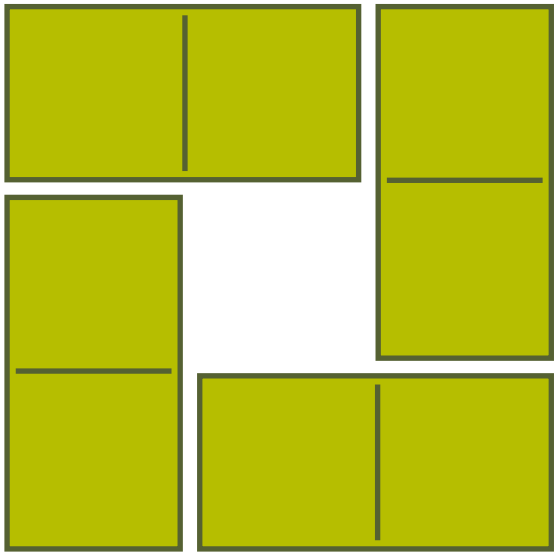
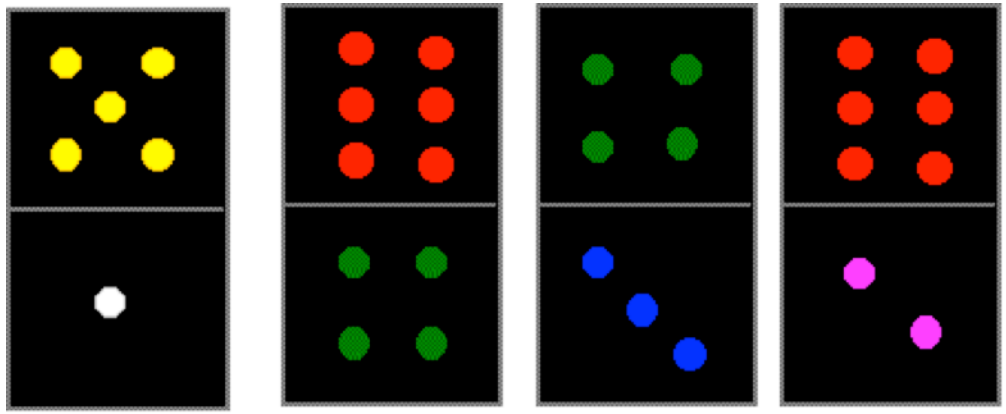
4 DOM

Use the four dominoes on the right to make a square ‘window’ like the one on the left.



The dominoes do not need to match where they touch but there must be the same number of dots on all four sides.



Add Three Dice

Place three dice in a row like the diagram below.

Find a way to turn each one so that the three numbers on top of the dice total the same as the three numbers on the front of the dice.

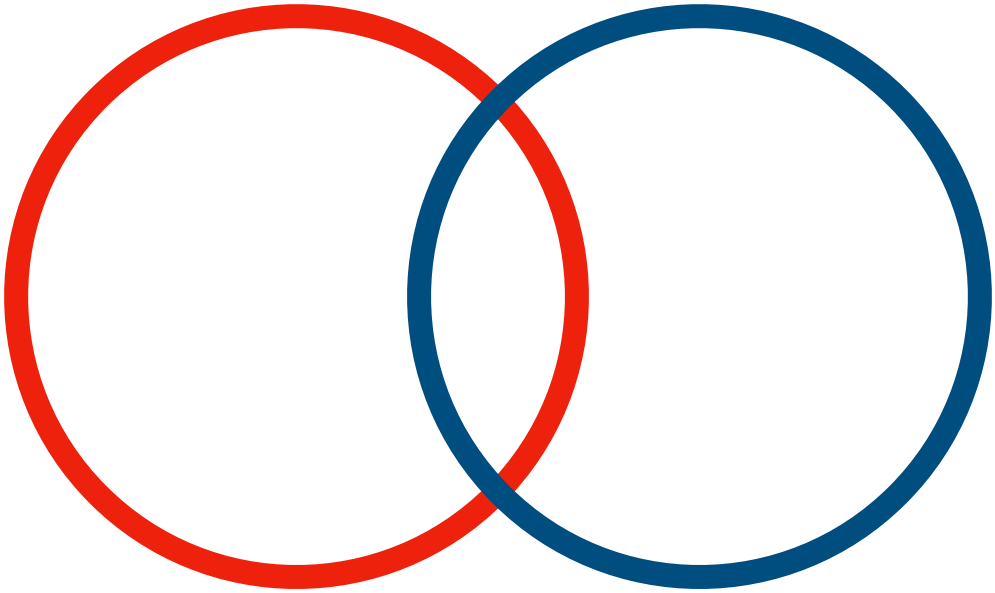
Can you find **all** the ways to do this?

You might want to record your answers.

Look at the totals on the back and bottom of the three dice – what do you notice?

Bean Bags 1

For this part of the task you will need 2 hoops and 8 bean bags (or 8 counters).



1 Using two hoops (as above), place the 8 bean bags into the hoops so that there are **4 in the blue hoop** and **6 in the red hoop**.

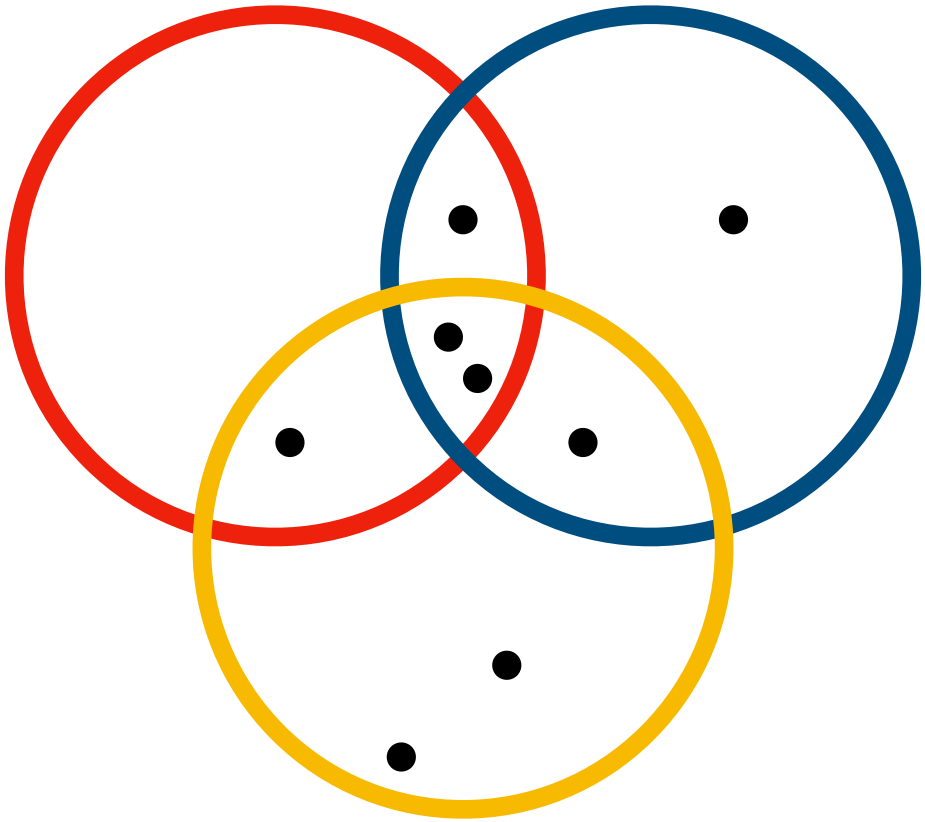
How many bags need to be in the overlap?

2 Now try with **2 in the blue hoop** and **7 in the red hoop**.

How many bags need to be in the overlap now?

Bean Bags 2

For this part of the task you will need 3 hoops and 8 bean bags (or 8 counters).



This picture shows **4 in the blue hoop**, **5 in the red hoop** and **6 in the yellow yellow hoop**.

This is not the only way in which it can be done. Find **at least two more ways** to put 4 in the blue hoop, 5 in the red and 6 in the yellow.

How many different ways are there of doing this?

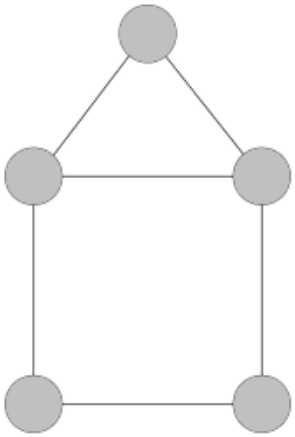
You might want to record your answers as you go.

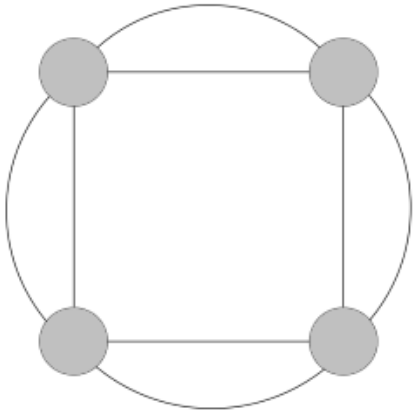
Can You Traverse It? 1

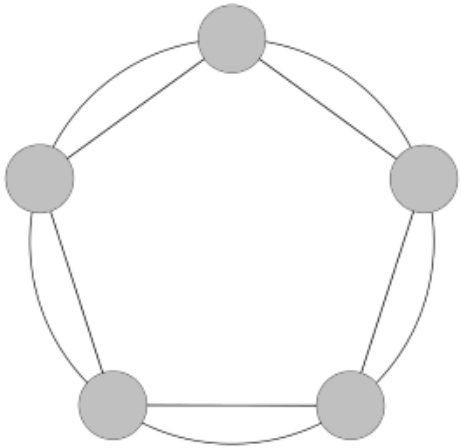
A traversable graph is one you can draw without taking your pen off the paper, and without going over any edge twice.

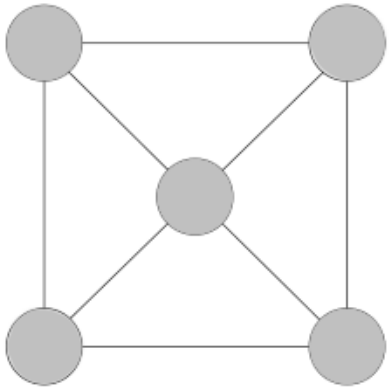
For each graph, decide whether or not it it traversable.

It might be helpful to keep a track of where you started, the route you took, and where you finished.

