VISIT MATH

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Itinerary

1. Walls
2. Porta S. Maria
3. Piazza dell'Anfiteatro
4. Guinigi Tower
5. Cathedral
6. Piazza S.Michele

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VisitMath Tours Lucca

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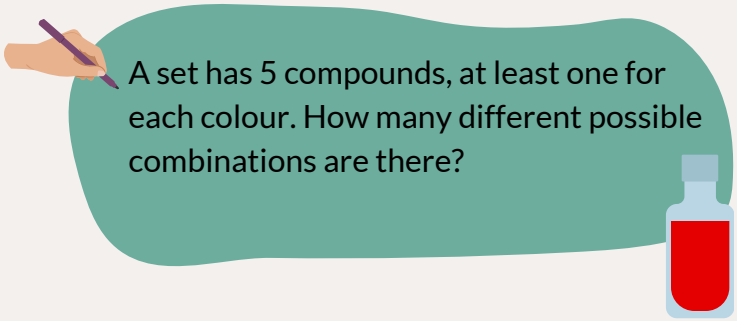
Oh no!
The wicked criminals of the Miscount organization are about to take over the city of Lucca. The only hope is to gather the compounds of mathematical power to transform yourself into the right supermath hero for the threat. Be careful, though, as the organization will strike where your agents are the weakest, so the right hero will be needed at the right time.

Step 1: With great power comes great responsibility

There are three types of compounds: red, corresponding to Algebra, green, corresponding to Logic, blue corresponding to Geometry.

Each completed task will give you one or more types of compounds, but each task not completed will give more power to the Miscount organization. So keep track of every completed and uncompleted task.

Here's the first challenge! For each exercise you solve, you get the compounds that are shown at the bottom right.



Since you don't have to worry about the order of the compounds, you already know that 3 of the 5 compounds are determined. So you just have to count how many combinations of the remaining 2 compounds you can have!

At the end of the tour, by counting the uncompleted tasks of all agents in your class, the type of villain that the Miscount organization has destined for Lucca will be determined. Will you, with the compounds collected, transform yourself into a supermath hero capable of countering the threat?

Now you can go to Porta S. Maria to start the tour!

Step 2: Sneak into the walls

The three historical gates of the city are guarded by sentinels, but some of them are infiltrators from the Miscount Organization. You can expose them because they **always speak falsely**, while the others, from the Mathematicians Guild, **always speak the truth**.

The Walls of Lucca stand as a defensive marvel, erected between the mid-16th century and the mid-17th century. These formidable fortifications encircle the city, showcasing a superb example in Europe of well-preserved walls constructed in accordance with the principles of modern fortification. The present ring of walls in Lucca spans precisely 4 kilometers and 223 meters, a testament to the culmination of the last reconstruction campaign. This ambitious undertaking commenced in May 1544 and concluded a century later, in 1648.

The entrance of Porta San Pietro is guarded by three sentinels: Aldo, Boldo, Coldo.
Aldo states, Coldo is a liar.
Boldo says, Coldo and I are of different types.
Coldo states, Boldo is a Mathematician.
What are the types of each of them?

To solve the exercise you can either check all combinations per Aldo, Boldo and Coldo, or you can deduce it statement by statement.
In the first strategy you check all the triples (L,L,L), (L,L,M), (L,M,L), (M,L,L), (M,M,L), (M,L,M), (L,M,M), (M,M,M), and you get that only (M,L,L) works.
In the second strategy, first note that If X claims to be of the same type as Y, then Y is Mathematician. if X claims to be of a different type from Y, then Y is Liar, so for Boldo statement, Coldo is Liar. Then you can conclude.

Use the hint above to solve the next two gates!

The entrance of Porta San Donato is guarded by four sentinels: Argaros, Borgaros, Corgaros, Dorgaros.
Argaros states, If Borgaros is a liar, then Dorgaros is a Mathematician.
Borgaros says, Corgaros and I are of the same type.
Corgaros states, Dorgaros is a liar. Dorgaros says, Borgaros is a Mathematician. What are the types of each of them?

The entrance of Porta Santa Maria is guarded by five sentinels:
Arte, Borte, Corte, Dorte and Erte.
Arte states, "Borte is a Mathematician".
Borte says, "If Dorte is a Mathematician, then is Erte too".
Corte states, "Erte and I are of different types.".
Dorte says, "Borte and I are of the same type".
Erte states, "Both Borte and Corte are Mathematicians".
What are the types of each of them?

