



LOGICAL THINKING is the theme for this INCLUSION AND HOME LEARNING GUIDE

This Guide suggests related learning activities for all ages from 4 to 17+

Just choose whatever seems suitable for your group of learners

The FIVE IN A LINE GAME was designed for both Primary Secondary

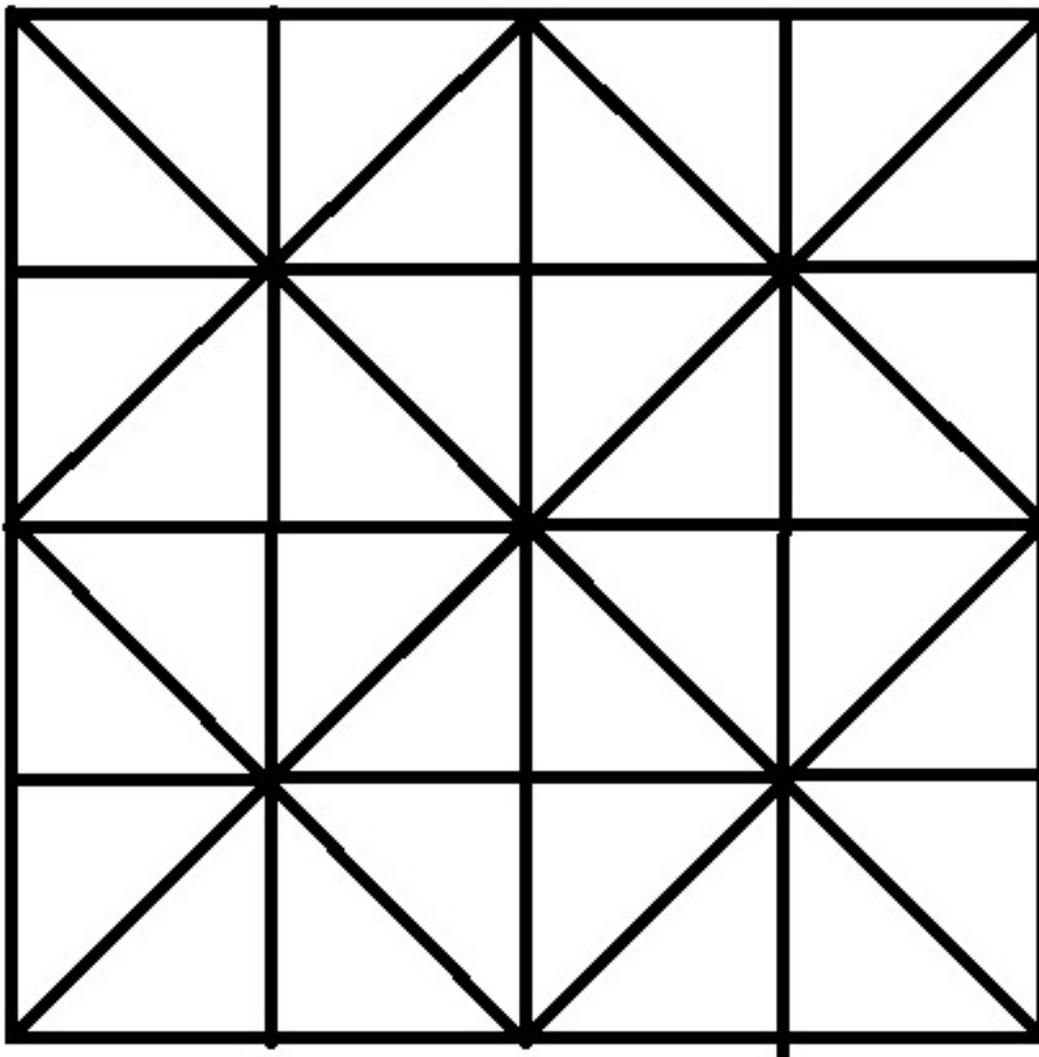
FIVE IN A LINE GAME

This is a game for two players. It requires a lot of thinking and strategic play.

Each player has 5 stones, counters, bottle tops or buttons that look different from the counters used by the other player.

To win, the player must be the first to get his or her 5 counters in a line. Each player has to stop the other player making a line.

The players take it in turns to place their counters on one of the lattice points on the board. When 10 counters have been placed, players take turns to move one counter at a time to an adjacent empty place along any of the marked lines. Players must move when it is their turn.



Alternative version

No stones are moved. Instead, both players place their stones until one makes a line of five. If neither player can make a line of 5 then the game ends in a draw.