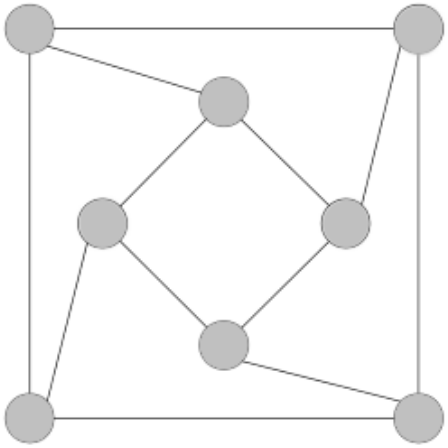


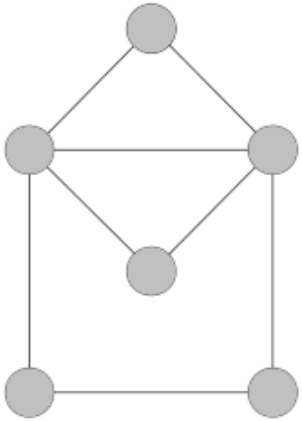


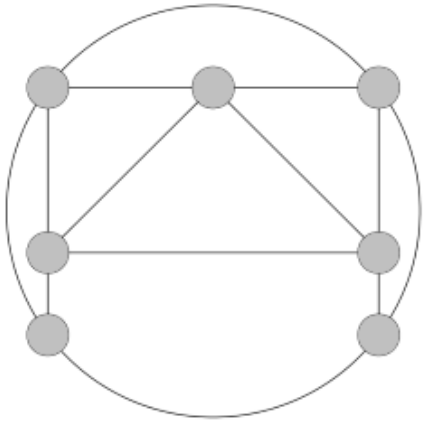


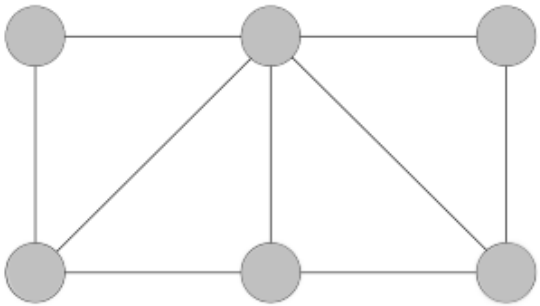


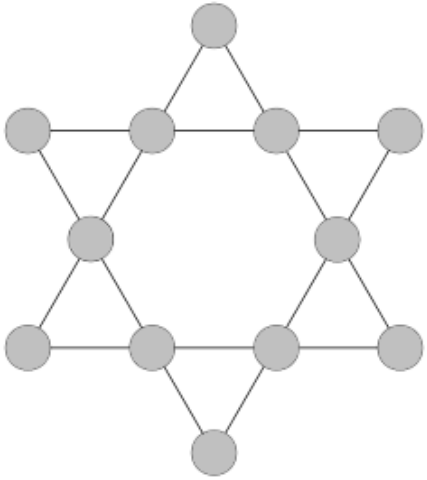
Can You Traverse It? 2

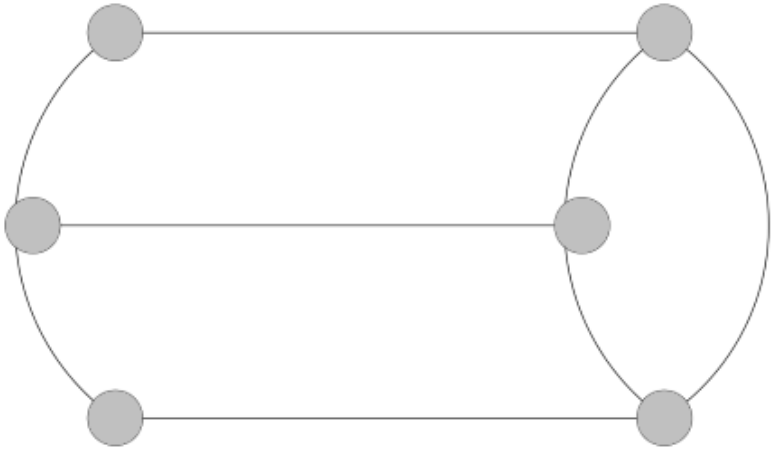












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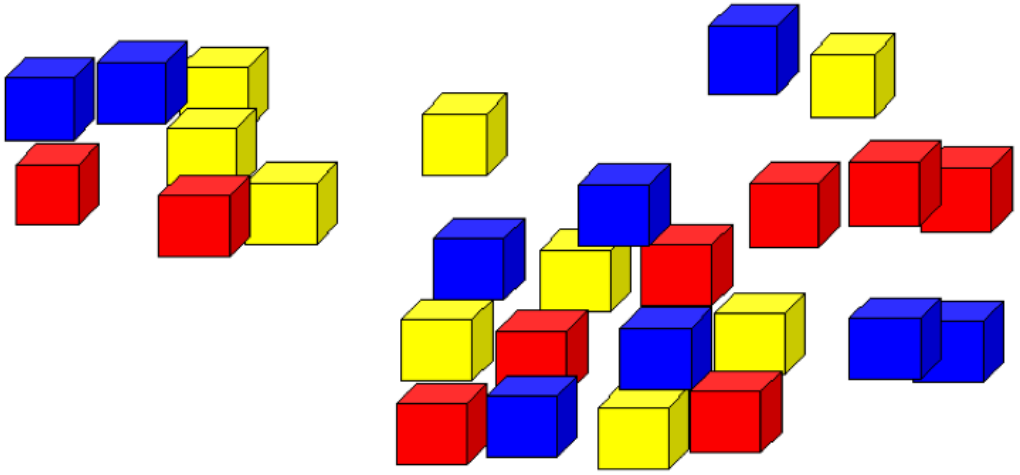
Activity 4

Creating Cubes

You have 27 cubes. There are 3 different colours and there are 9 cubes of each colour.



Arrange them into a large **3 by 3 by 3 cube** in this special way:

On each face of the new large cube, **no row** or **column** of cubes can contain **two** cubes of the **same** colour.

Crossing the Bridge

Four friends (Matt, Helen, Tom and Asha) need to cross a bridge. **They all start on the same side of the bridge**.

It is an old bridge so **a maximum of two people can cross at once.**

It is dark and dangerous and they have just one lamp. **People that cross the bridge must carry the lamp to see the way**.

Each person walks at a different speed:

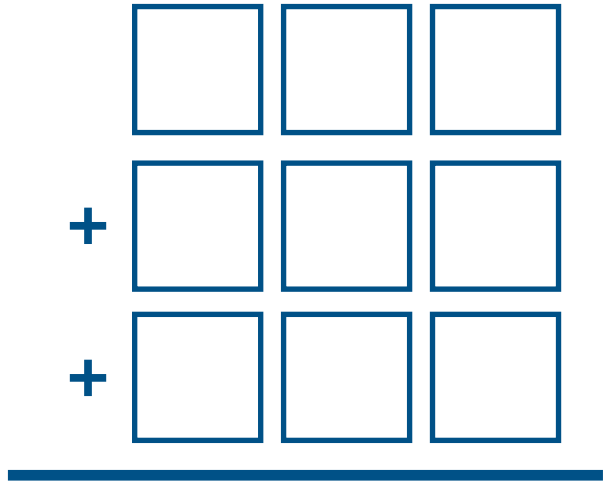
- Matt takes **1 minute** to cross
- Helen takes **2 minutes** to cross
- Asha takes **7 minutes** to cross
- Tom takes **10 minutes** to cross

When a **pair walks together, they must go at the rate of the slower person.**

Can you figure out how all four of them can get to the other side in just **17 minutes**?

Dicey Operations

This is a game for two players.



To Start: You need a die and two empty grids like the one on the right.

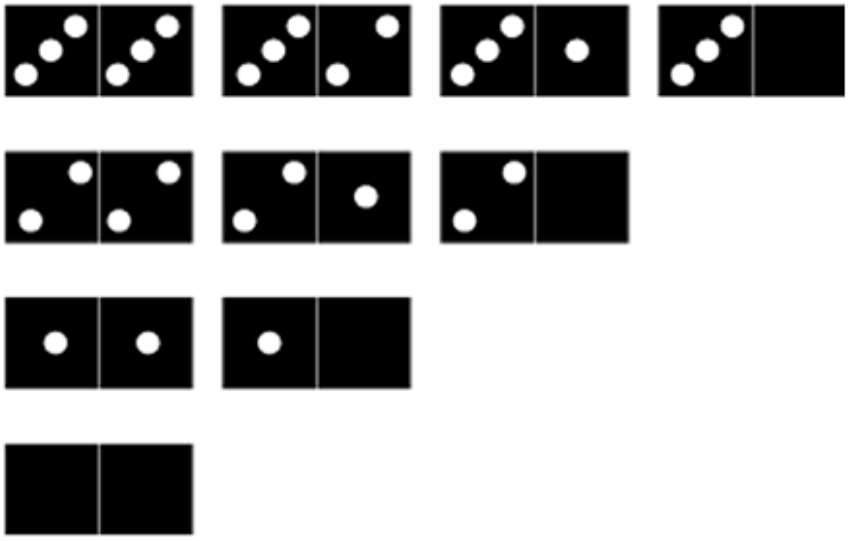
How to play: Takes turns to roll the dice and write the number you rolled into a square on your grid.

To Win: When your grid is complete add together the three 3-digit numbers. The closest to 1000 wins.

Domino Square

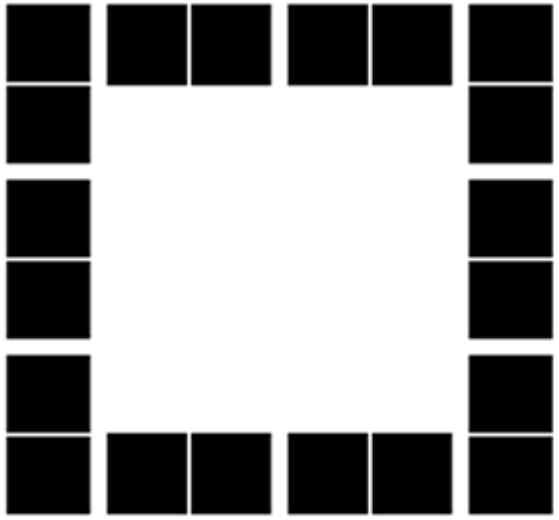
You need these 10 dominoes.

The highest is ‘double three’.



Use these dominoes to make a square so that each side has **8 dots.**

The dominoes do not have to match.



