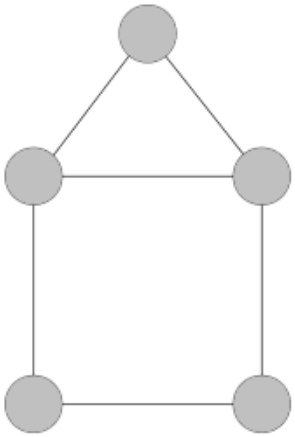
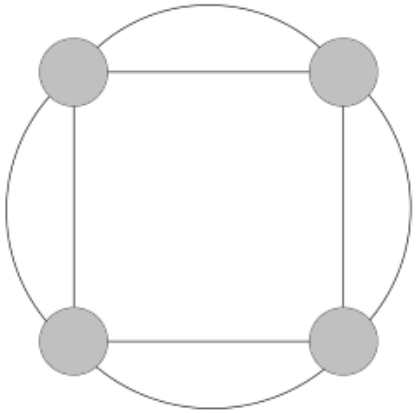
Can You Traverse It? 1

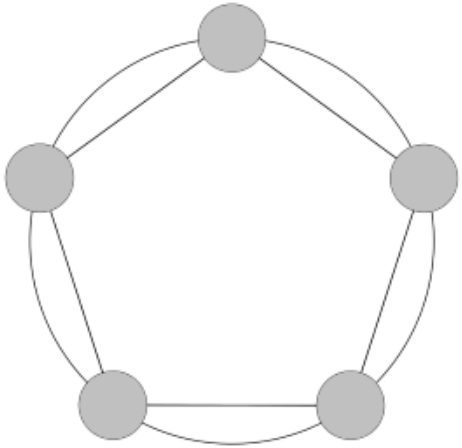
A traversable graph is one you can draw without taking your pen off the paper, and without going over any edge twice.

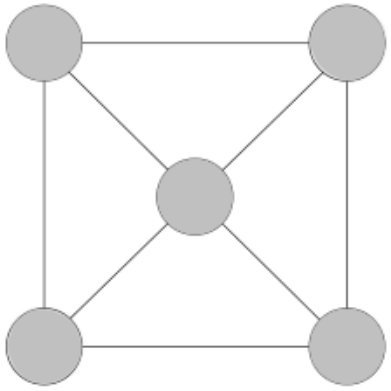
For each graph, decide whether or not it it traversable.