Step 3: Win the Game

Once you enter from Porta Santa Maria, you must immediately undertake a mission! An informant has advised you that some of the compound was left around that area during the Lucca Comics period and has remained there even after the stands were removed.

In a specific season each year, the city walls serve as the venue for Lucca Comics & Games, an international fair devoted to comics, animation, games (role-playing, board, card), video games, and the realms of fantasy and science fiction imagery.
Regarded as Italy's foremost event in the industry, it holds the premier position in Europe and stands as the second-largest globally, trailing only Tokyo's Comiket. The event attracts major players in the industry, along with a growing number of specialized shops, comic book stores, and cultural gaming associations.

The portion of the compound is locked in a safe, in front of which Alice and Bob, two gaming enthusiasts, are starting a new game of dice. It seems that the safe combination precisely matches the simplified probability of Alice's victory!

Alice starts by rolling a fair six-sided die, numbered from 1 to 6. If 4, 5 or 6 comes up, Alice wins; if the result is 1, 2, or 3, the game continues, and the die is passed to Bob. Now, Bob rolls the die. If 4, 5 or 6 appears, Bob wins; however, if the result is 1, 2, or 3, the die is passed back to Alice, and so on.

Could you calculate the probability that Alice has to win at the end of the game?

To compute the probability, remember that the game ends with a winner, so the chances for Alice plus the chances for Bob of winning must be equal to 1 (since there is no other option). Hence, P(A)+P(B)=1, so...

Now you can move to Piazza dell'Anfiteatro, where it seems to be a weird situation.

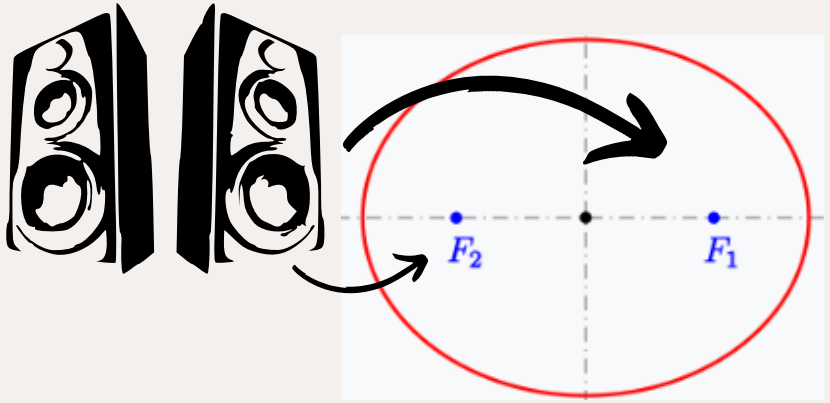
Step 4: Play with acoustics

Piazza dell'Anfiteatro is under attack! The Miscount organization has placed powerful distorters to block communications. You are provided with the equipment that can counteract the distorters if placed in the right locations.

The current magnificent Piazza dell'Anfiteatro, distinguished and unparalleled in its character, was designed by the architect Nottolini in 1830. He dismantled certain structures that had occupied the centre and laid out the thoroughfare known as Via dell'Anfiteatro around it

Sound waves emitted from a source in an **elliptical environment**, originating from one of the two foci, are elastically reflected uniformly toward the other focus, regardless of the initial direction and the dimensions of the environment.
This means that in Piazza dell'Anfiteatro, you could achieve optimal communication by placing one person at one focus and the other at the other focus. The **major axis** of the square measures 67 meters, while the **minor axis** measures 39 meters.

To properly counteract the acoustic distorters, you will need to place the equipment in the two foci of the square. At what distance from the centre, marked by a cross, should you place it?



Go to Guinigi Tower! There is something going on there...

Step 5: Mind the steps

You are chasing a very fast agent of the Miscount organization, but he's also very confused! He sneaks into the Guinigi Tower, trying to cover his tracks by going a bit forward, a bit backwards.

The tower constitutes a significant component of a grand structure commissioned by the affluent and influential Guinigi family, prominent merchants of Lucca during the 14th century. It stands as the sole remaining testament among the more than 250 towers that once adorned the city during the medieval era. Soaring to a height of 44.25 meters, its pinnacle features a suspended garden where sizable, centuries-old holm oaks have been carefully planted. Accessible by ascending 230 steps, this unique tower provides a glimpse into the city's historical past.

The agent has reached about halfway up the steps of the Guinigi Tower when he starts moving differently. He ascends one step, descends two steps, ascends three steps, descends four steps, and so on, stopping the first time he ascends consecutively eighty steps.

How many total steps (counted with repetition) he has covered in this manner?

How many steps he took in total descending and how many he took ascending?