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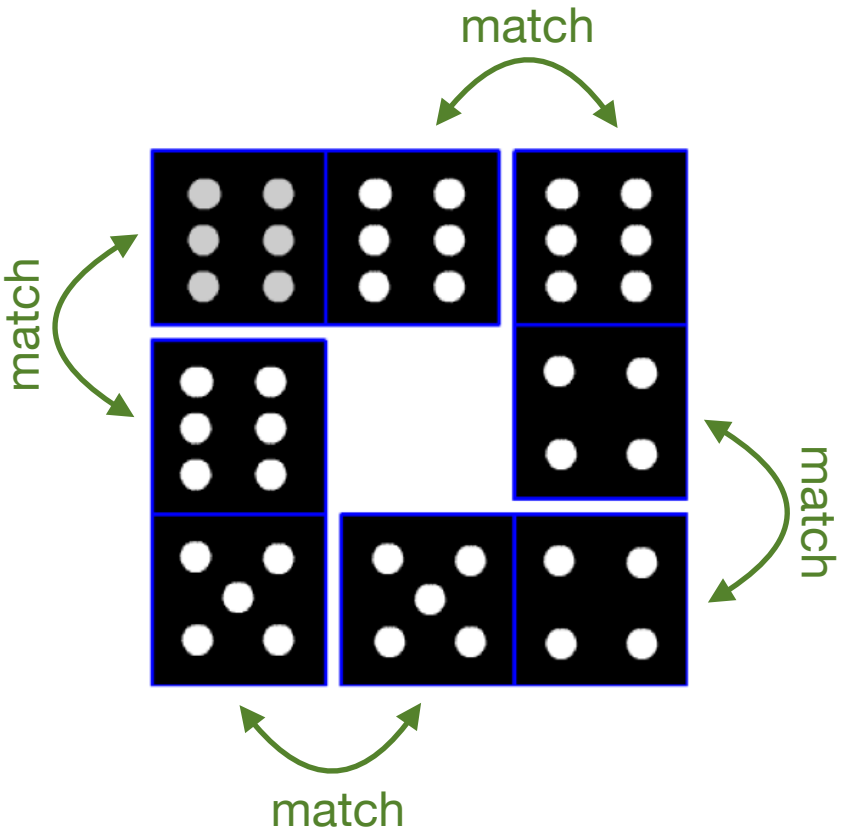
Activity 8

Domino Tetrads

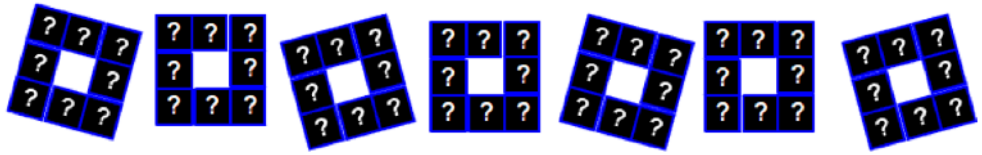
You can make a small square like the example on the right by using four dominoes.



Make sure that where the dominoes touch, the numbers of spots on each side is the same.

Your Task

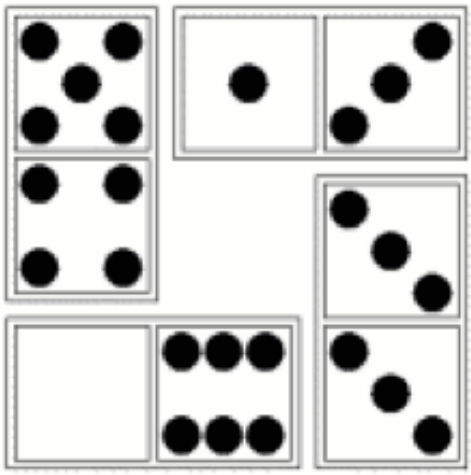
Using a full set of 28 dominoes can you make 7 small squares (each with 4 dominoes)?



Domino Windows

In this diagram the four dominoes make a small square.
We will call this small square a “domino window”.

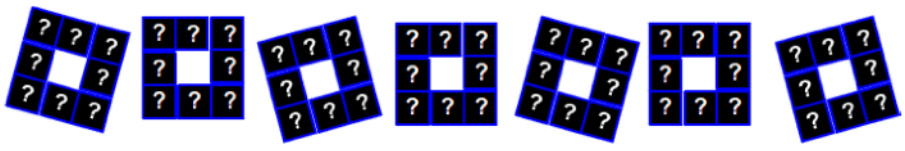
The spots on all four sides add up to make 9.
We will call this total the “spot sum”.



Use an entire set of 28 dominoes to make **7 domino windows**, each made up of 4 dominoes.

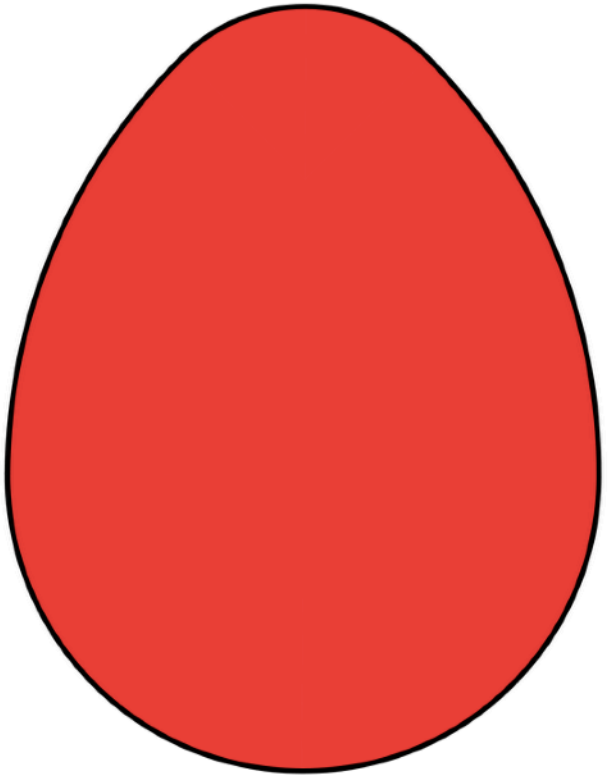
Each window must have the same "spot sum” on all 4 sides.

However, your windows can have different spot sums. In fact, it is not possible to have the same spot sum on every every window. Can you explain why?



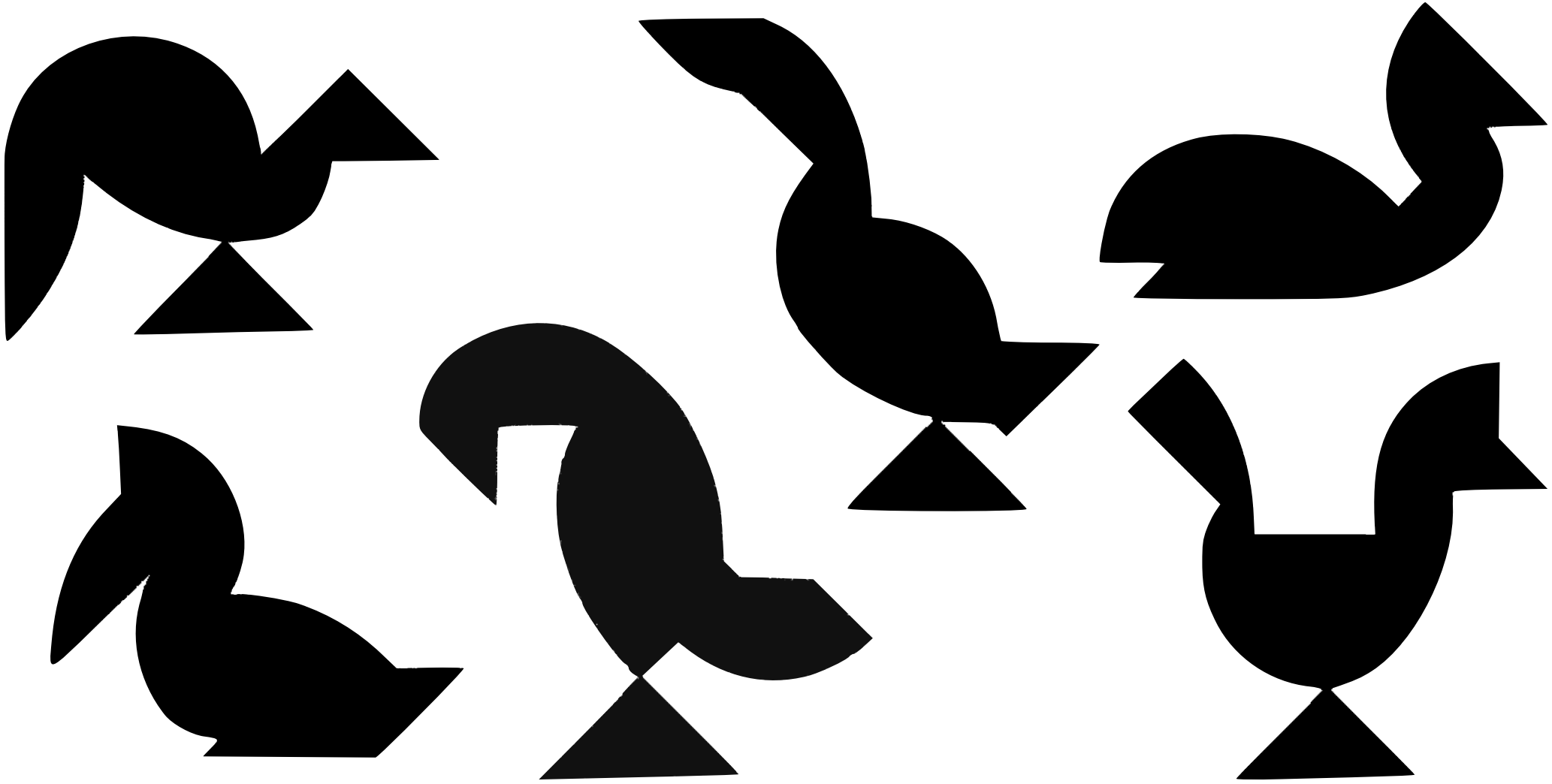
Egg Tangram 1

First, try to make this egg shape with **all 9 pieces**.



When you have done that, see if you can make some of the bird shapes on the other sheets, each bird uses **all 9 pieces**.

Egg Tangram 2



Factors & Multiples Game

This is a game for two players.

What you have to do:

The first player chooses an even number from the grid that is less than 50, and covers it with one of their counters.

The second player chooses a number to cover. The second player's number must be a factor **or** multiple of the first number.

Continue taking turns covering numbers with counters. Each number covered must be a factor or multiple of the previous number covered by the other player.

The first person who is unable to cross out a number loses.

For example, the game on the right started:

Player 1: **12**

Player 2: **4**

Player 1: **88**

Player 2: **11**

Player 1: **77**

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Fifteen

This is a game for two players.

Take it in turns to choose **one** of the whole numbers **1** to **9**.

Each number can be chosen only once.

To win, you must have **three** numbers that add up to **15**.

If you both have three numbers but neither player has a total of 15, continue playing until:

- one of you has three of numbers totalling 15 (they win), or
- there are no numbers left to choose (it is a draw).

First Connect Three

This is a game for two players.

To play the game:

On your turn roll both the dice and then choose whether to add them together other or subtract one from the other.

For example, if you rolled a 1 and a -2, your options would be:

-2 + 1 -2 - 1 1 - -2

Then place a counter on top of your answer.

You cannot cover a number which has already been covered.

If you are unable to find a number which has not been covered you must pass.

To win the game:

The winner is the first to complete three in a row. The row can be horizontal, vertical or diagonal.