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

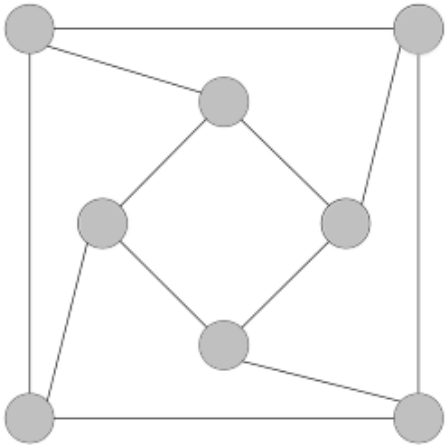


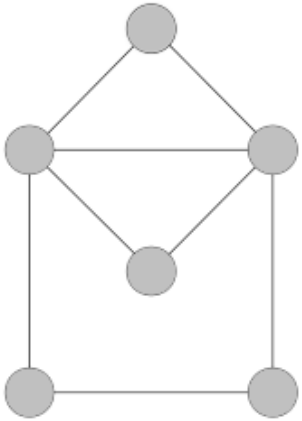


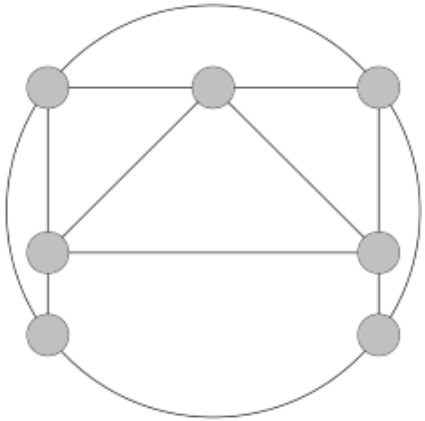


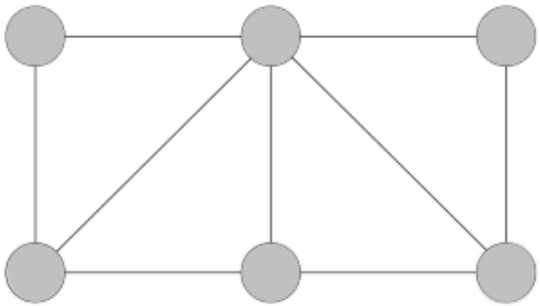


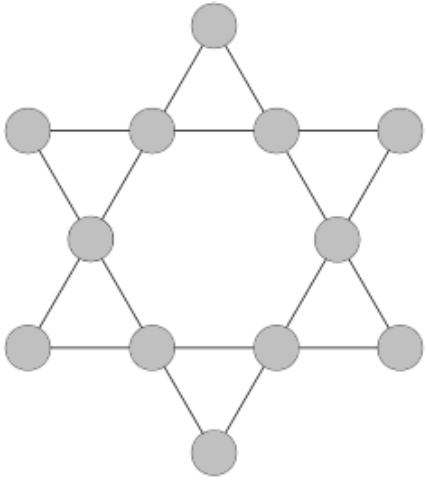
Can You Traverse It? 2

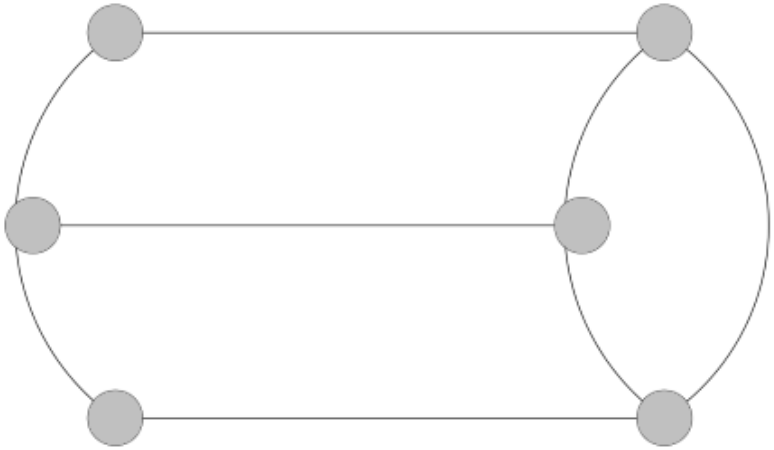












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Activity 4

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

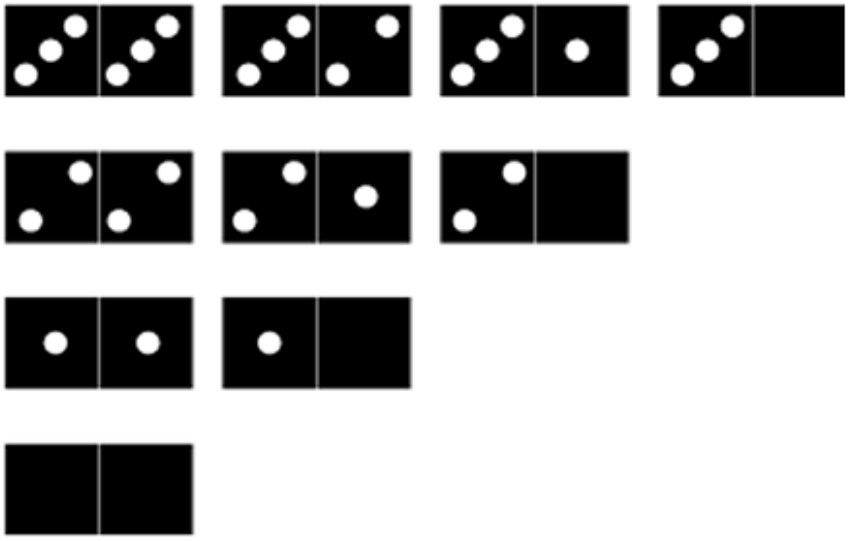
When a **pair walks together, they must go at the rate of the slower person.**

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

Domino Square

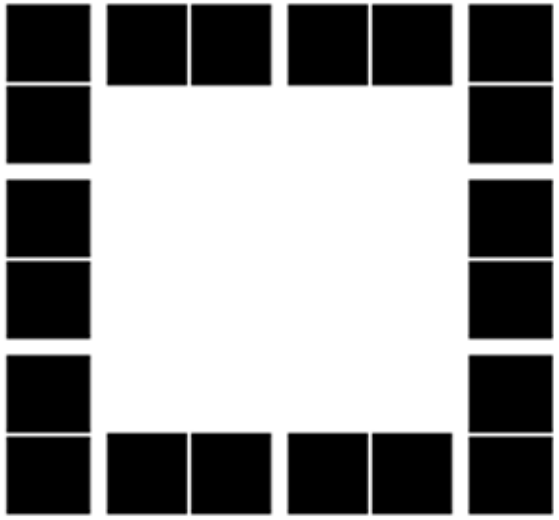
You need these 10 dominoes.