At what distance from the starting step did he arrive?

You can use the Gauss formula to count the sum of the first integers (the sum of the first n integers is equal to n(n+1)/2).

The mayor ask you to help him at the Cathedral of S. Martino!

Step 6: Escape from the Labyrinth

On the right side of the Cathedral of San Martino, near the bell tower, we find an unusual symbol carved in the 12th century.
We are talking about a labyrinth, often depicted inside churches, primarily as pavement.

The Cathedral of Lucca, dedicated to San Martino, graces the square bearing the same name, situated in a secondary area of the city based on urban layouts dating back to Roman times. Despite its significance, the Lucca Cathedral presides over a modest square, with adjacent buildings leaning against its structure.
According to tradition, the initial church of St. Martin was constructed at the request of St. Frediano, the Bishop of Lucca, who passed away in 588. It underwent reconstruction in 1070 under the auspices of Pope Alexander II (1061-1073), who solemnly consecrated it in the presence of Countess Matilda of Canossa.

In the latter part of the 12th century, the church entered its third and definitive phase of reconstruction, primarily centreed around the reorganization of the facade. The ongoing works, conducted intermittently, reached completion only in 1637 with the finalization of the Sanctuary Chapel. Throughout the centuries, a succession of master builders took charge of the construction.
Notably, Antonio Pardini from Pietrasanta (1395-1419) played a crucial role during his tenure, shaping the building into the form it retains to this day.

The Miscount organization has kidnapped the most important city officials and hidden them inside the maze (which has the shape on the right). The hostages are not all in the same position, so you will need to search the various exit paths of the maze.

If the maze has multiple connected components, it means that an exit cannot be found from certain positions. Try colouring the diagram and making hypotheses about the solvability of the maze.

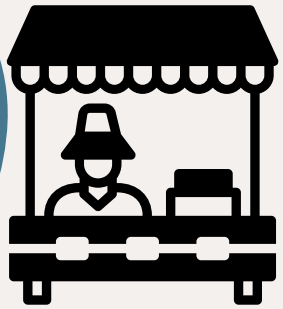
Next step: Piazza S. Michele

Step 7: The art of the exchange

Oh no! The Miscount organization has set a trap for you in Piazza S. Michele, and a temporal leap throws you a few centuries into the past. You need a battery to return to the present, and a merchant has one in possession, but he will exchange this strange object only for several grams of silk.

Piazza S. Michele stands as the focal point of Lucca's historic centre, serving as the natural nexus of a labyrinthine network of streets and alleys converging from various corners of the city. The square offers diverse perspectives depending on the myriad entrances leading to it.
Occupying the site of the ancient Roman forum, Piazza S. Michele occupies the strategic intersection of two primary thoroughfares: the primary cardo (extending from north to south, encompassing the present-day Via Fillungo, Via Cenami, and Via S. Giovanni) and the main decumanus (stretching from west to east, encompassing today's Via S. Paolino, Via Roma, and Via S. Croce).

Since its inception, the square has been the nucleus of the Roman colony's administrative, political, and religious activities, evolving into the epicentre of the medieval city. During the Middle Ages, as craftsmanship and commerce flourished, Lucca emerged as the silk capital of Europe. The square became a hub for business and social interactions, featuring bustling money changers' stalls and fabric merchants' shops.



The fabric merchant only accepts florins as currency, and you only have one ducat. You then head to the money changer's booth, which displays the following currency exchange rates:
- For one shilling, you get a ducat plus two crowns plus one florin.
- For two shillings, you get a ducat plus four crowns plus ten florins.

How many florins do you receive in exchange for your ducat?

How many florins do you receive in exchange for your ducat?

After changing the currency, you go to the fabric merchant, who displays the following prices for silk:
- One hectogram of silk for two diamonds plus two brass ingots.
- Two hectograms of silk for three diamonds plus three brass ingots plus two florins.

With the florins you have, how many hectograms of silk do you get?

Step 8: Fight the villain

The powerful villain sent by the Miscount organization is revealed! For each colour, count how many exercises were not completed by the **agents in your class** of that colour. The colour with the majority represents the villain you'll have to face! Be careful, if two or more colours are tied, you'll have to face **all** corresponding villains!

Now, based on the compounds you've collected, choose which supermath hero to transform into!

Cost:
Win against: Blue

Cost:
Win against: Red

Cost:
Win against: Green

Cost:
Win against: Red, Blue

Cost:
Win against: Blue, Green

Cost:
Win against: Green, Red

Cost:
Win against: Red, Green, Blue