HELP

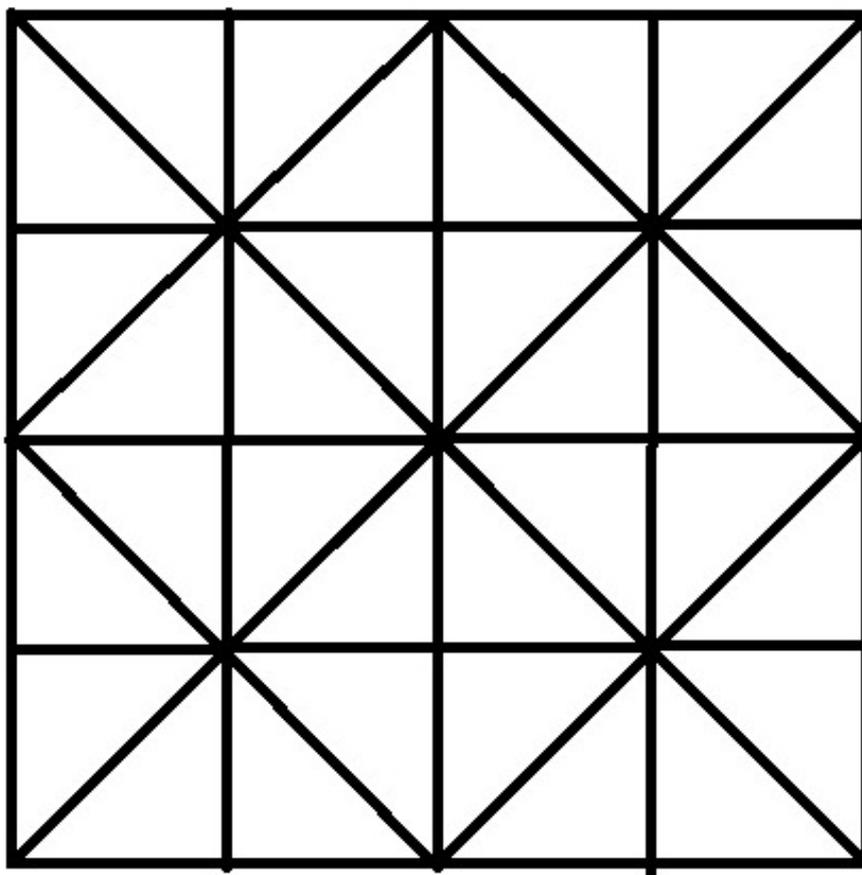
It is possible to make a line of 5 of your counters on 10 vertical, 10 horizontal and 2 diagonal lines. You need to keep watching your opponents moves to stop him or her getting a line before you do. Plan your strategy according to what your opponent does.

NEXT

You could try Gomoku which is the same game played using a 15×15 board or a 19×19 board. This is more challenging than the simple game on a 5×5 board

Gomoku, also called *Five in a Row*, is an [abstract strategy board game](#). It is traditionally played with [Go](#) pieces (black and white stones) on a Go board. Because pieces are typically neither moved nor removed from the board, Gomoku may also be played as a [paper-and-pencil game](#). The game is known in several countries under different names.