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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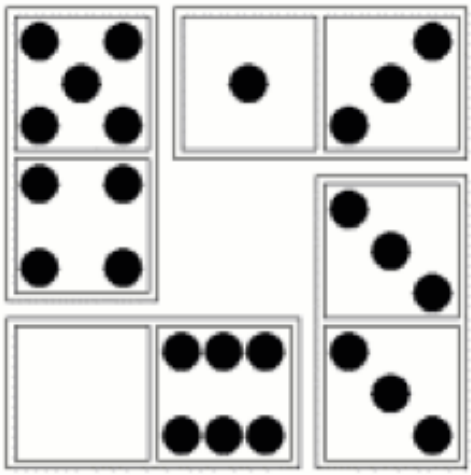
Activity 8

Domino Windows

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

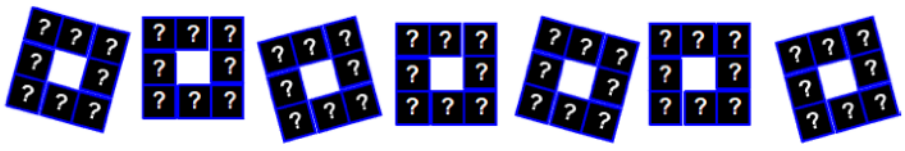
The spots on all four sides add up to make 9.
We will call this total the “spot sum”.



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?



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**

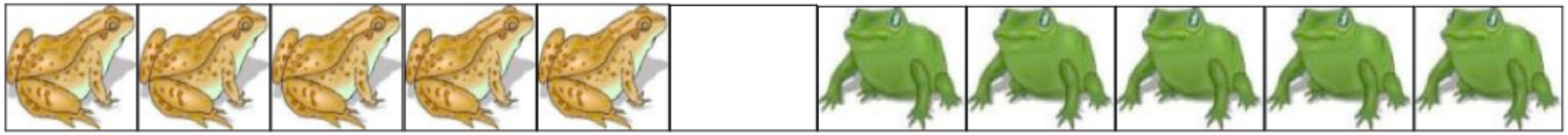
Player 2: **11**

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

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.**

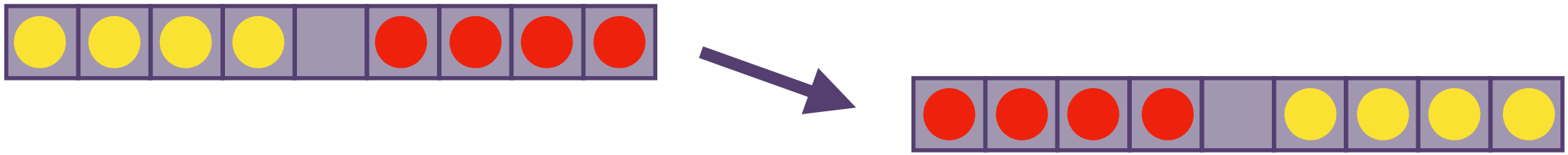
Frogs can jump over another frog, but only one at a time.

