Maths Circle Guidance Pack 2

The resources in this pack use maths normally met at ages 7 to 11.

The activities and games have been selected to encourage mathematical thinking such as working systematically and reasoning and also communication skills and perseverance.

Some of these activities require equipment, including multilink cubes, dominoes and dice. You may also wish to use plastic counters, plastic tiles and teddy counters although a printable version is included.

For longevity you may wish to laminate the instructions and the printable pieces.

Creating Cubes*	27 multilink cubes - 9 each of red, yellow and blue
Dicey Operations *	Dice
Domino square*	Dominoes
First Connect Three*	Dice, counters, 9 red and 9 blue
Got it	Pen and Paper
Mystery Matrix	Pen and Paper
Nim-7	7 counters
Sandwiches	2 sets of 1-7 digit cards
Sets of Numbers	Pen and Paper
Seven Flipped	7 mats
Shape Times Shape	Pen and Paper
Tangrams	Sets of Tangram
Tea cups	16 cups 16 saucers (printable versions included)
Twinkle Twinkle	8 counters- 4 red, 4 blue
Two Stones	4 counters- 2 red, 2 blue

* Requires additional equipment.

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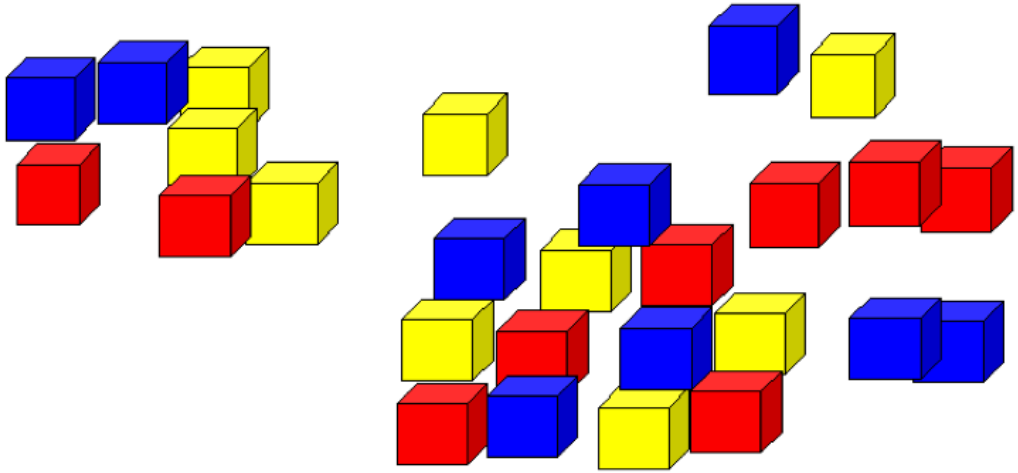
Creating Cubes

You need:

27 small cubes, 9 each of any 3 colours.



Arrange them into a large **3 by 3 by 3 cube** so that, on each face of the large cube, **no row** or **column** of cubes contains **two** cubes of the **same** colour.

Dicey Operations in Line

Find a partner and a die (preferably 0 - 9 but if you don't have one you can use a 1 - 6 die).

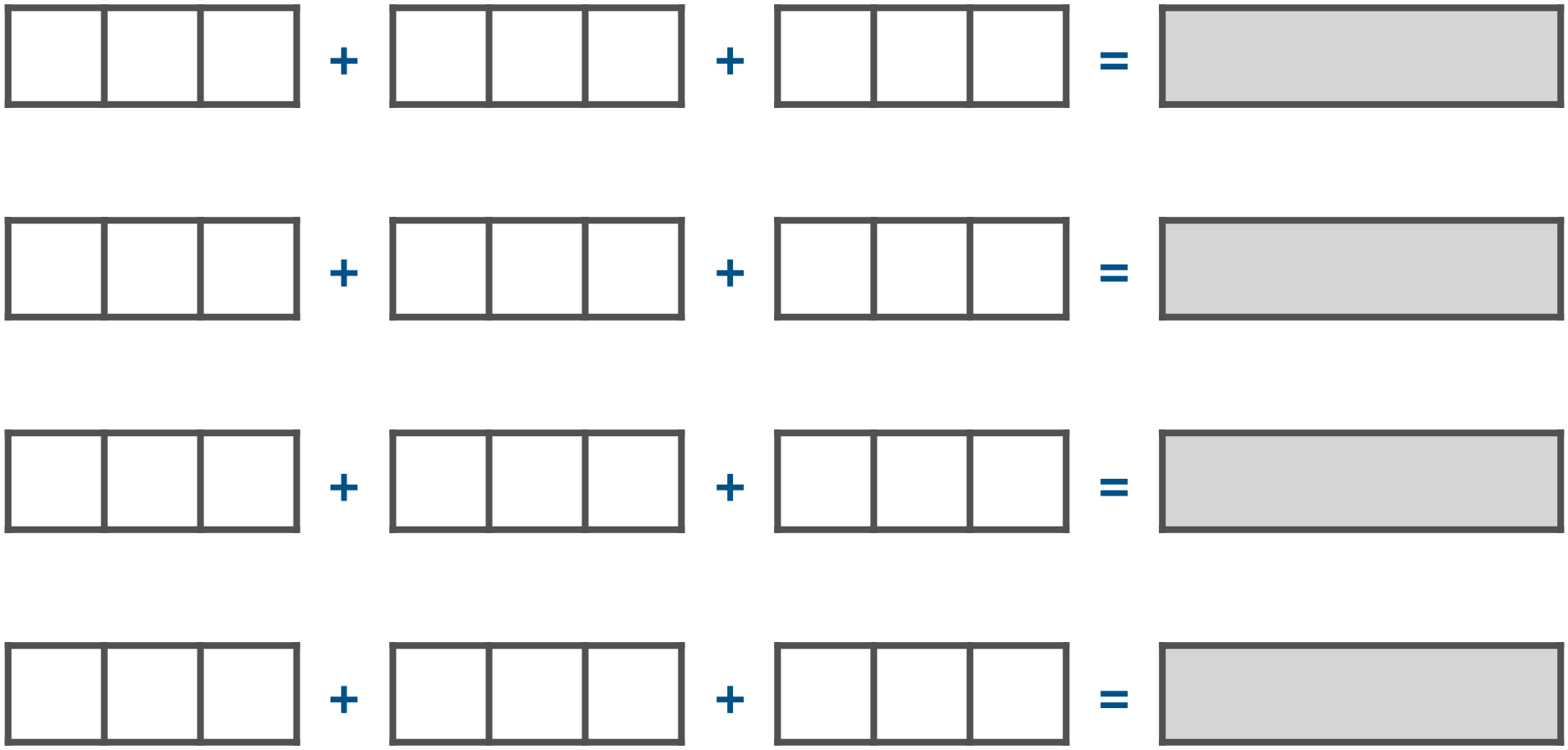
Each of you draw an addition layout like this:

Take turns to throw the die and decide which of your cells to fill in.

Throw the die nine times each until all the cells are full.