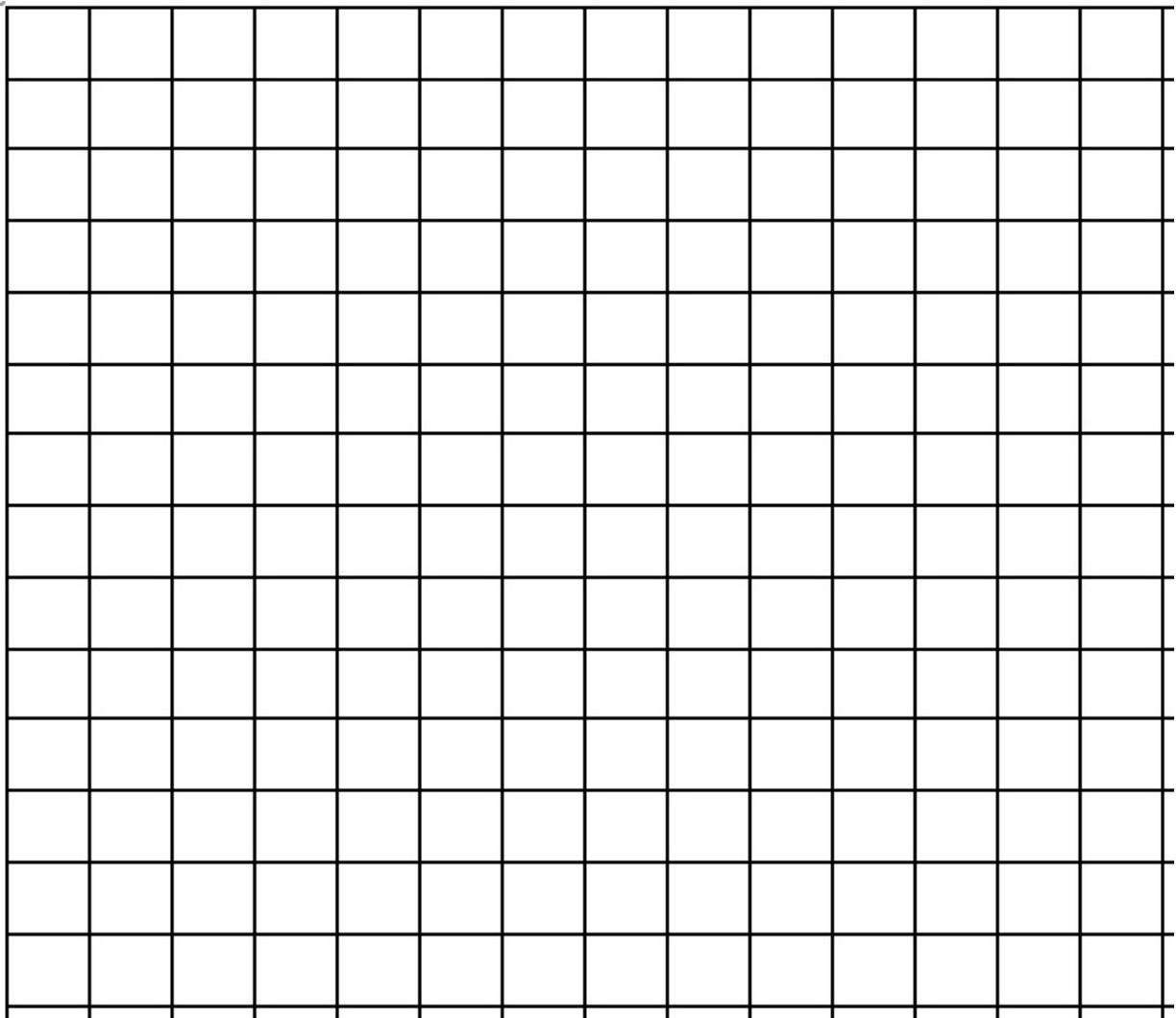
Players alternate turns placing a stone of their colour on an empty intersection. The winner is the first player to form an unbroken chain of five stones horizontally, vertically, or diagonally.



GOMOKU BOARD

Both Five in a Line and Gomoku games can be played with pencil and paper.

GOMOKU BOARD



INCLUSION AND HOME LEARNING GUIDE

THEME: LOGICAL REASONING

Young children

Play **Tic Tac Toe (3 in a line)**.

Can they work out how to avoid losing?

Can they force a draw?

Upper Primary and Lower Secondary

Play **Five in a Line Game** with your children and let them play with each other. This is a game where adults and older children are often beaten by younger ones. Let everyone play the game and encourage concentration and perseverance.

After several days when people have had the opportunity to play the game, you could organise a competition in which everyone gets to play everyone else. If someone becomes the champion in your household, invite anyone else to challenge the 'champion' to a contest of 5 games. If the challenger wins then he or she becomes the new champion.

Key Questions

- Has your opponent got 3 stones anywhere on the same line?
How can you stop your opponent getting 5 in a line?
- If you go there, what would be the best move for your opponent? What would you do then?
- What would be a good next move for your opponent? What would you do then? If you did that what would your opponent do?

Upper Secondary

Play **Gomoku** which is a similar and much more challenging game.

Gomoku is (五目並べ) in the Japanese language. **Go** means five, and **moku** means pieces (or eyes or dots). The game is also popular in Korea where it is called

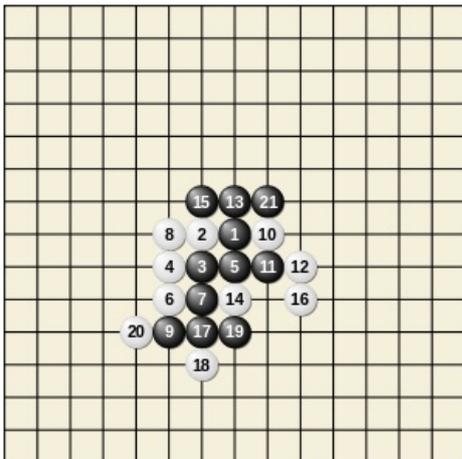
Omok (오목 [五目]) which has the same structure and origin as the Japanese name.