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

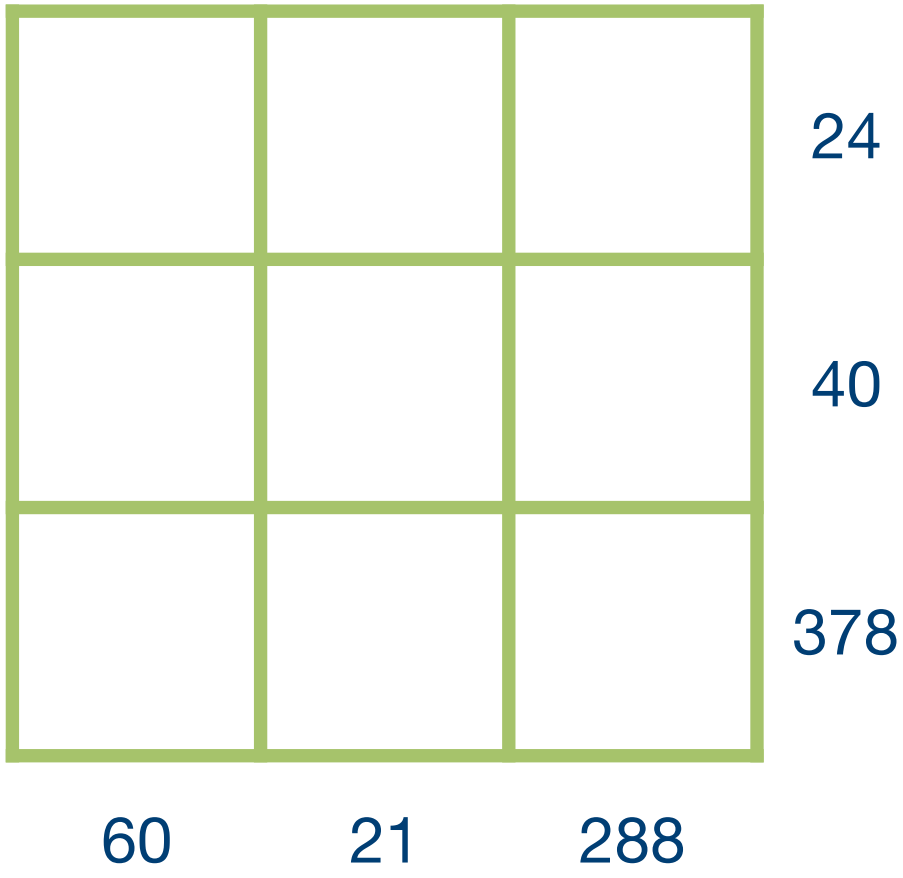
Gabriel wrote the numbers 1-9 in a 3x3 grid.

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?

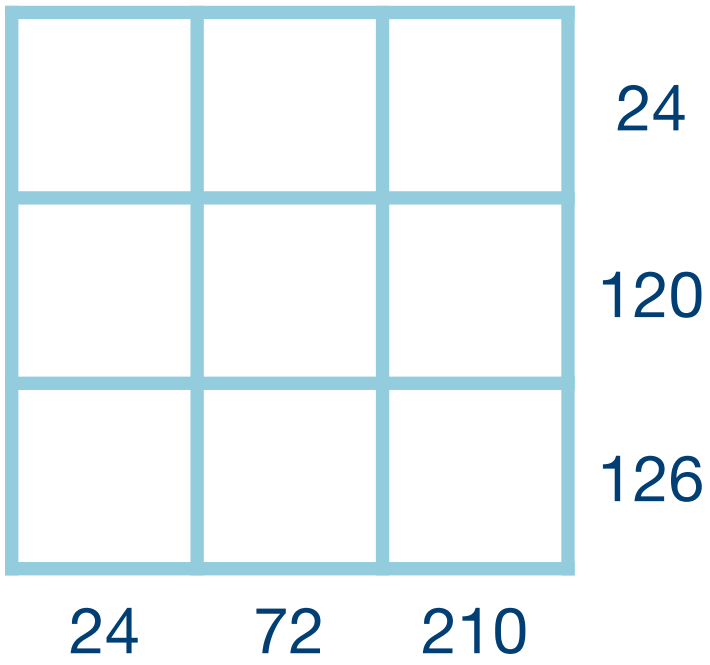
Did you have enough information, not enough, or exactly the right amount?

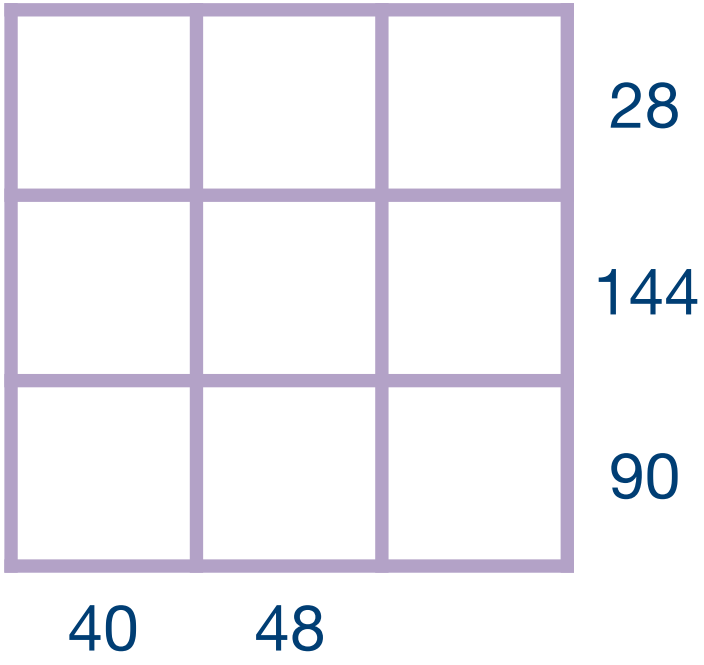


Gabriel's Problem 2

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.