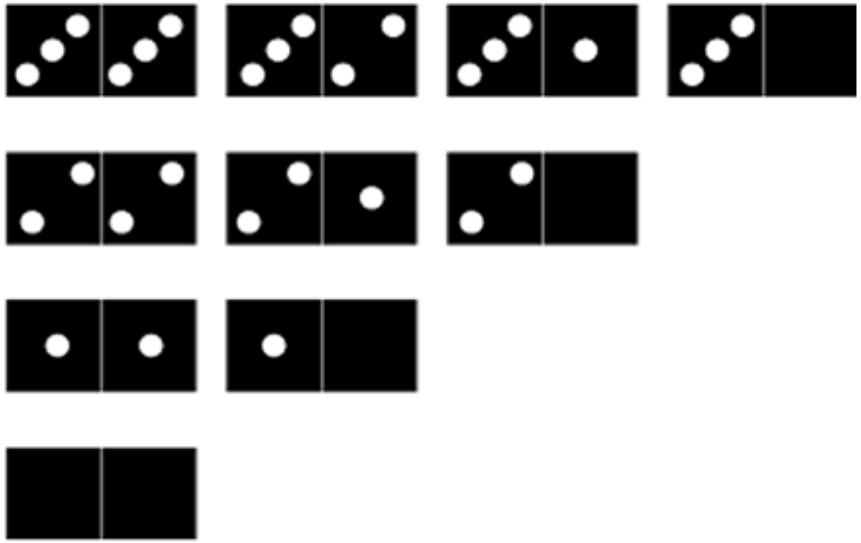
Whoever has the sum closest to 1000 wins.

Dicey Operations

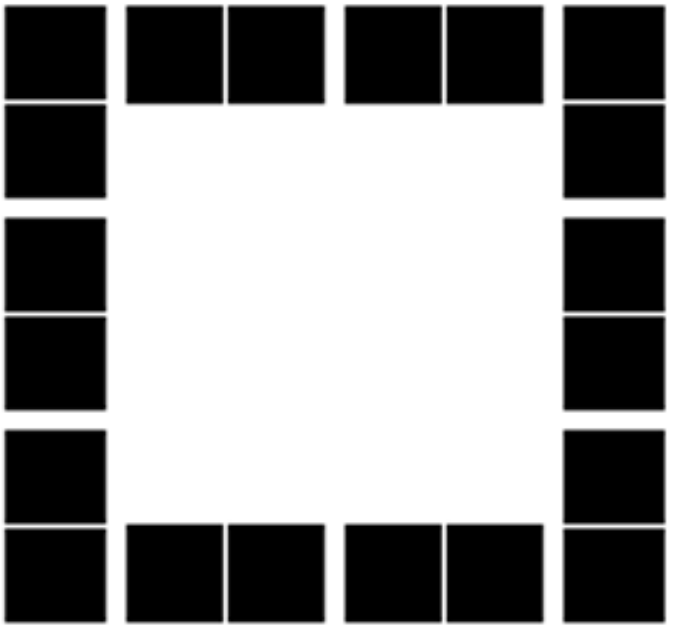


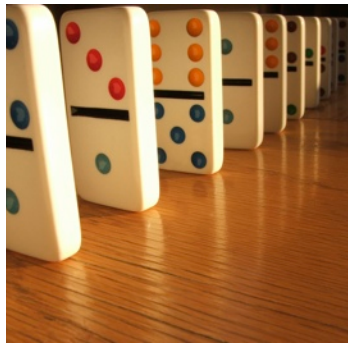
Domino Square

These are the ‘double-3 down’ dominoes.



Use these dominoes to make this square so that each side has eight dots.





First Connect Three

You need :

a partner
a playing board
two dice
counters, two colours

In this game, the winner is the first to complete three in a row, either horizontally, vertically or diagonally.

What you have to do:

Roll both the dice and decide whether you want to add or subtract to produce a total shown on the board.

On the board, cover your total with a counter.

You cannot cover a number which has already been covered.
If you are unable to find a total which has not been covered you must pass.

Are there some numbers that we should be aiming for? Why?

Which number on the grid is the easiest to get? Why?

Which number is the most difficult to get? Why?

For a more challenging version of this game, you could look at Connect Three. http://nrich.maths.org/5911/index

Game Board (First Connect Three)

	-5	-4	-3	-2
-1	0	1	2	3
4	5	6	7	8
9	10	11	12	

Got It!

This is a game for two players.

Start with the target number of **23**.

The first player chooses a whole number from 1 to 4.

Players take turns to add a whole number from 1 to 4 to the running total.

The player who hits the target of 23 wins the game.

Can you find a winning strategy?
Can you always win?

What happens if you choose a new target number?

What happens if you change the range of numbers you can add?

Can you work out a winning strategy for any target and any range of numbers?

Mystery Matrix

Can you fill in the multiplication square?

The numbers 2 to 12 were used to generate it, with exactly one number used twice.

x						
	32			40		
					49	
			22			
		15				27
			24			
					42	

NIM

Place the 7 counters in a group and decide who will go first. (In the next game, the other player will have the first turn).

Each player takes turns to take away either one or two counters.

The player that has the last turn loses.

Keep playing until you work out how to win, find a winning strategy.

Does it matter who has first turn?

Sandwiches

1. Start with two 1’s, two 2’s and two 3’s

1 1 2 2 3 3

Arrange these six digits in a line so that:

between the two 1's there is one digit
between the two 2's there are two digits
and between the two 3's there are three digits

2. Now, try to do it if you only have two 1's and two 2's – one digit between the 1’s and two digits between the 2’s. Can it be done?

3. It is possible to make a line as before if you include two four's, and between the two 4's there are four digits. Try it.

1 1 2 2 3 3 4 4

Please turn over

Sandwiches

Sandwiches continued...

4. If you have two 5's too, it is actually impossible to make a line as described at the start of this activity - that is with 5 digits between the 5's.

It's also impossible to do it if you have two 6's as well as all the others...

BUT ...

if you have two each of the digits 1 to 7

IT CAN BE DONE!!

1 1 2 2 3 3 4 4 5 5 6 6 7 7

There is more than one way of doing this – try to find at least one arrangement that works with all seven digits.

Sets of Numbers

How many different sets of numbers with at least four members can you find in the numbers in this box?

For example, one set could be multiples of four, another set could be odd numbers.

2			51			124			39
	91	27			8			36	
				3		17			13
		119					56		
121									
		143		136		64			49

Seven Flipped

You have seven hexagonal-shaped mats, each with one side red and one side blue.

Starting red side up, these mats all have to be turned over - but you can only turn over exactly three at a time.

What is the smallest number of moves you can do this in?