RULES OF GOMOKU

1. Gomoku is played with black and white pieces on a 15 by 15 board.
2. Black plays first, and players alternate in placing a stone of their colour on an empty intersection.
3. The winner is the first player to get an unbroken row of five stones horizontally, vertically, or diagonally. **Free-style Gomoku** requires a row of five or more stones for a win.
4. The rule of **three and three** bans a move that simultaneously forms two open rows of three stones (rows not blocked by an opponent's stone at either end). The rule of **three and three** aims to reduce black's advantage.

Because pieces are typically not moved or removed from the board, Gomoku may also be played as paper and pencil game.

Play a few games recording ALL THE MOVES. When one of the players has won the game together go through the game move by move, try to see where the losing player might have done better with a different move.



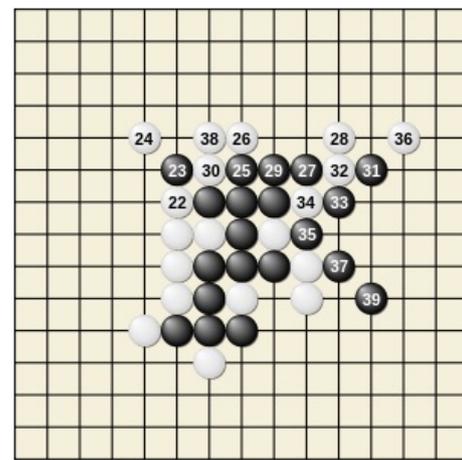
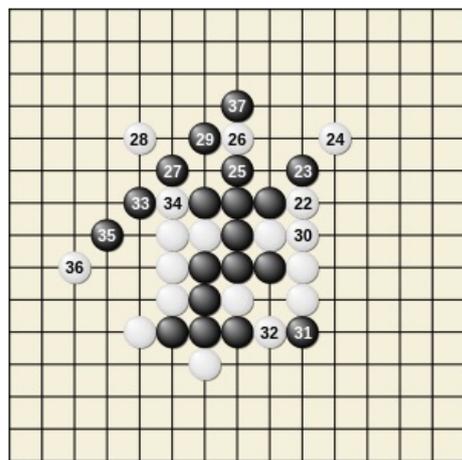
EXAMPLE GAME

Here you see the first 21 moves in the game.

Move number 20 is a mistake.

As you can see from the sequence of moves on the left below, Black can force a win, and wins at move 37.

But, in the follow on from the first 21 moves shown on the right, you can see that Black loses his advantage and White wins at move 38.



Gomoku has proved an enormous challenge for mathematicians and computer programmers. For Artificial Intelligence (AI) experts to write a computer program to defeat a human champion was far more difficult for Gomoku than for chess. Not until 2017 did a computer outperform the world human champion in public competitions. In the Gomoku World Championship 2017 there was a match between the world champion computer program Yixin and the world champion human player Rudolf Dupszki. Yixin won the match with a score of 2–0.



Very young children play the game of Go in SE Asia although it's a more complicated game than Gomoku.

In 2017, AlphaGo, a computer program developed by a team in Cambridge UK, was the first computer program to beat a professional player in a championship.

AlphaGo defeated the world's Go player Ke Jie securing the victory after winning the second game in a three-part match. DeepMind founder Demis Hassabis said Ke Jie had played "perfectly" and "pushed AlphaGo right to the limit" See the trailer for the Amazon Prime documentary film AlphaGo (2017)

https://youtu.be/8tq1C8spV_g

Why do this activity?

Games like this teach children to reason logically. They must be able to visualise the board several moves ahead, with different possible sequences of play, and choose the best move to make next. Playing such games with concentration helps learners to develop their thinking skills.

Learning objectives

In doing this activity students will have an opportunity to develop their mathematical thinking and visualization skills.

Generic competences

In doing this activity students will have an opportunity to:

- analyze, **make hypotheses** (if I did this and he did that ...) and to reason logically;
- play games competitively with **consideration and respect for others**.

Follow up

Tell the group about Gomoku (see the Next box on page 1). They might like to try it. In Korea this game is played very seriously by young children as an introduction to the game of Go which is simpler to learn than chess but more challenging to play with skill. For the story of the victory for Artificial Intelligence over the best champion plays see https://en.wikipedia.org/wiki/AlphaGo_versus_Lee_Sedol

MATHS



TOYS

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