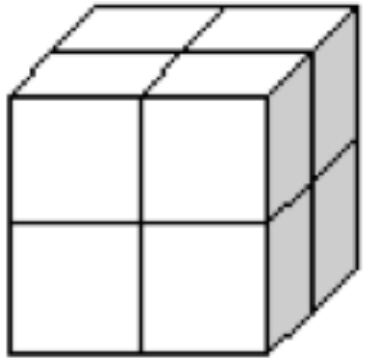
In the game on the right the red player has won by getting 2, 6 and 10, which are all in a row.

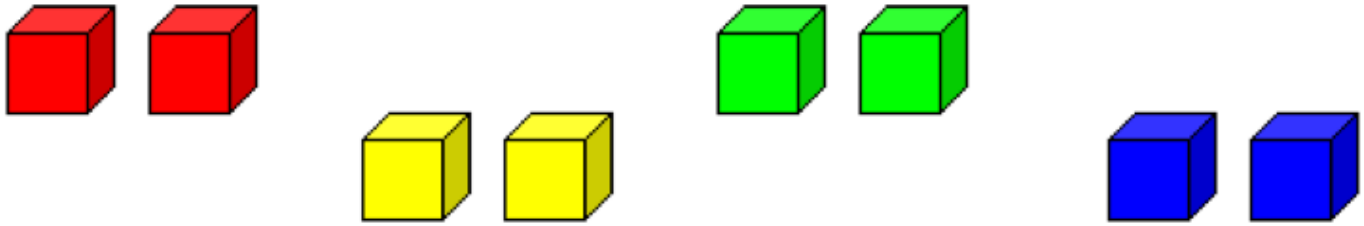
	-5	-4	-3	-2
-1	0	1	2	3
4	5	6	7	8
9	10	11	12	

Four Colours

Fit these 8 cubes together to make a cube.

On each face there must be one of each colour.

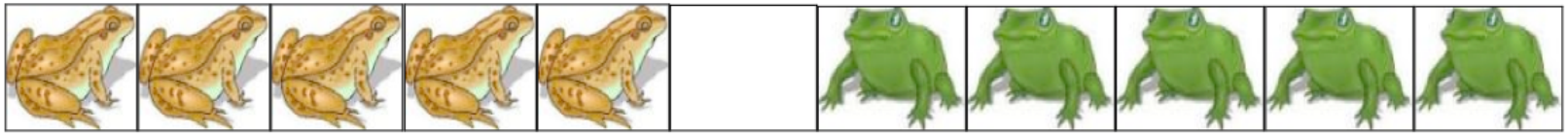




Is there more than one way to do it?

Frogs 1

There are five brown frogs and five green frogs sitting on their lily pads like this:



The aim: Swap the green frogs with the brown frogs.

The rules:

You can only **move one frog at a time**.

Frogs can only move **one square at a time.**

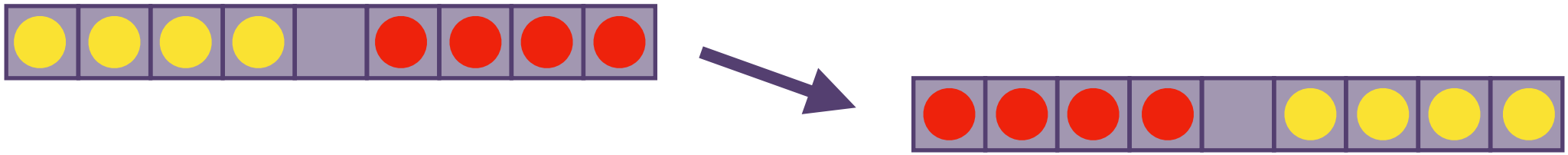
Frogs can jump over another frog, but only one at a time.

The **brown** frogs can only move (or jump) **right.**
The **green** frogs can only move (or jump) **left.**

Frogs 2

Instead of using real frogs, use some counters. Choose one of the grids to start on and set up your counters (smaller grids are best to start on).

Move and jump the frogs until they have swapped completely swapped ends.



What is the smallest number of moves it takes to swap all the frogs over?

Try putting more frogs at one end than the other.

Gabriel's Problem 1

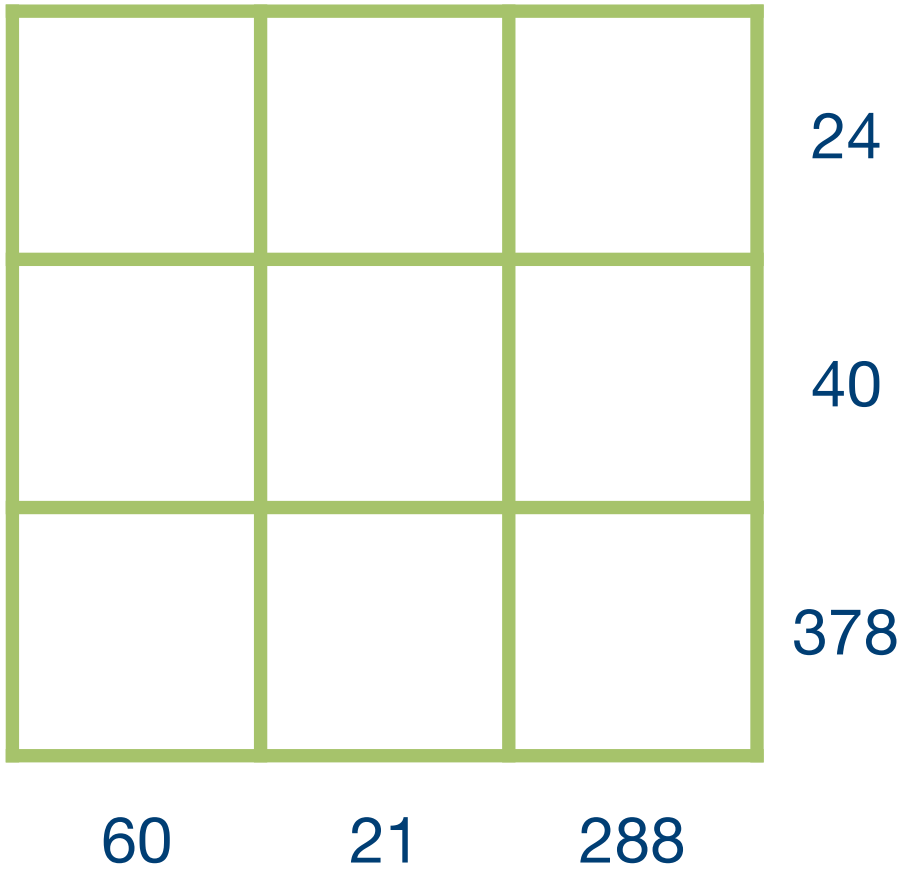
Gabriel wrote the numbers 1-9 in a 3x3 grid.

He then multiplied together all the numbers in each row and wrote the resulting product next to that row. He also multiplied the numbers in each column together, and wrote the product under that column.

He then rubbed out the numbers 1-9.

Can you work out where Gabriel placed the numbers 1-9 in the grid?

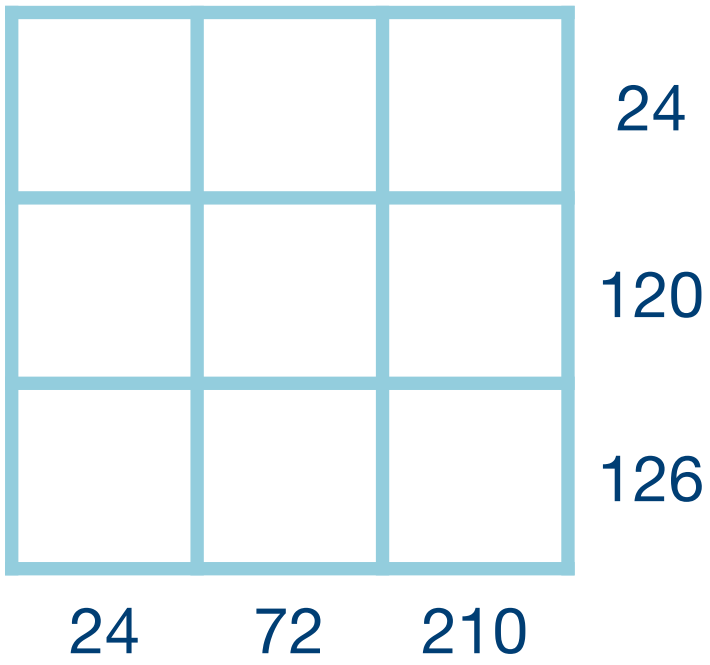
Did you have enough information, not enough, or exactly the right amount?

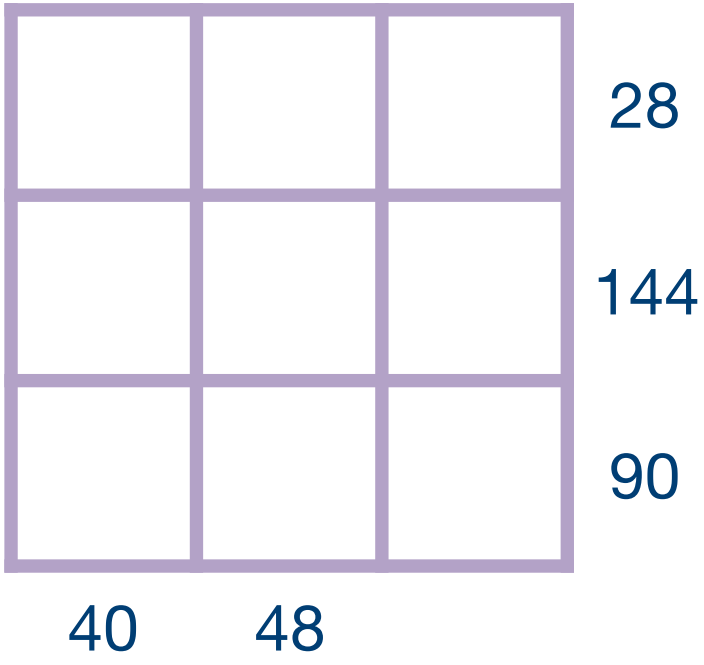


Gabriel's Problem 2

Can you place the numbers 1-9 in the grid to give the marked products in each row and column?

One of these two grids has more than one solution.