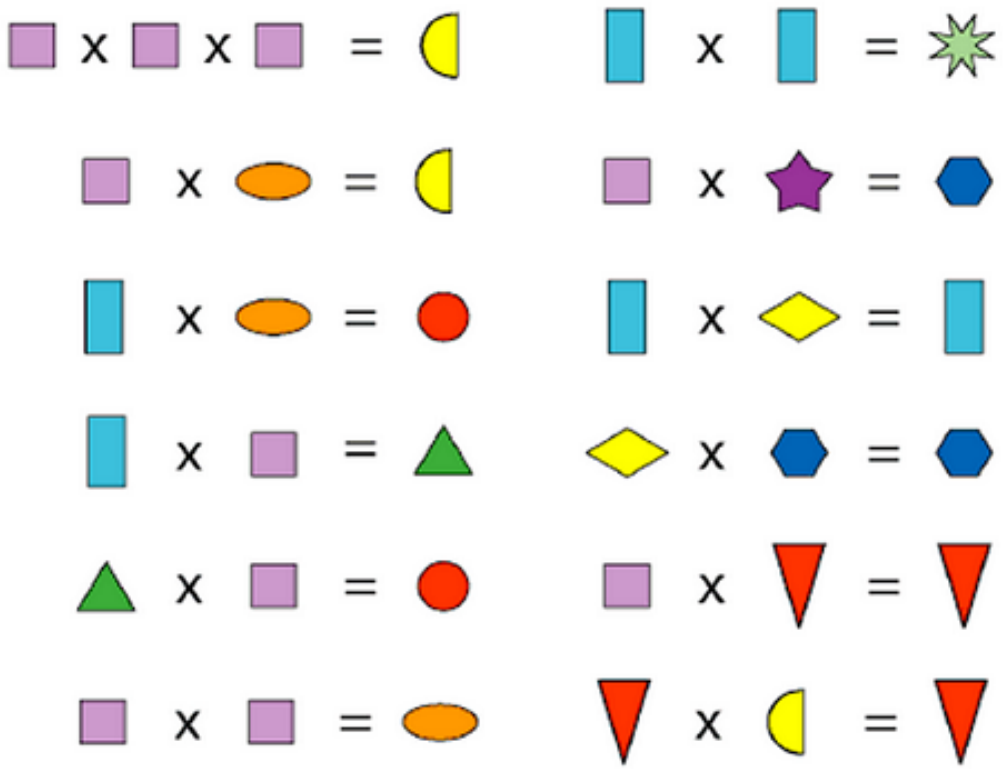
Try with other numbers of mats. Do you notice any patterns in your findings?
Can you explain why these patterns occur?

Shape Times Shape

The coloured shapes stand for eleven of the numbers from 0 to 12.

Each shape is a different number.

Can you work out what they are?

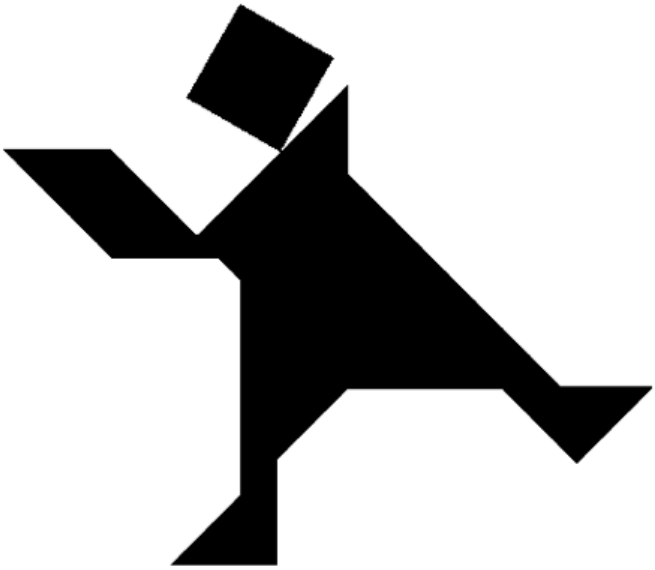


World of Tan 2 - Little Ming

First, use all 7 pieces to make a square.

Then try the two figures below:

Little Ming



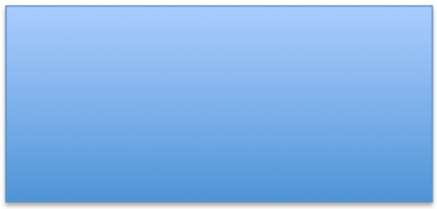
Little Fung

More Tangrams using the 7 Pieces

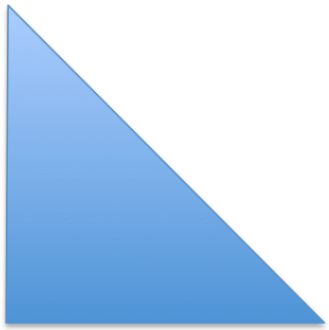
It is possible to make shapes other than a SQUARE and some are shown below.

Give some of them a try.