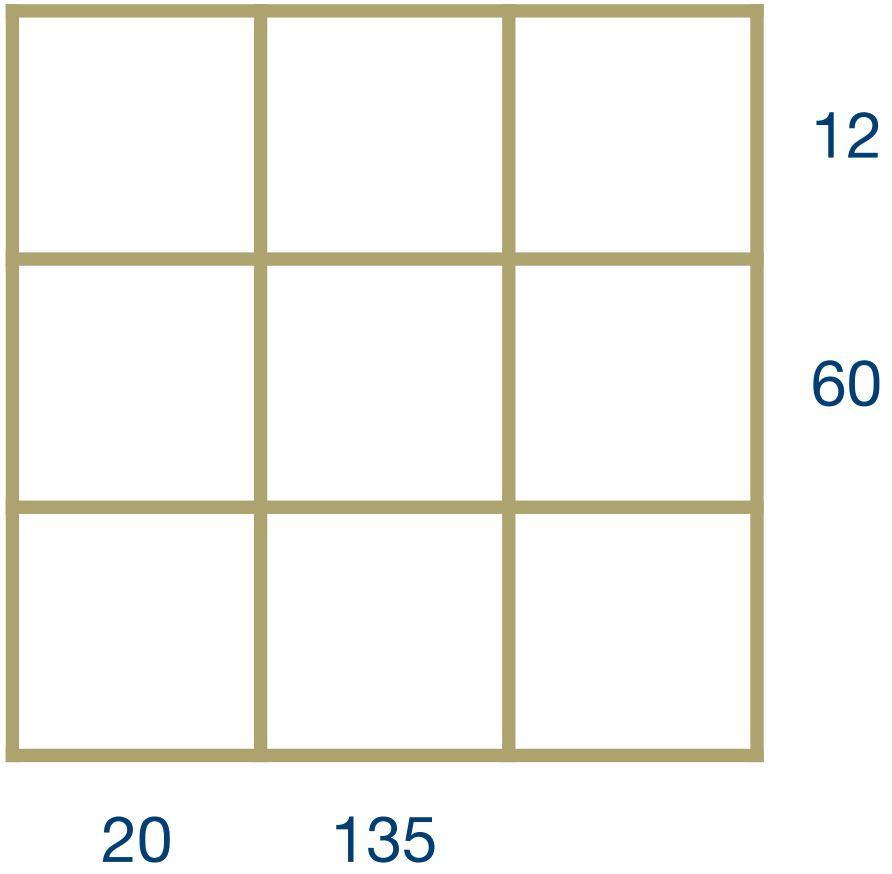




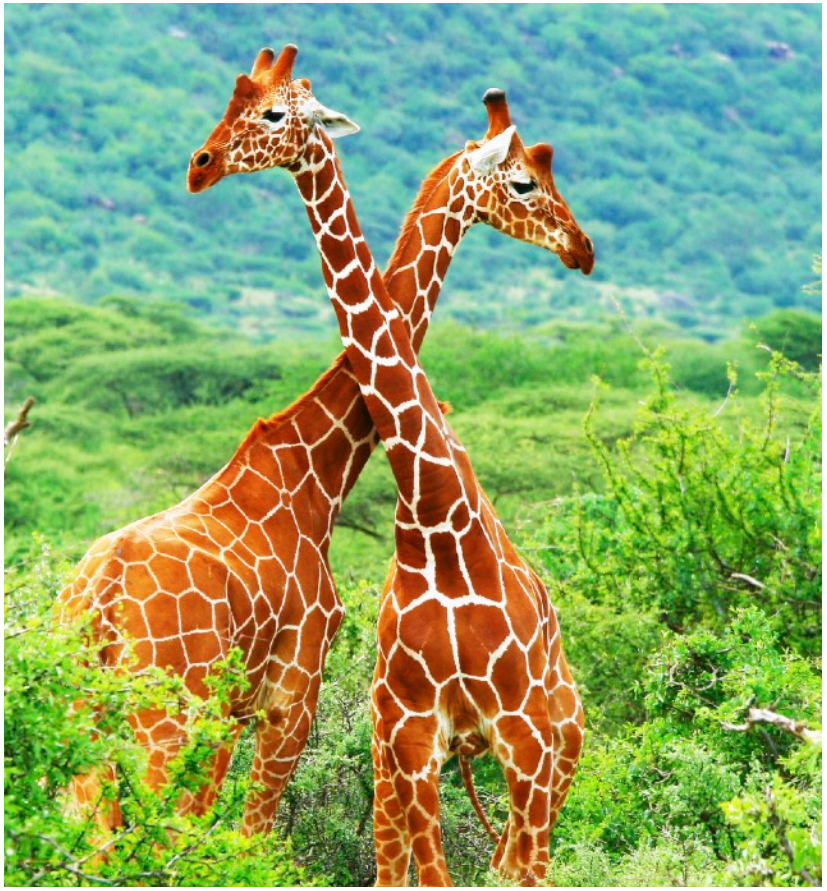
Gabriel's Problem 3

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

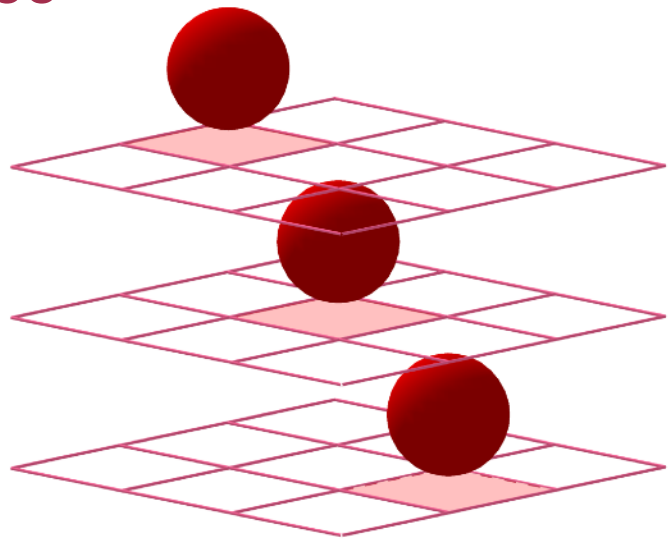
2) take the same number of biscuits from both jars.

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

Do you think it matters who goes first?

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?

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?