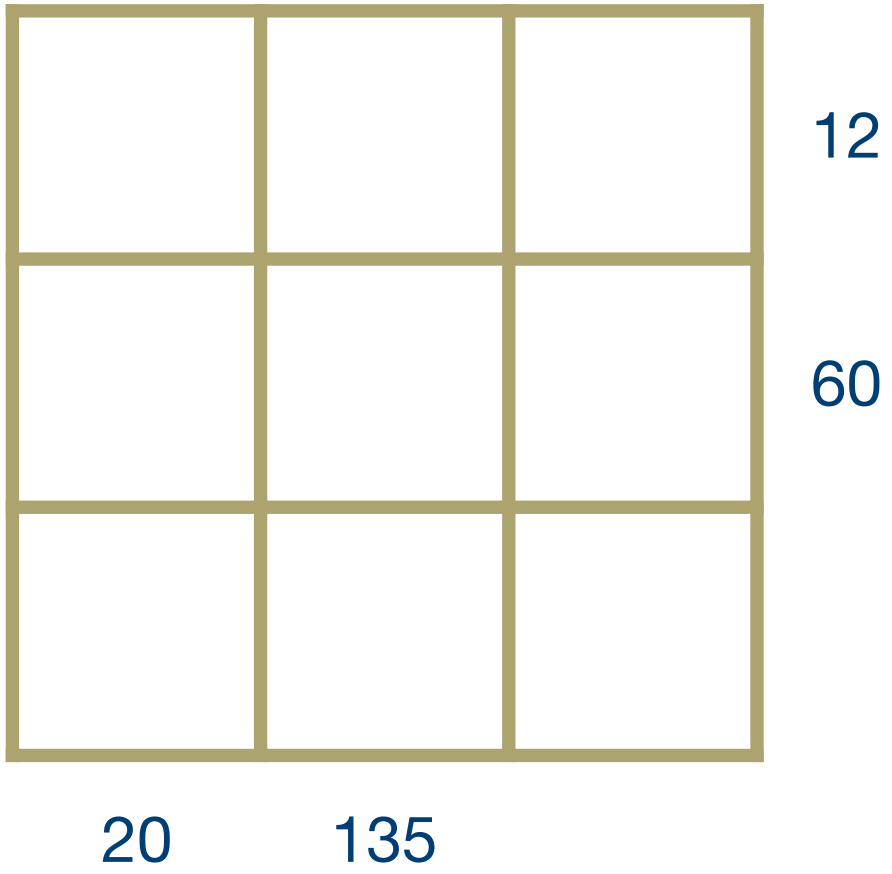




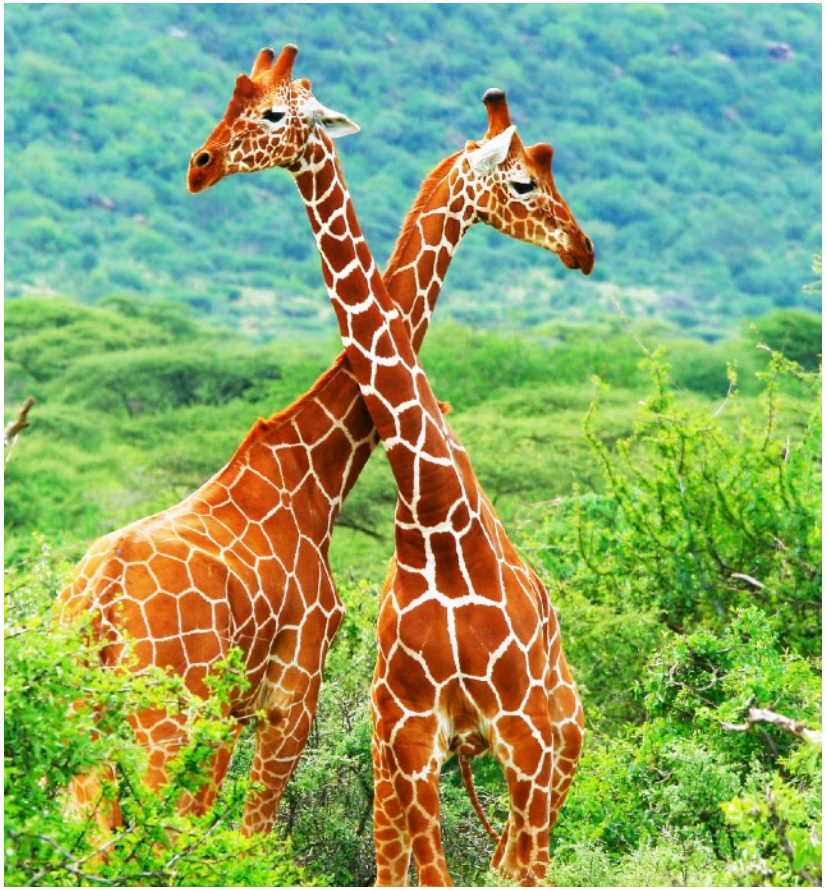
Gabriel's Problem 3

To make this grid, Gabriel used the numbers **1**, **2**, **3**, **4**, **5**, **6**, **9**, **10** and **12**.

Can you place these numbers in the grid to give the marked products in each row and column?



Largest Product



$3 + 3 + 4 = 10$
$3 \times 3 \times 4 = 36$

$3.3 + 6.7 = 10$
$3.3 \times 6.7 = 22.11$

What is the greatest product that can be made from numbers that add up to 10?

$5 + 5 = 10$
$5 \times 5 = 25$

$1 + 9 = 10$
$1 \times 9 = 9$

$1 + 2 + 3 + 4 = 10$
$1 \times 2 \times 3 \times 4 = 24$

Last Biscuit

This is a game for two players.

To Start

Put 4 biscuits in one jar and 8 in the other.

How you play

Take turns to take biscuits off the board following the rules below.

To Win

The winner is the person who takes **the last biscuit** (or biscuits).

Rules:

When it's your turn you can either:

1) take any number of biscuits from just one jar

or

2) take the same number of biscuits from both jars.

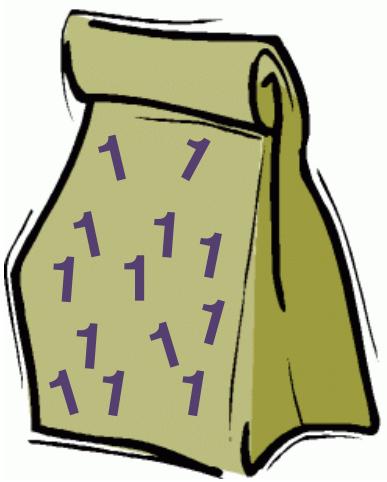
Think carefully and see if you can discover a winning strategy.

Do you think it matters who goes first?

Make 37

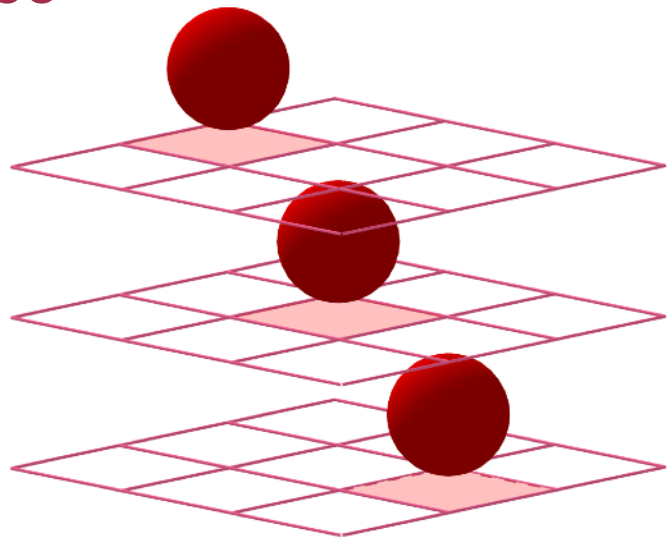
Four bags contain a large amount of 1s, 3s, 5s and 7s.

Pick any ten numbers from the bags so that their total is 37.



Marbles in a Box

Imagine a three dimensional version of noughts and crosses where two players take it in turn to place different coloured marbles in a box.



The box is made from 27 transparent unit cubes arranged in a 3-by-3 array.

The object of the game is to complete as many winning lines of three marbles as possible.

How many different ways can you make a winning line?

Mixed Up Socks

Start with three pairs of socks.

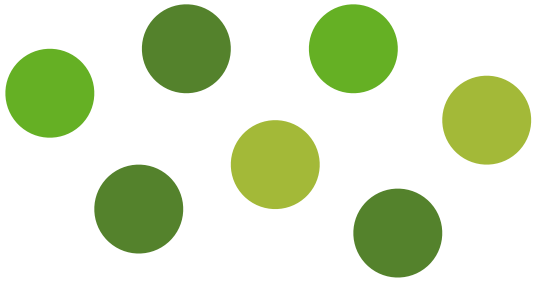
Mix them up so that each pair has two different socks in it.

Now can you mix them so that each pair is different from the other pairs?

Now try it with four pairs of socks. Can you find more than one way to do it?

How many ways are there to do it? How do you know you have found all the ways?

NIM



This is a game for two players.

To Start: Place the 7 counters in a group.

How you play: Takes turns to pick up either one or two counters.

To Win: The player that picks up the last counter loses.

Can you find a winning strategy that guarantees you will win?

Does it matter who goes first?

Nine Colours

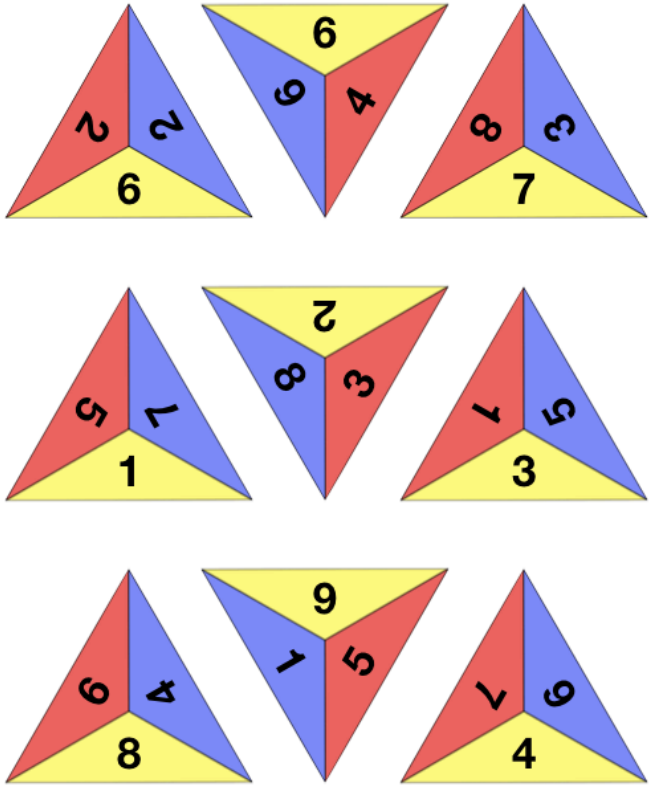
You have 27 small cubes, 3 each of nine colours.

Can you use all the small cubes to make a 3 by 3 by 3 cube so that each face of the bigger cube contains one of each colour?

One Big Triangle

Here are nine triangles. Each one has three numbers on it.

Your challenge is to arrange these triangles to make one big triangle, so the numbers that touch add up to 10.

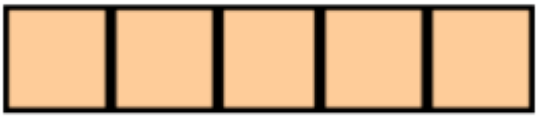


Penta Place 1

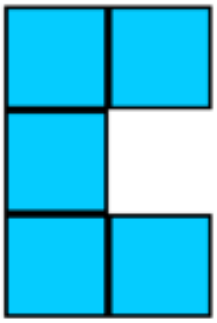
Penta people always build their houses using **five square rooms on one level** (the ground level).