RECTANGLE



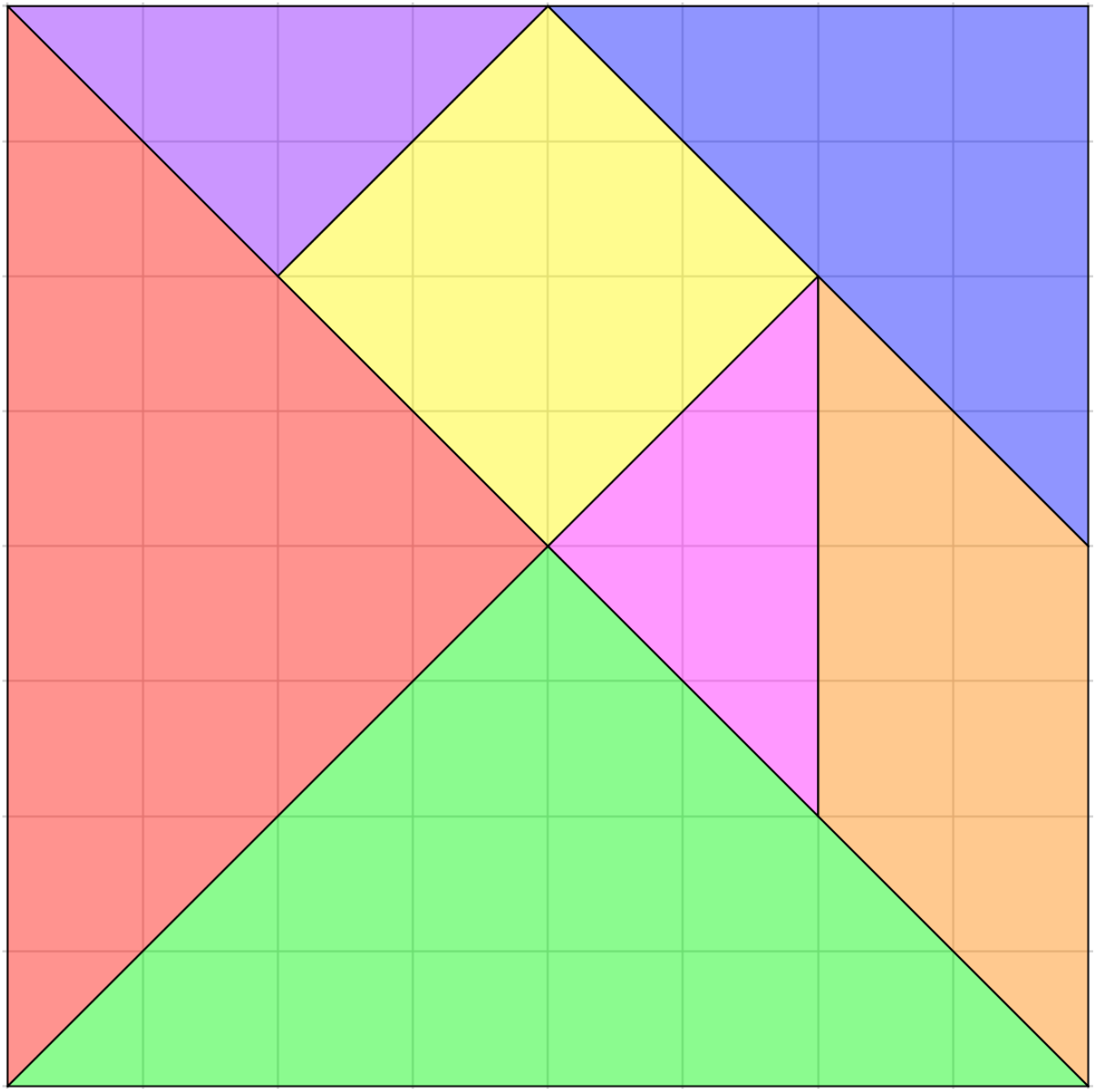
RIGHT ANGLED ISOSCELES TRIANGLE



PARALLELOGRAM

TRAPEZIUM

Tangram Pieces



Teacups

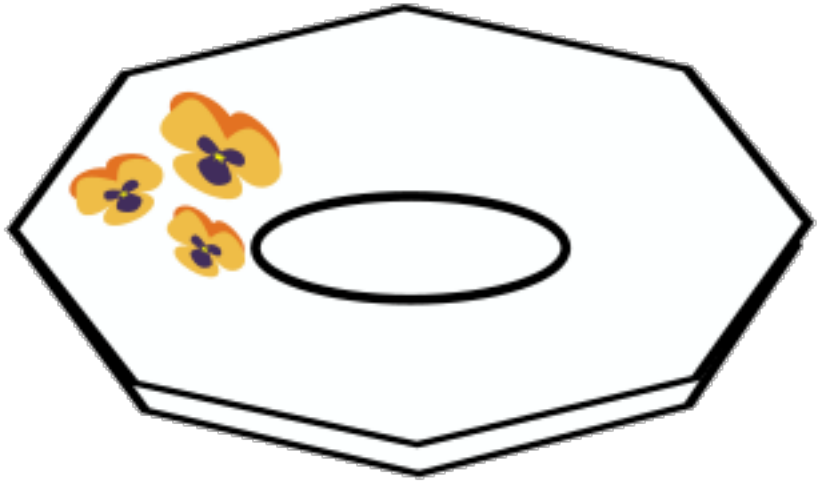
You have four green cups and saucers, four white, four red and four blue, and a small tablecloth.

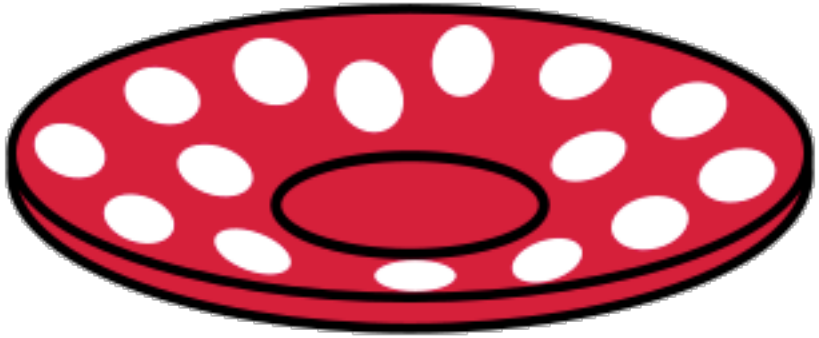
Arrange the cups and saucers (each cup on top of a saucer) into the four by four grid, on the tablecloth, so that in every row and every column there is only one cup of each colour and one saucer of each colour.

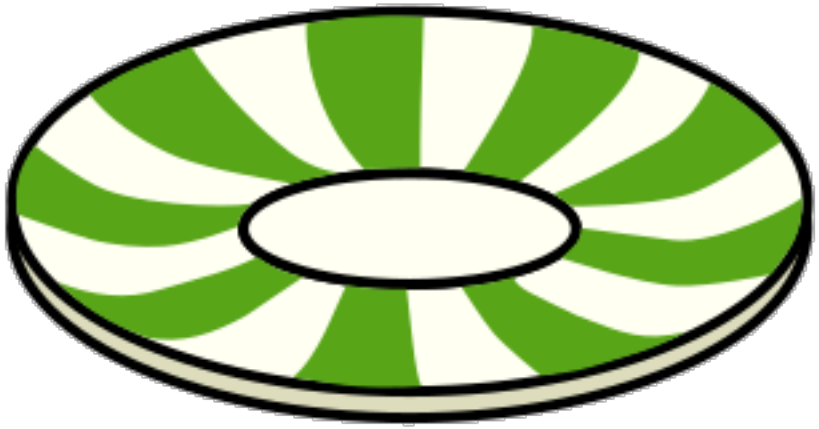
AND

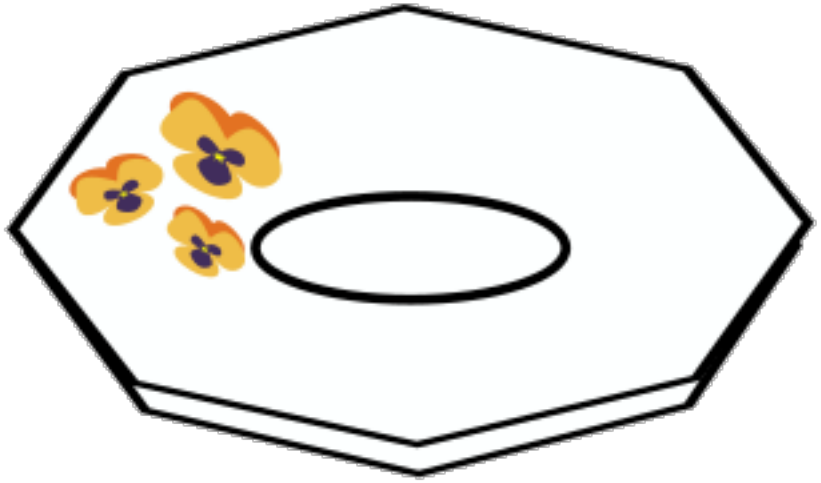
each cup and saucer combination is different from any other combination.