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.

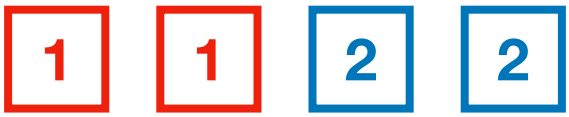
Sandwiches 1

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

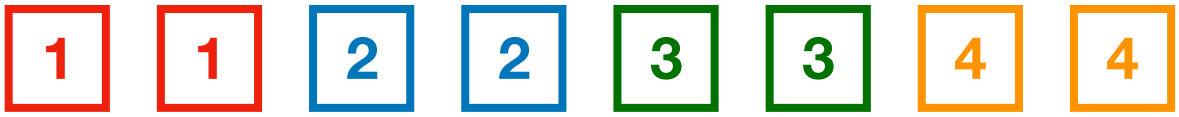
Arrange these six digits in a line so that:

- 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?**

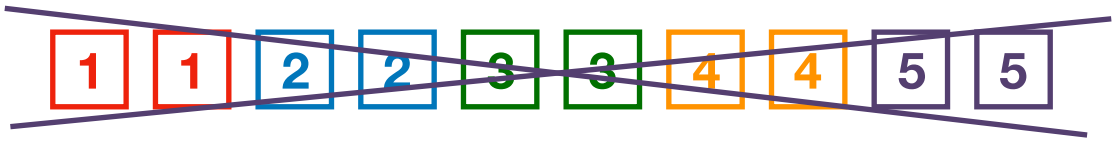


3) It is possible to add two 4's and then arrange all the numbers as in part **(1)** but now with four digits between the two 4's.

