Early Years* (2017). Her website,

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