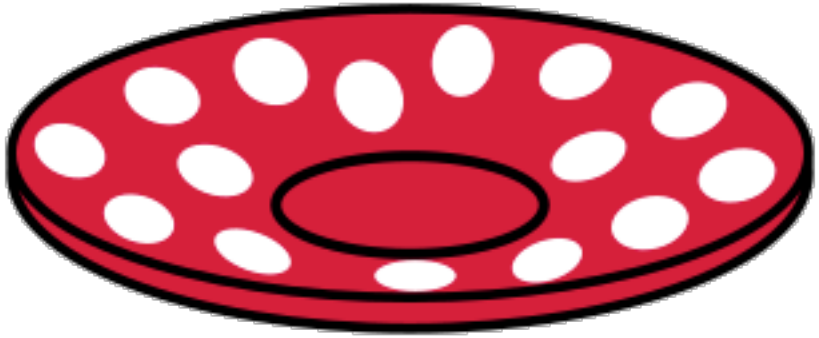
For example, you should have a red cup on a green saucer, a green cup on a green saucer, a blue cup on a green saucer, a white cup on a green saucer, and so on...

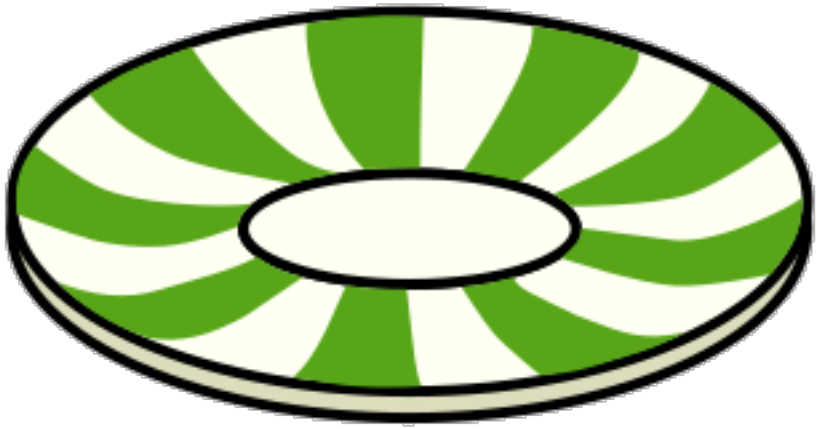


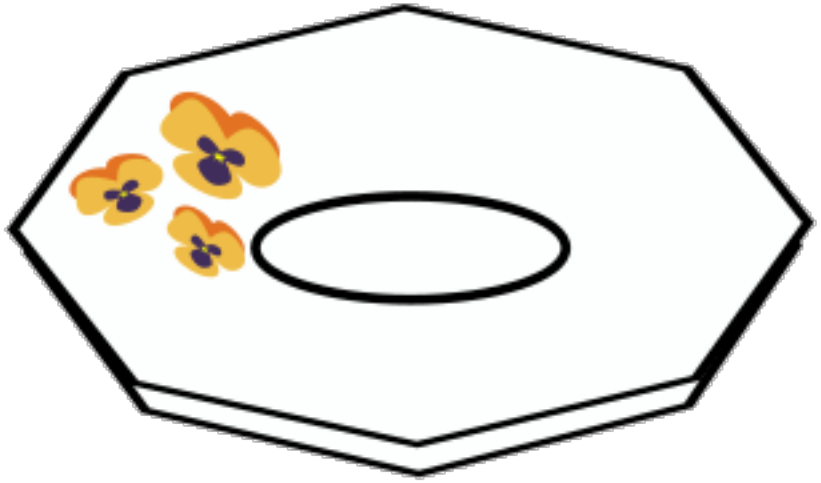


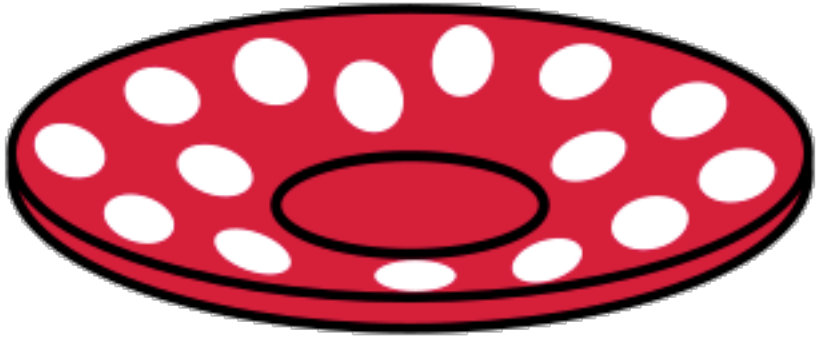


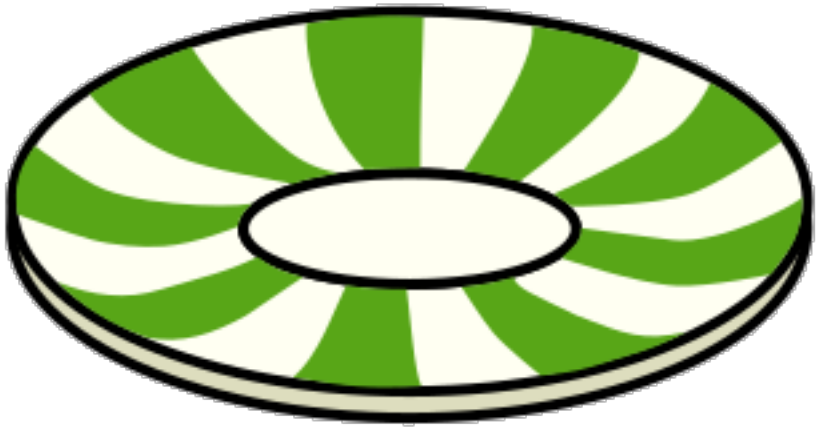


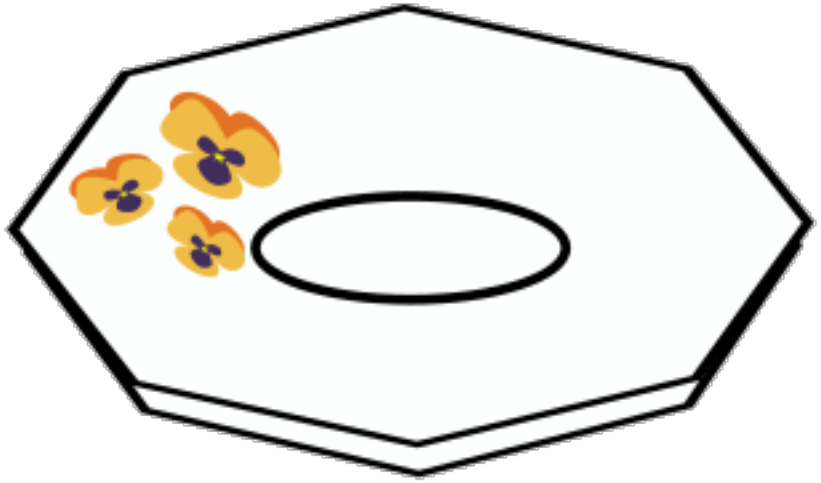


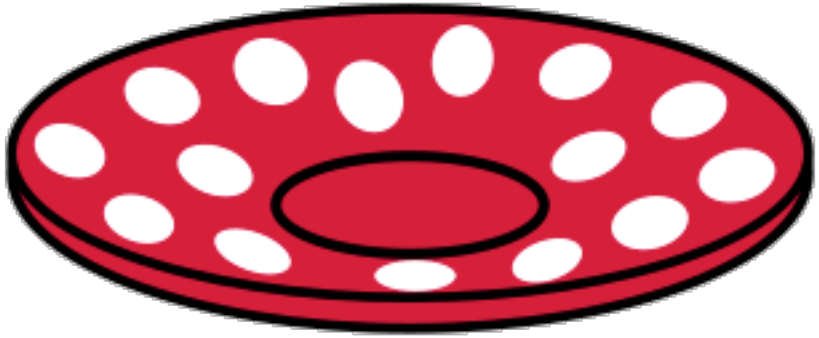


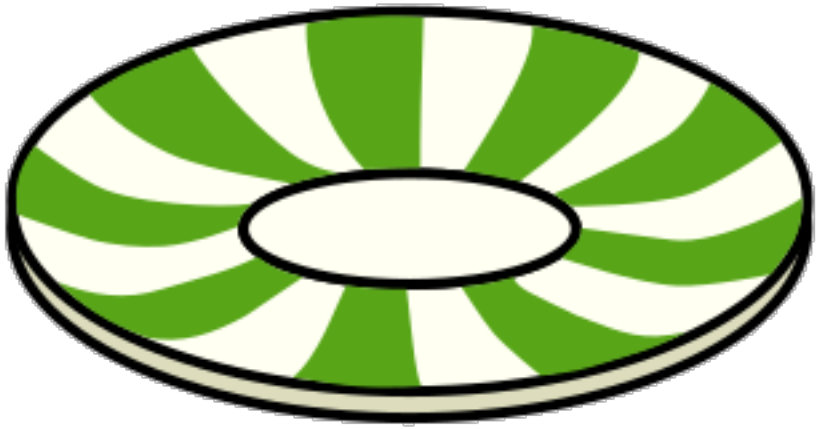












Twinkle Twinkle

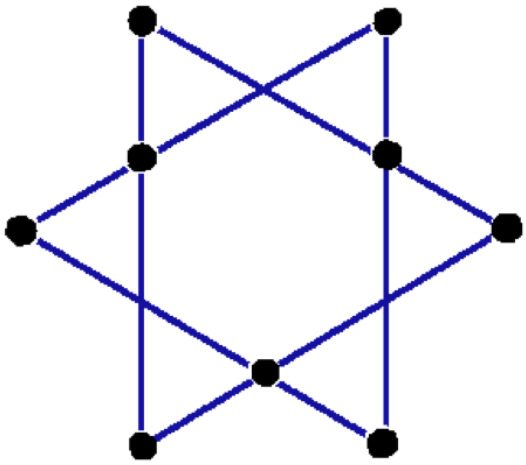