The houses can be made in a variety of different shapes, but a room **must be joined to at least one other room by a wall.**

Here is an example of a Penta house,
viewed from above:



Here is different example:



What you have to do:

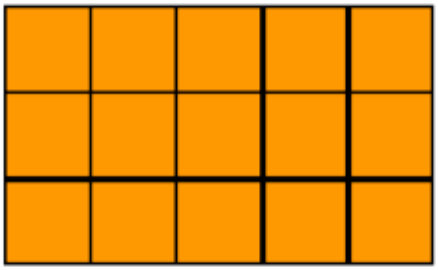
Try to find all possible Penta house shapes that are possible.
Use multilink cubes where each room is one cube.

Penta Place 2

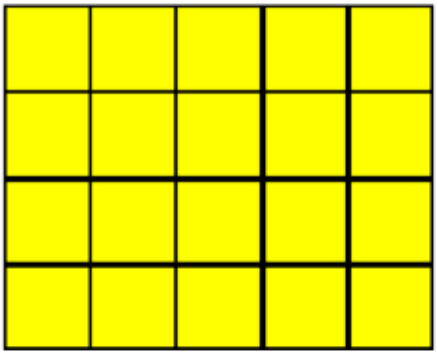
New Penta houses are being built in Penta Place.

The homes are built right next to each other and are arranged and fitted together to create rectangles.

1) Use **three of the Penta houses** you created and fit them together to make a 3x5 rectangle like this one.

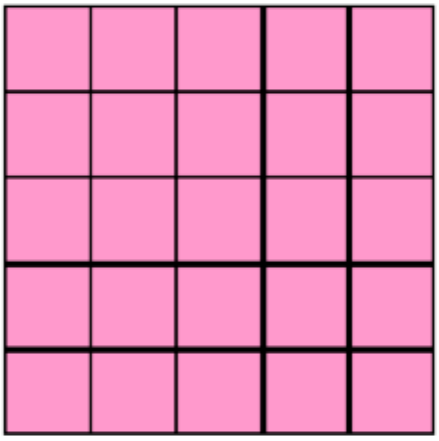


2) Can you make other sized rectangles using **three of the Penta houses**?



3) Try to find **four of the Penta houses** that fit together to make a larger rectangle like the one on the left.

4) On the right is a 5 by 5 square. Use **five of the Penta houses** to construct a similar square.



Pentanim

This is a game for two players.

To Start

Put 10 counters onto the ‘Pentanim’ game board, one in each space.

How you play

Take turns to pick up either one counter or two adjacent counters ('adjacent' means that they are connected by a line and there are no other counters in between).

To Win

The winner is the player who picks up the last counter or the last two counters.

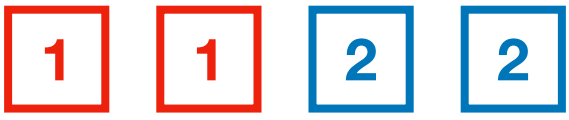
Sandwiches 1

1) Start with two 1's, two 2's and two 3's (as below).

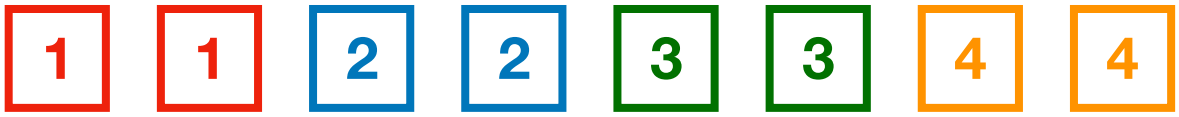
Arrange these six digits in a line so that:

- 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?**

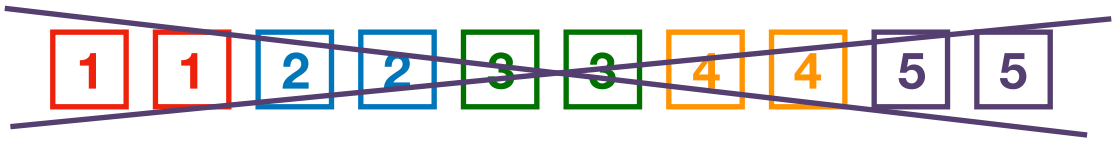


3) It is possible to add two 4's and then arrange all the numbers as in part **(1)** but now with four digits between the two 4's.

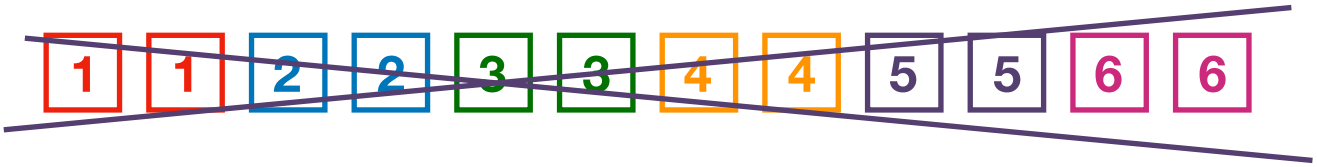


Sandwiches 2

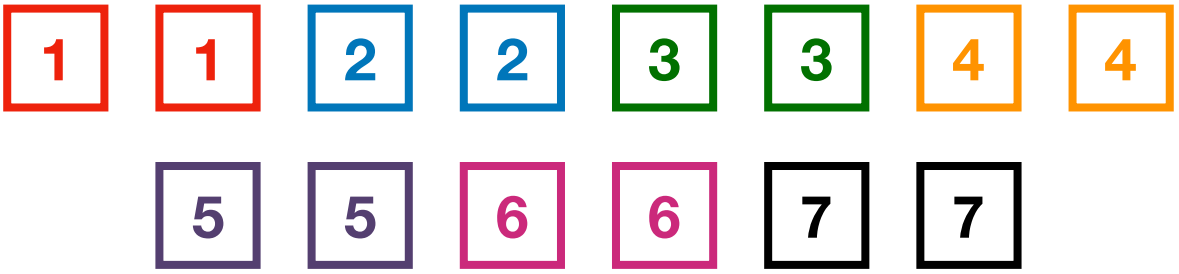
4) If you try to add two 5's (as below) it is **impossible** to arrange them in a 'sandwich'!



It's also **impossible** to do if you also add two 6's.



However, it can be done when you add two 7's! Can you manage it?

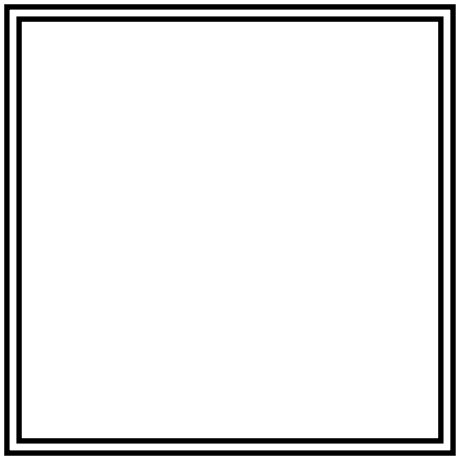


5) There is more than one way of doing this – try to find at least two arrangements that work with all seven digits.

Square Tangram

The first puzzle is to make a square using just four of the pieces...

This will fit in the smallest square outline in the middle of the sheet.



Now try making a square using all five pieces...

It should fit the next square outline, only slightly larger than the centre square.

For an extra challenge:

Ask for another set of the five pieces and try making one large square with all ten pieces...

Sticky Numbers

Look at the following line of numbers:

10	15	21	4	5

They are arranged so that each pair of adjacent numbers adds up to a square number:

$$10 + 15 = 25$$
$$15 + 21 = 36$$
$$21 + 4 = 25$$
$$4 + 5 = 9$$

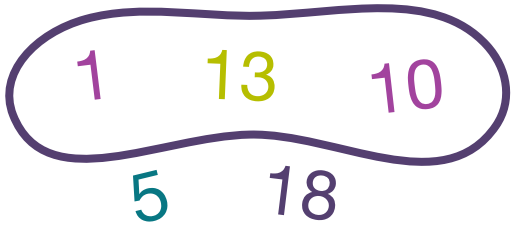
Your Task

Try to arrange the numbers 1 to 17 in a line so that each adjacent pair adds up to a square number.

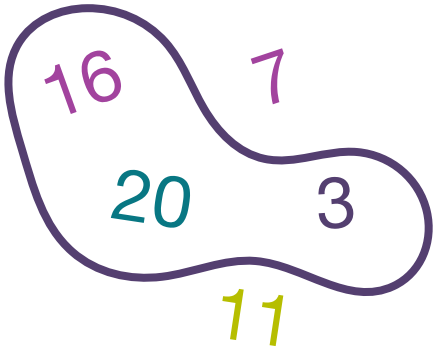
Can you arrange them in more than one way? If not, can you explain why your solution is the only one?

Take 3 from 5

Choose any five positive whole numbers.



Now find three of the numbers which, then you add them up, make a multiple of 3.



Will any set of five always include three numbers that will add up to a multiple of 3?

Teacups

Arrange the cups and saucers into the four by four grid so that:

- Every **row** has only one cup of each colour and one saucer of each colour.
- Every **column** has is only one cup of each colour and one saucer of each colour.

AND

Put each cup on top of a saucer so that there are no repeated combinations.

For example, you could have a blue cup on a blue saucer, a red cup on a blue saucer, a blue cup on a red saucer, etc…

Teddy Bear Line-Up

To Start

Line up all 16 teddy bears so that there are:

- four greens next to each other,
- then four yellows next to each other,
- then four blues next to each other,
- and finally four reds next to each other.

The Challenge

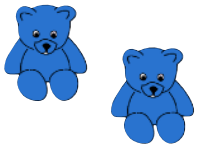
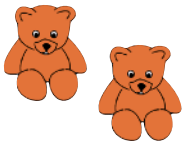
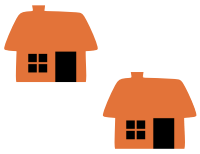
Swap two bears with each until no two bears of the same colour are next to each other.