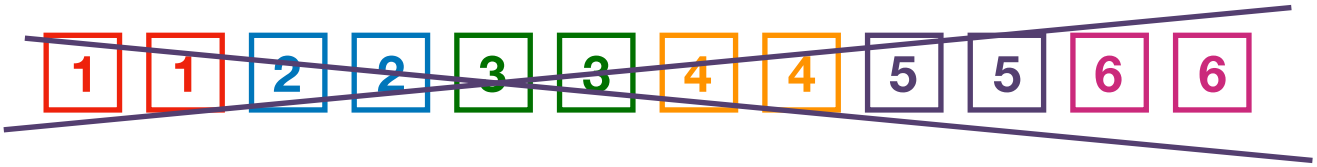


Sandwiches 2

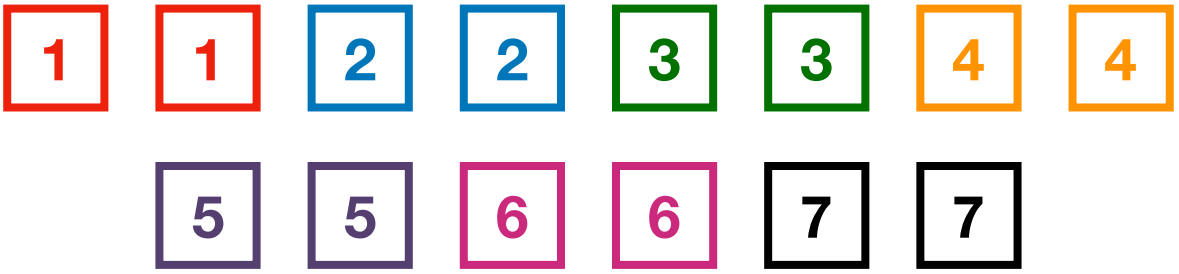
4) If you try to add two 5's (as below) it is **impossible** to arrange them in a 'sandwich'!



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.

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:

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

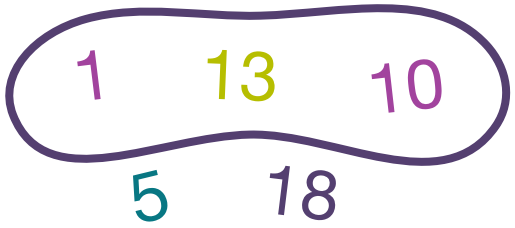
Your Task

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

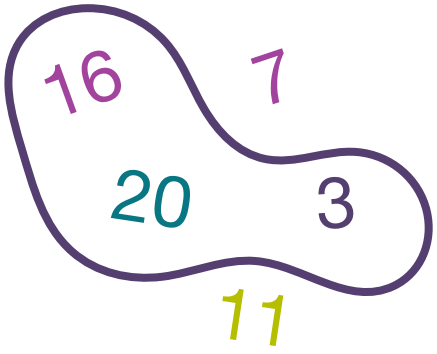
Can you arrange them in more than one way? If not, can you explain why your solution is the only one?

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.

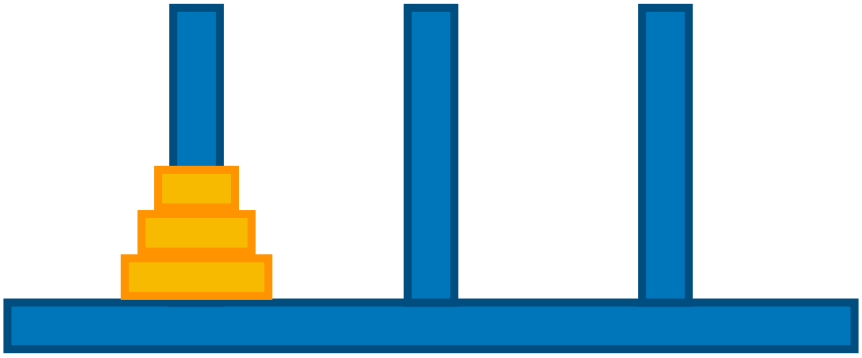
AND

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…

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

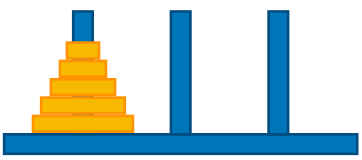
Move all three pieces to the right peg/area.