This is a game for two players.

You need a star game board and a set of four counters each.

To win, a player must place three of his/her own counters in a straight line.

To begin, each player takes turns to place one counter on an empty black spot.

Then, if no-one has yet made a line of three, play continues by taking turns to pick one counter and move it to an empty black spot.

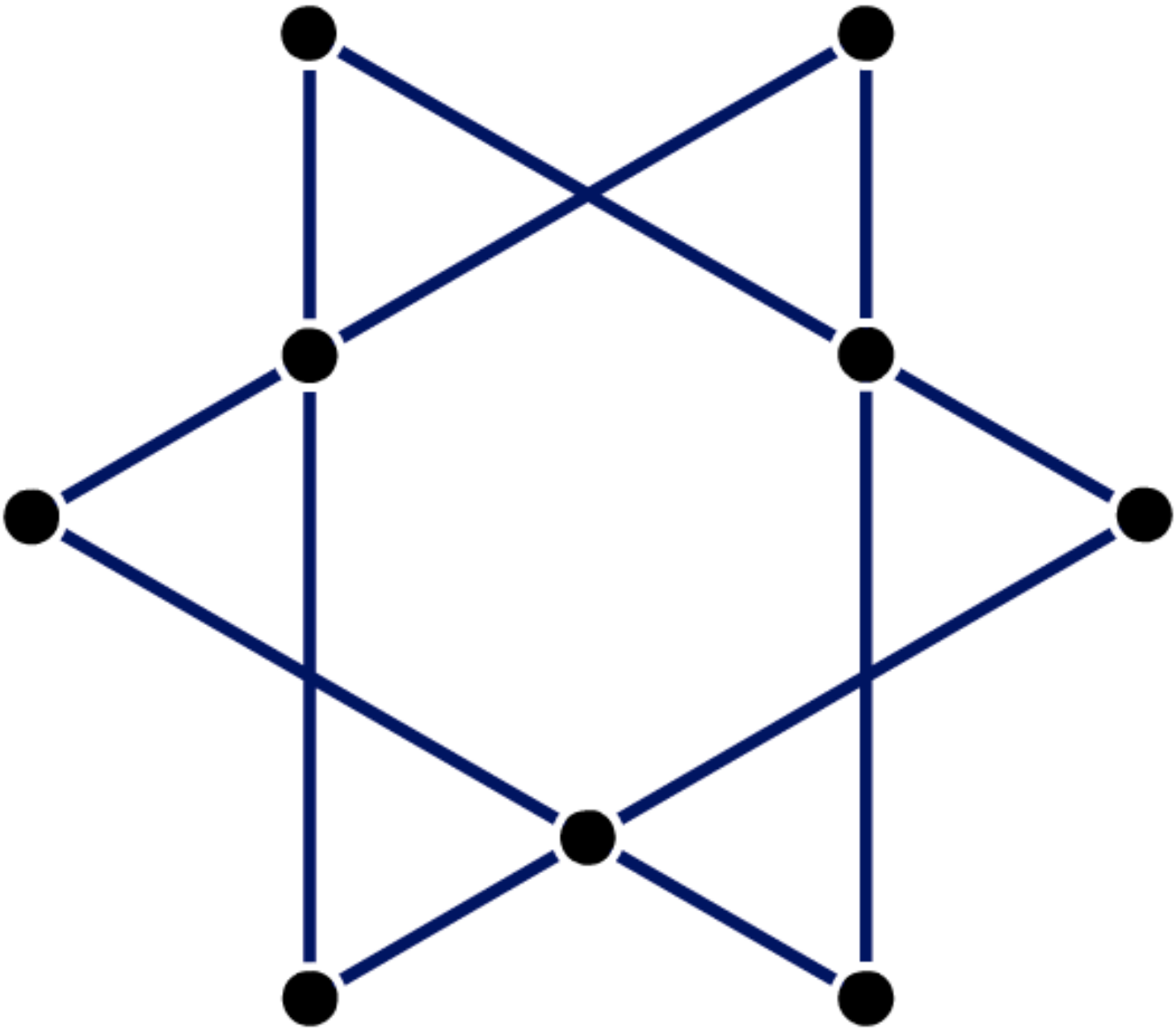


What moves will increase your chance of winning?

Does it matter who goes first?

Is it possible to play an 'endless' game?