The Big Question

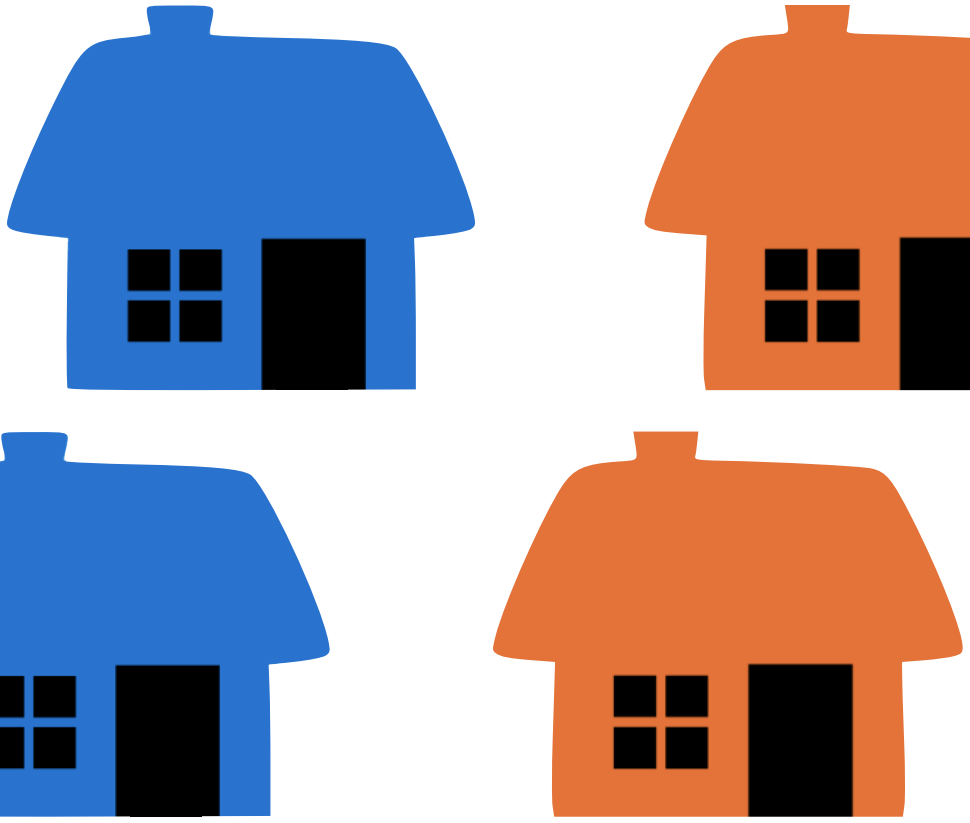
What's the least number of moves you can take to rearrange the bears as described?

Teddy Town 1

In Teddy Town, there are:

2 blue teddies 	2 yellow teddies 
2 blue houses 	2 yellow houses 

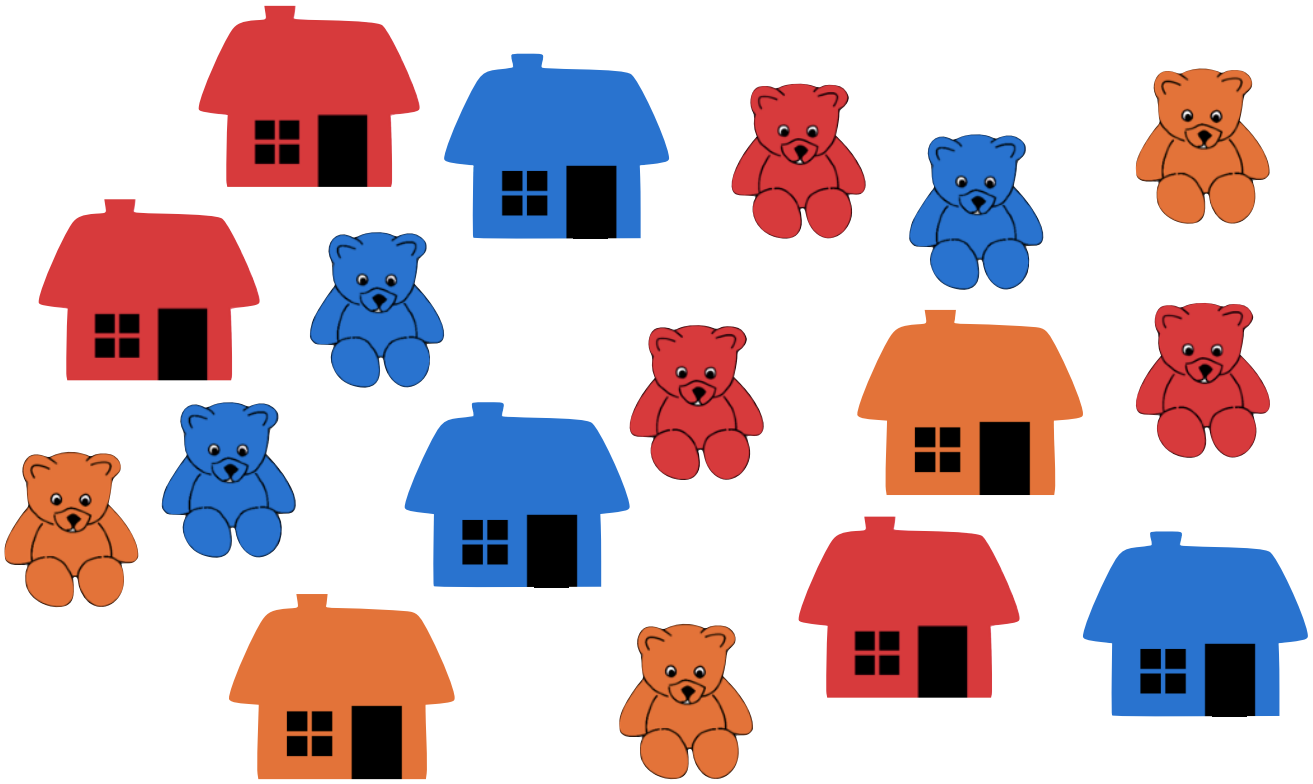
Can you put each teddy into a house so that all four combinations are different from each other?



Teddy Town 2

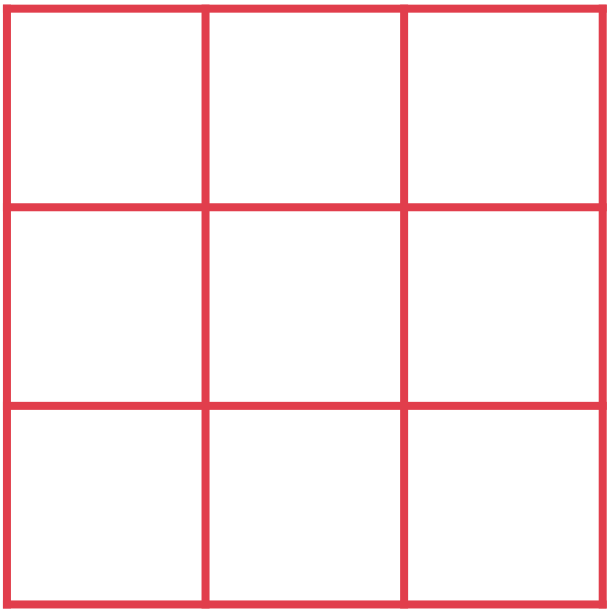
Teddy town has grown and there are now **three** different colours of teddies and houses: red, yellow and blue.

In Teddy Town there are now 9 teddies and 9 houses:



Can you make nine different combinations of teddies in houses?

Teddy Town 3

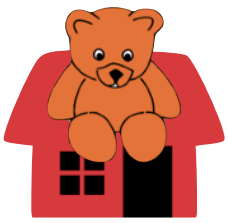


To the right is a small map of Teddy Town, where the streets are very special.

If you walk along any street in any direction all the houses are a different colour and the teddies living in the houses are different colours too.

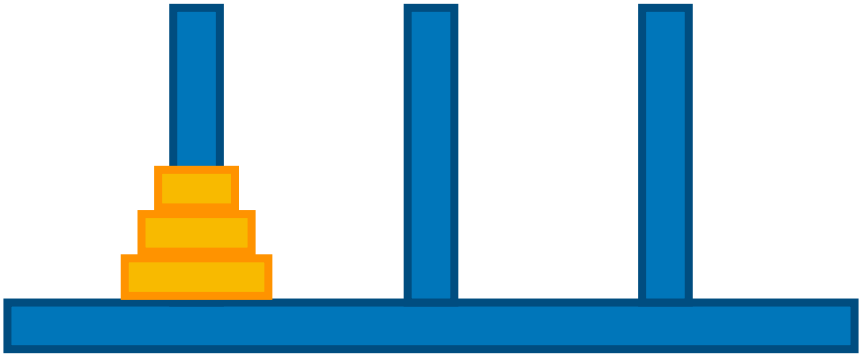
In other words, looking at the map grid, each row and column must have different coloured houses and different coloured teddies.

Can you arrange the nine different combinations you've found on the large scale map?



The Tower of Hanoi

This is a very old puzzle from Asia which is sometimes called “The Tower of Brahma”.



To Start

Put the three smallest pieces on the left peg/area and in order of size (with the largest on the bottom).

The Aim

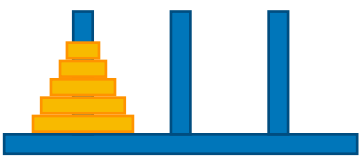
Move all three pieces to the right peg/area.

The Rules

- You can only move one piece at a time.
- You may not place a larger piece on top of a smaller piece.

What is the smallest number of moves you complete it in?

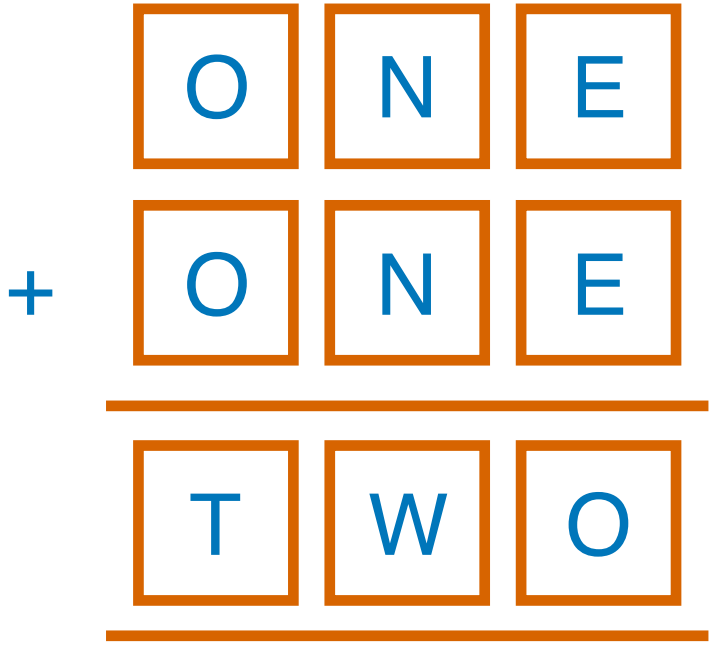
Now try starting with 4 pieces on the left, then with 5 and so on…

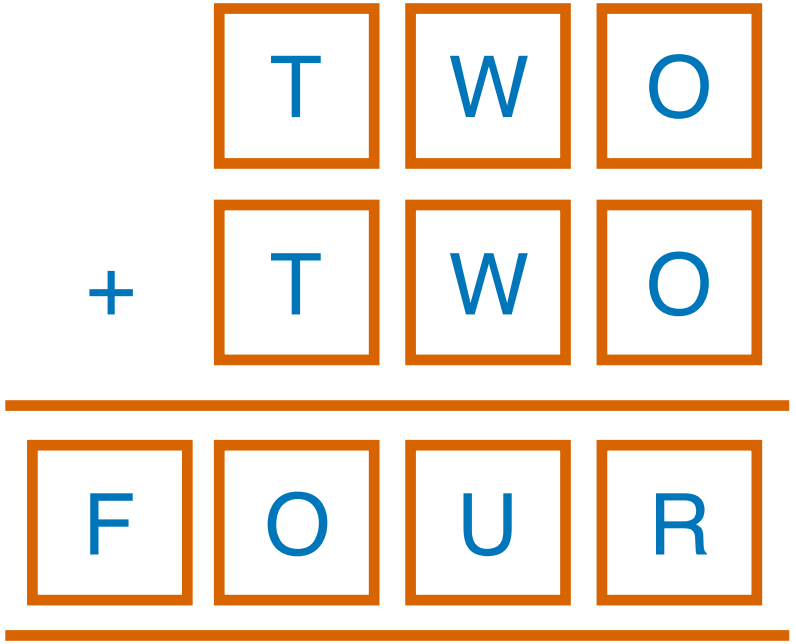


Two and Two

How many solutions can you find to the two sums below?