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…



Who's Who? 1

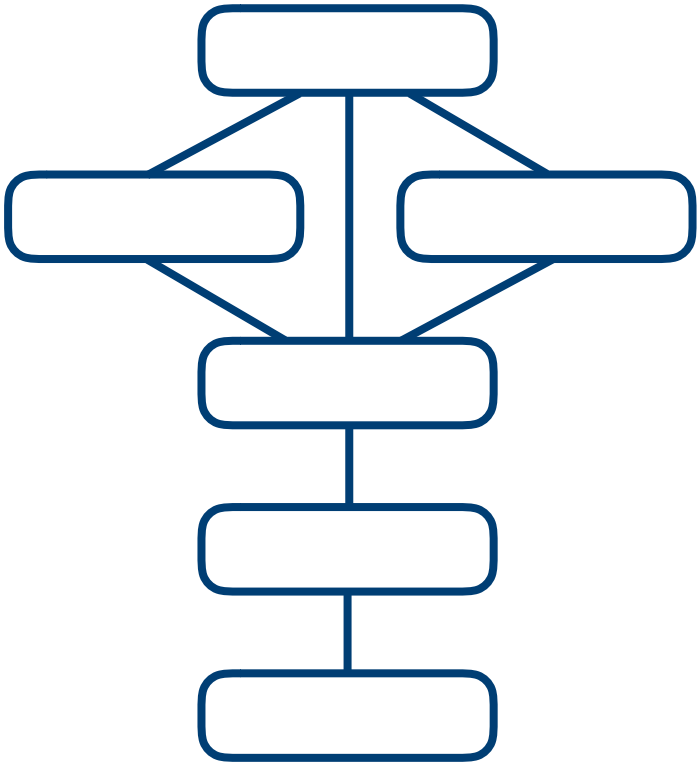
We can represent a group of friends by drawing a graph.

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?

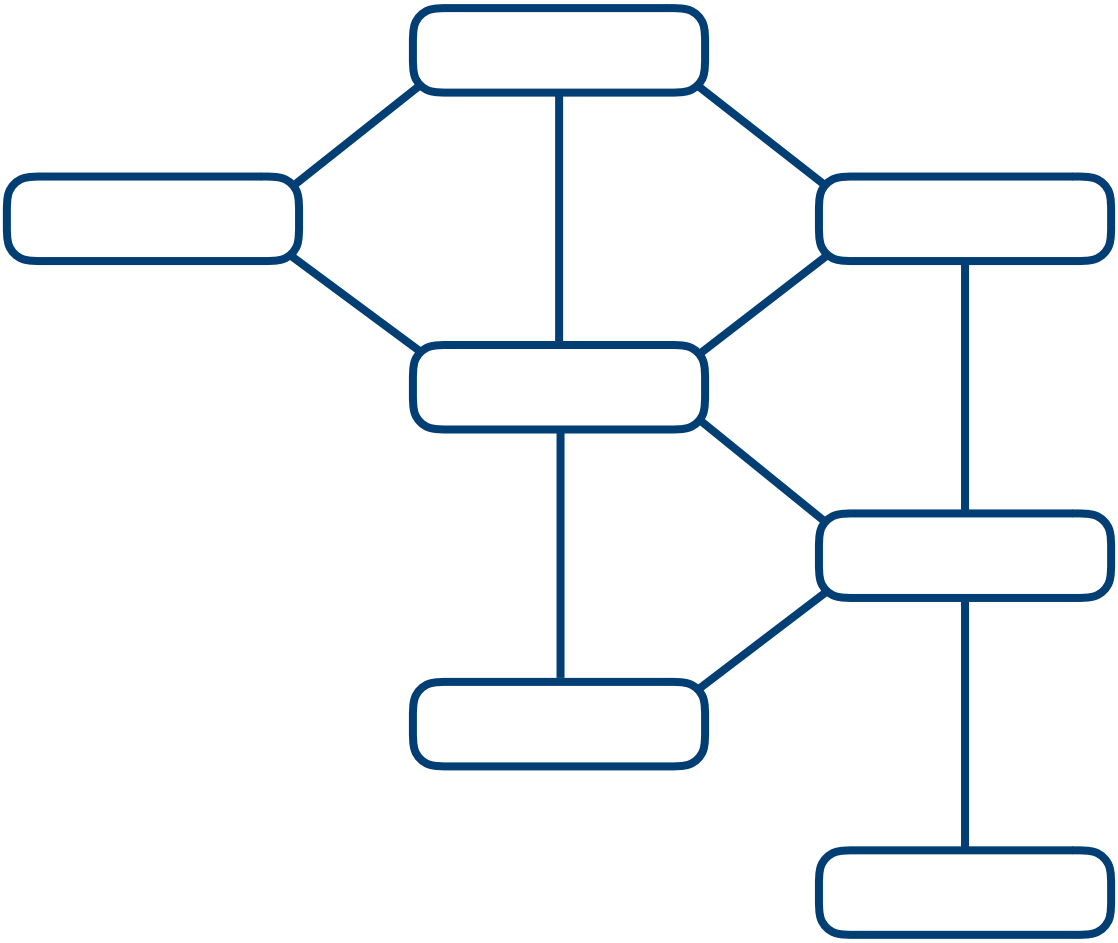


1. Alan has 3 friends, Barney, Charlie, and Daniel.
2. Barney and Ed are both friends with Charlie.
3. Ed is Frank's only friend.

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