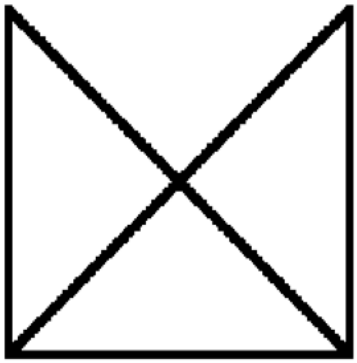
Twinkle Starboard



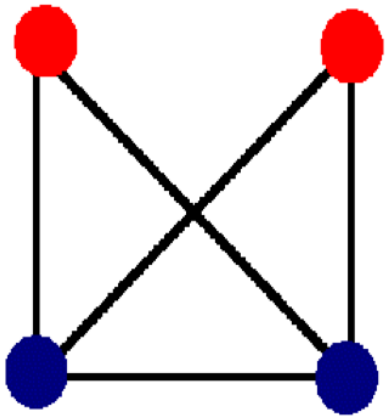
nrich.maths.org/roadshow

Two Stones

This game is for two players. Each player needs two counters or buttons (the stones) to put on the board below.



Place two stones at the top and two at the bottom as shown below. (At the start of the next game the players should swap positions.)

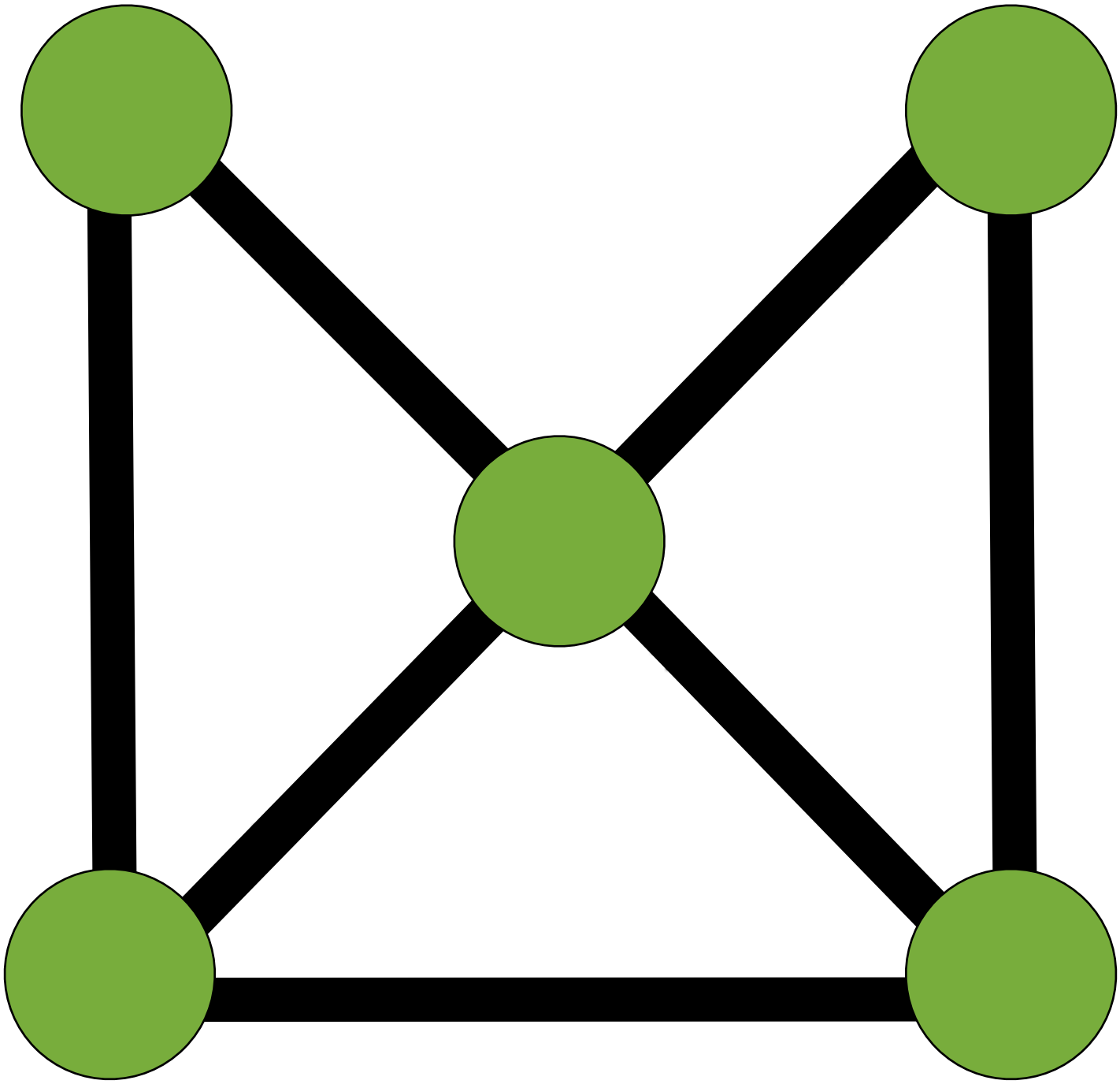


The players take turns at sliding one stone along a line to an empty spot. (So the first move will always be to the middle).

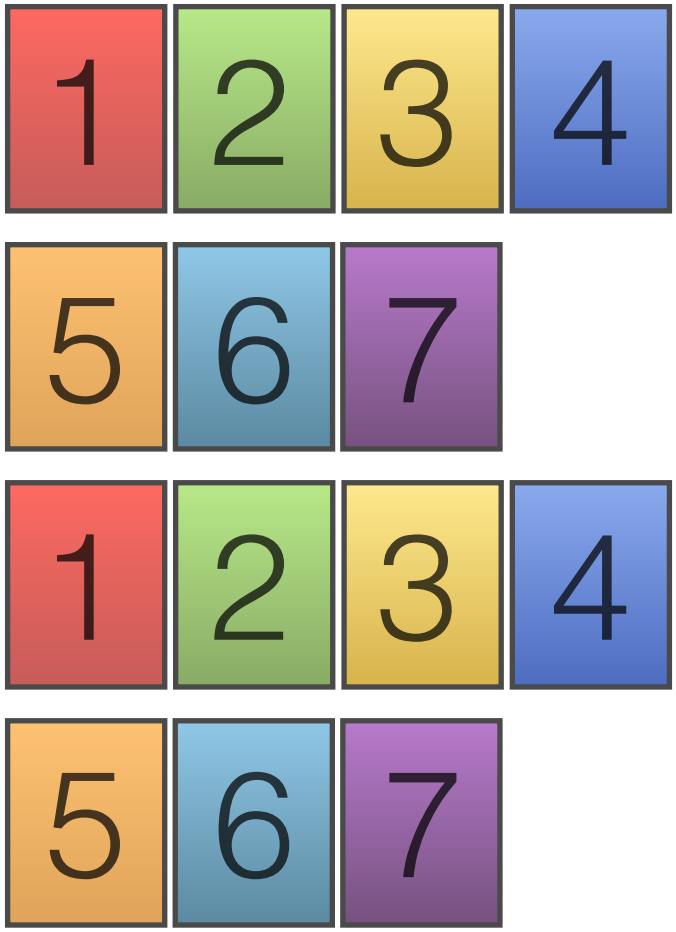
To win, you have to block the other player so he or she can't move.