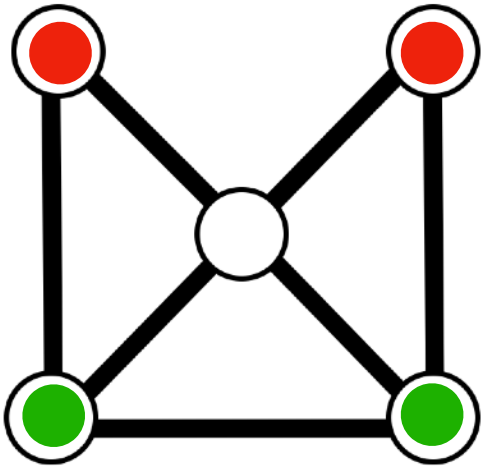
Each of the different letters stands for a different number.





Two Stones

This game is for two players. Each player plays with two counters of the same colour.



To Start

Place two stones at the top and two at the bottom as shown on the right.

To Play

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 that they cannot move.

Next Game

At the start of each game the players should swap positions.

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

Two Digit Targets

Arrange the digits 0-9 in the five boxes below to make two-digit numbers as close to the targets as possible. You can use each digit once only.

a) Largest even number

b) Largest odd number

c) Smallest odd number

d) Largest multiple of 5

e) Number closest to 50

For a challenge, use all your answers in the sum:

a + b - c + d + (difference between e and 50)

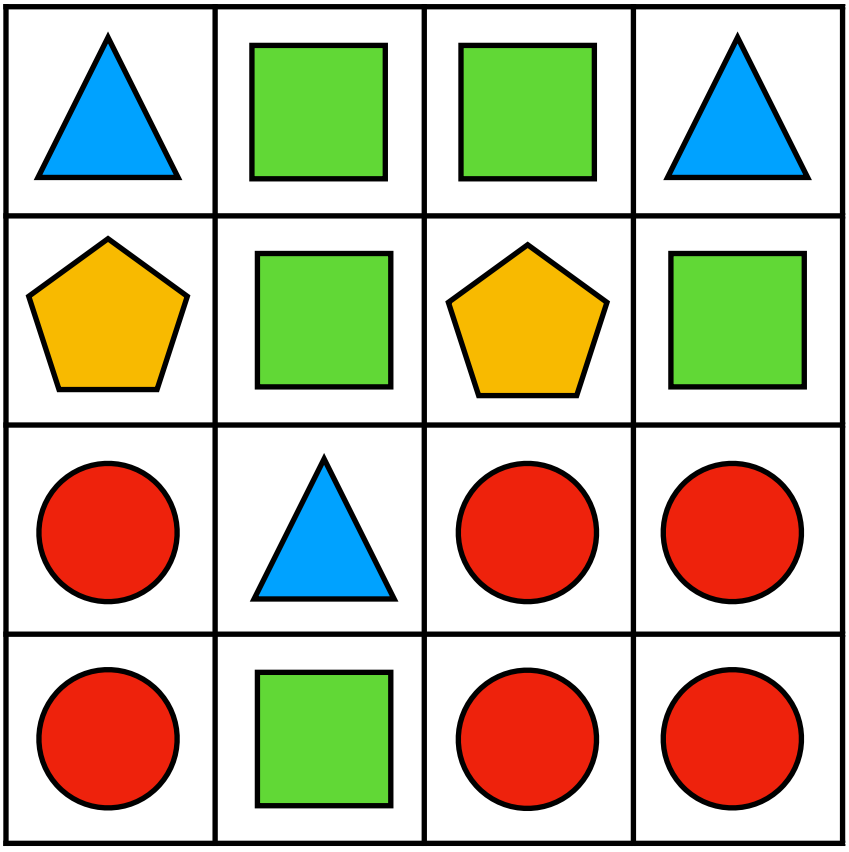
What is the highest total you can make?

What's it Worth?

Each symbol has a numerical value.

The total for the symbols is written at the end of each row and column.

Can you find the missing total that should go where the question mark has been put?



Who's Who? 1

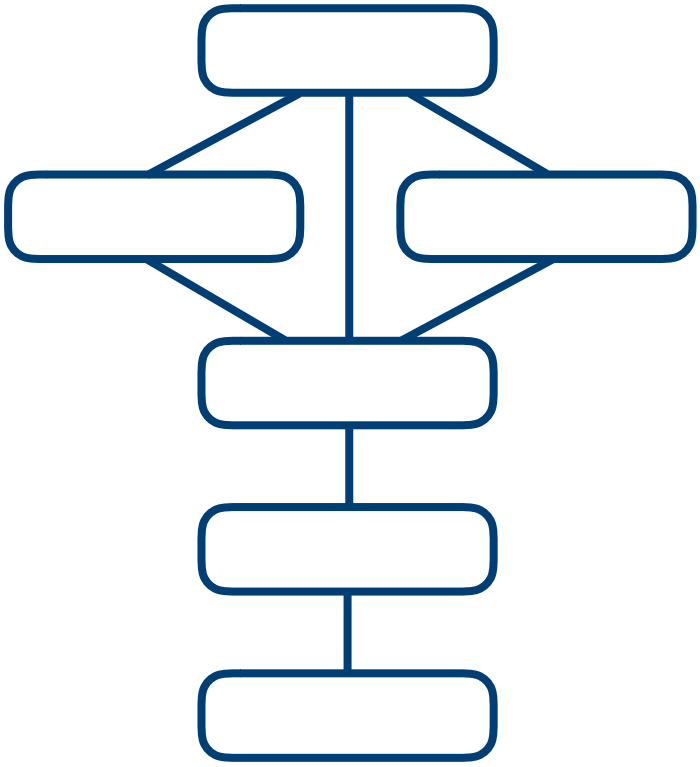
We can represent a group of friends by drawing a graph.

Each node (circle) represents a person.

An edge (line) joins two nodes if and only if those two people are friends.

Below is a graph showing a group of friends.

Can you work out who's who using the clues?

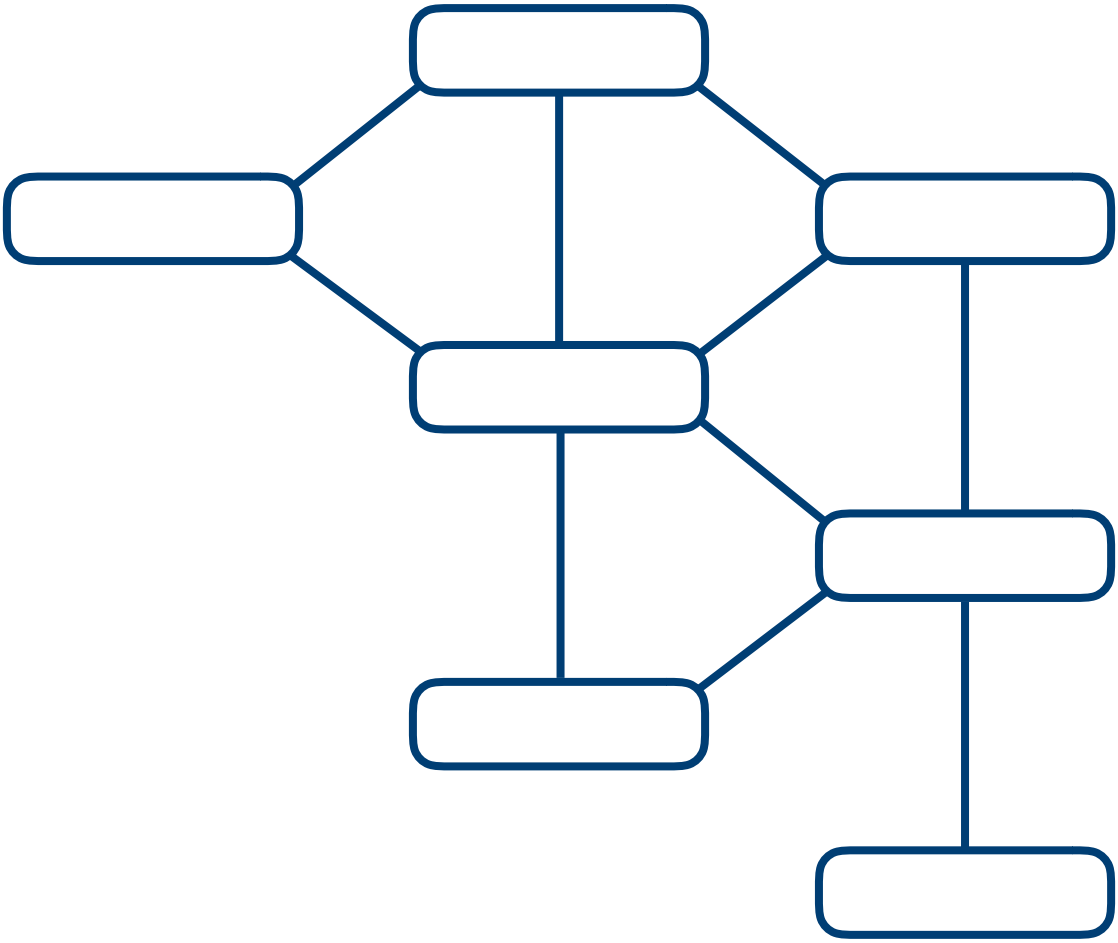


1. Alan has 3 friends, Barney, Charlie, and Daniel.
2. Barney and Ed are both friends with Charlie.
3. Ed is Frank's only friend.

Who's Who? 2

Here is a second network of friends.

Again, **use the clues below to figure out who's who**.



1. Bella and Ciara are friends
2. Emily and Ciara are not friends
3. Bella is Fiona's only friend
4. Anna has more friends than anyone else
5. Daphne has three friends
6. Gill and Daphne are not friends
7. Emily has two friends