In China this Game is known as Pong hau k'i and in Korea it is called Ou-moul-ko-no.

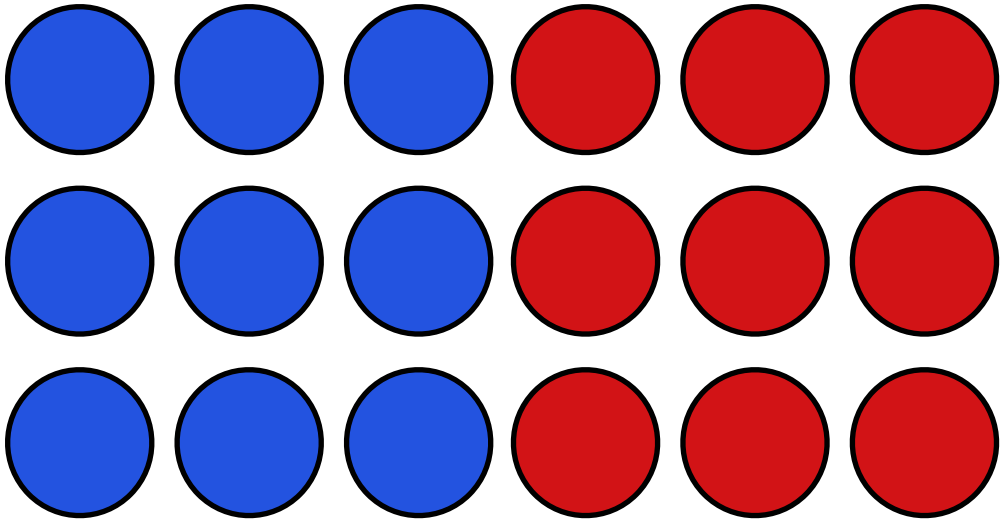
Two Stones Game Board



Printable Pieces



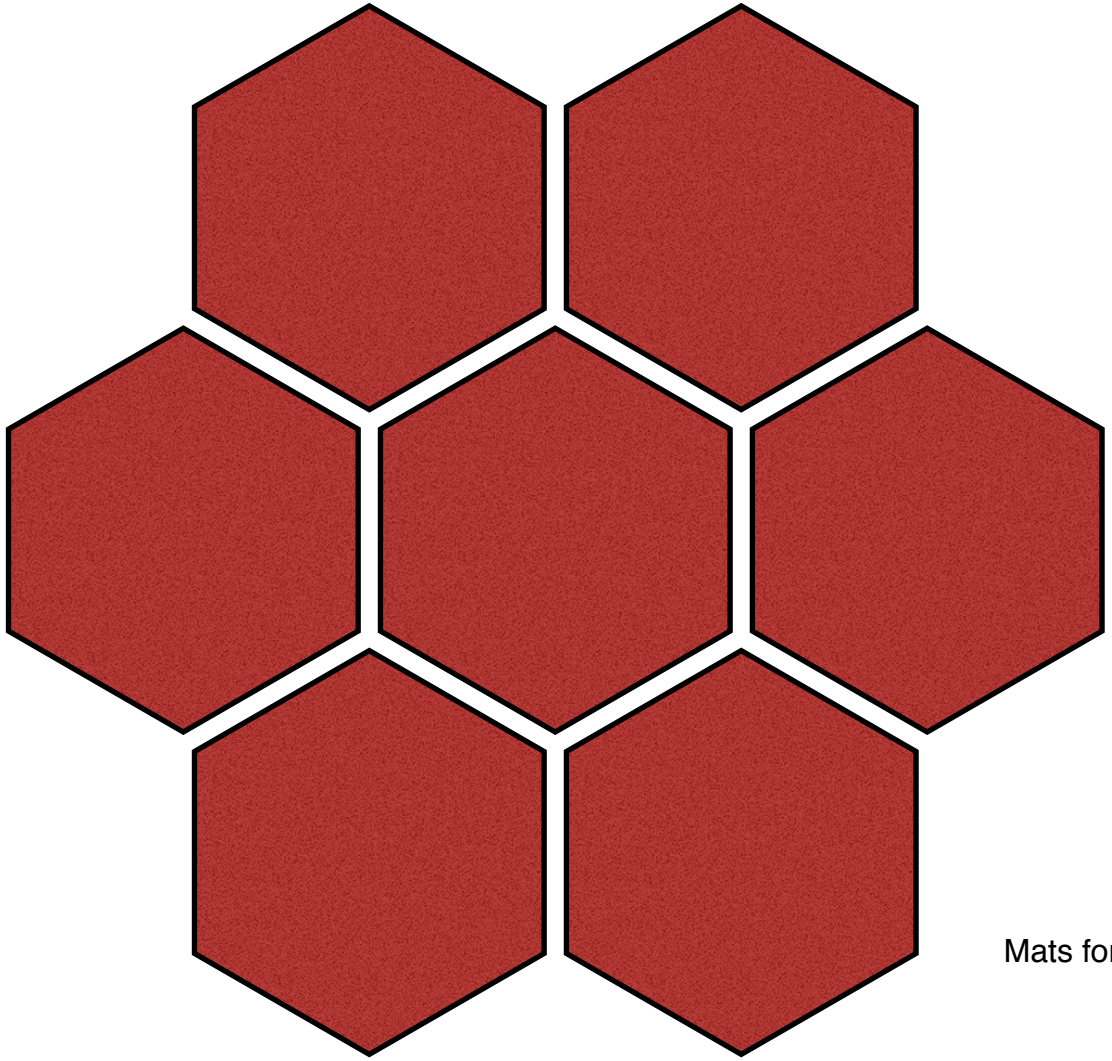
Digit cards for Sandwiches



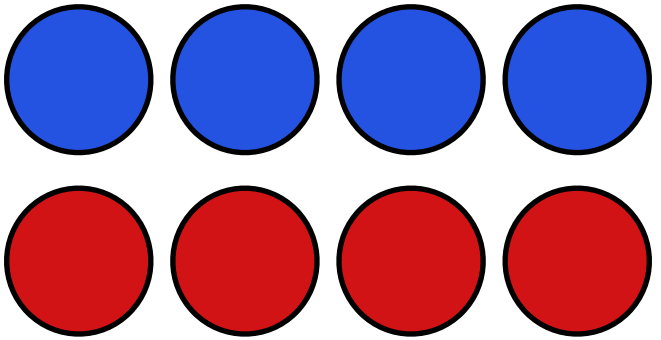
Counters for First Connect Three

Tiles for NIM

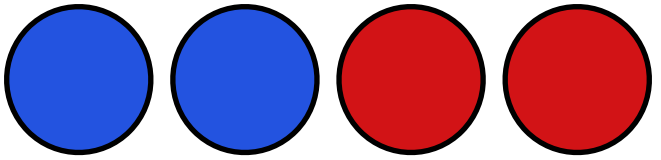
Printable Pieces



Mats for Seven Flipped



Counters for Twinkle Twinkle



Counters for Two Stones