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Text development: Damaris West

Front cover: Patt Ramenta

Pictures: Agata Szczęsna

I dedicate this book

to my whole family for their constant support throughout,

to all code lovers,

and to Clive West who was instrumental in bringing it into being.

Greg

Legends of Aivirai

MUKO

and the Secret

part I

Introduction

I have prepared this book because I love maths and puzzles. I also love the creativity of Zbigniew Nienacki, J. K. Rowling and Dan Brown.

There is also another reason.

A peculiar puzzle exists in our world. It is around 30 years old and officially not solved yet, despite the fact that thousands have tried. I would like to draw a little bit of your attention to it.

I want to give you some quite interesting information, gradually – piece by piece. There are reasons for doing it this way. I do not want to spoil the fun. I will explain everything when the time is right.

I have been thinking about creating this book for a long time. I wanted to create a type of book that has never been crafted before - I am not talking here about the plot perspective.

I was told that "it cannot work", "books are dying in the era of smartphones" and "it makes no sense".

I have tried to draw other authors` attention but I have encountered impassable walls. Finally I made a decision.

I will prepare it myself and find help to do so (thank you Damaris, Agatha and Patt).

I share with you the first part free of charge I hope you will enjoy reading it!

If you liked my story and think it has some value, donate whatever you can to the RMHC Chapter in Poland called "Fundacja Ronalda McDonalda":

www.frm.org.pl/pl/wesprzyj-nas/wplac-i-pomoz?locale=en

They are doing a great job making it possible for families of sick children to stay together. RMHC organizes Ronald McDonald Family Rooms and Ronald McDonald Houses in and next to children's hospitals. Sick kids and their nearest and dearest thereby gain a measure of normality and the chance to take a break from hospital reality.

In the "NO to cancer in children" campaign, the Ronald McDonald Care Mobile tours Poland in order to provide kids across the country with free ultrasound screening focused on early detection of cancer symptoms. To find out more about Keeping Families Close, go to www.frm.org.pl

When making a PayPal money transfer, make sure to include "**A Book that Helps**" in the title of the transaction.

On the other hand, if you didn`t like the book, I am sorry it didn`t work. If you have a minute or two and want to share any thoughts with me, please do so. I would really like to hear from you.

So, in short, the first part is just a taster. There are some big prizes. Take a look on aivirai.com/challenge.php

Just try! There will be much more waiting for you in the next parts.

@GregMaterna

Chapter 1

You are here for a reason. You will find out why when the time is right. Pythagoras

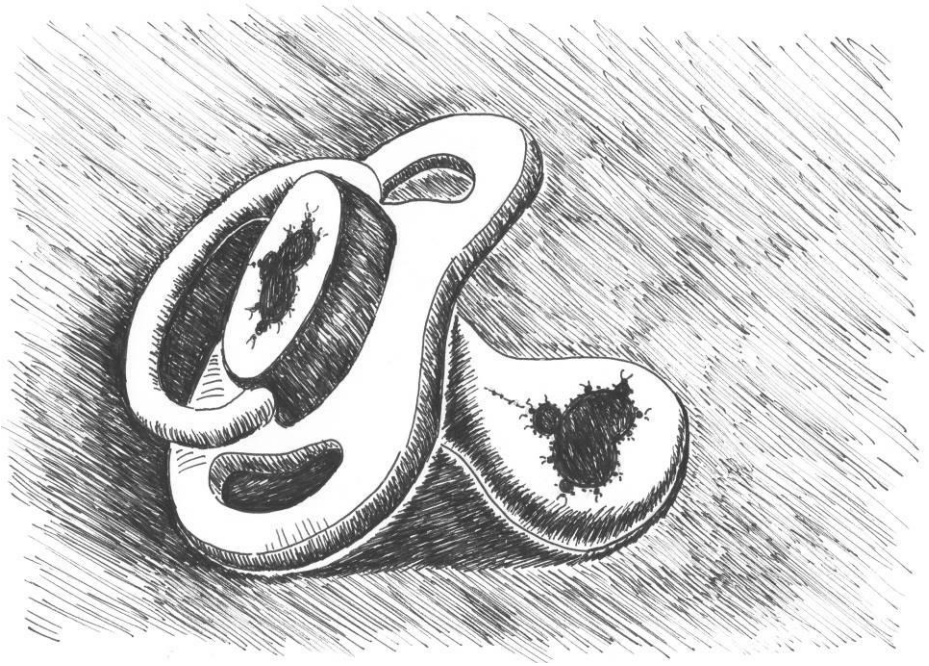
Muko's memories occur mainly in his dreams. The images that are conjured up aren't sharp like memories sometimes are. They have fuzzy edges because they are images seen through the eyes of a child, and small children see everything blurred in their first years.

He is dreaming about a day at the beach. Although it's not an extraordinary scene, there's a magical, timeless quality about it. The sun is bright but it's not the sun that attracts him. Something else shines and throws out sparkles of light and isn't so far away. He can reach it. He just has to keep going. He crawls and crawls over the soft, sinking sand and the breathing sound that the shiny thing makes gets louder and louder.

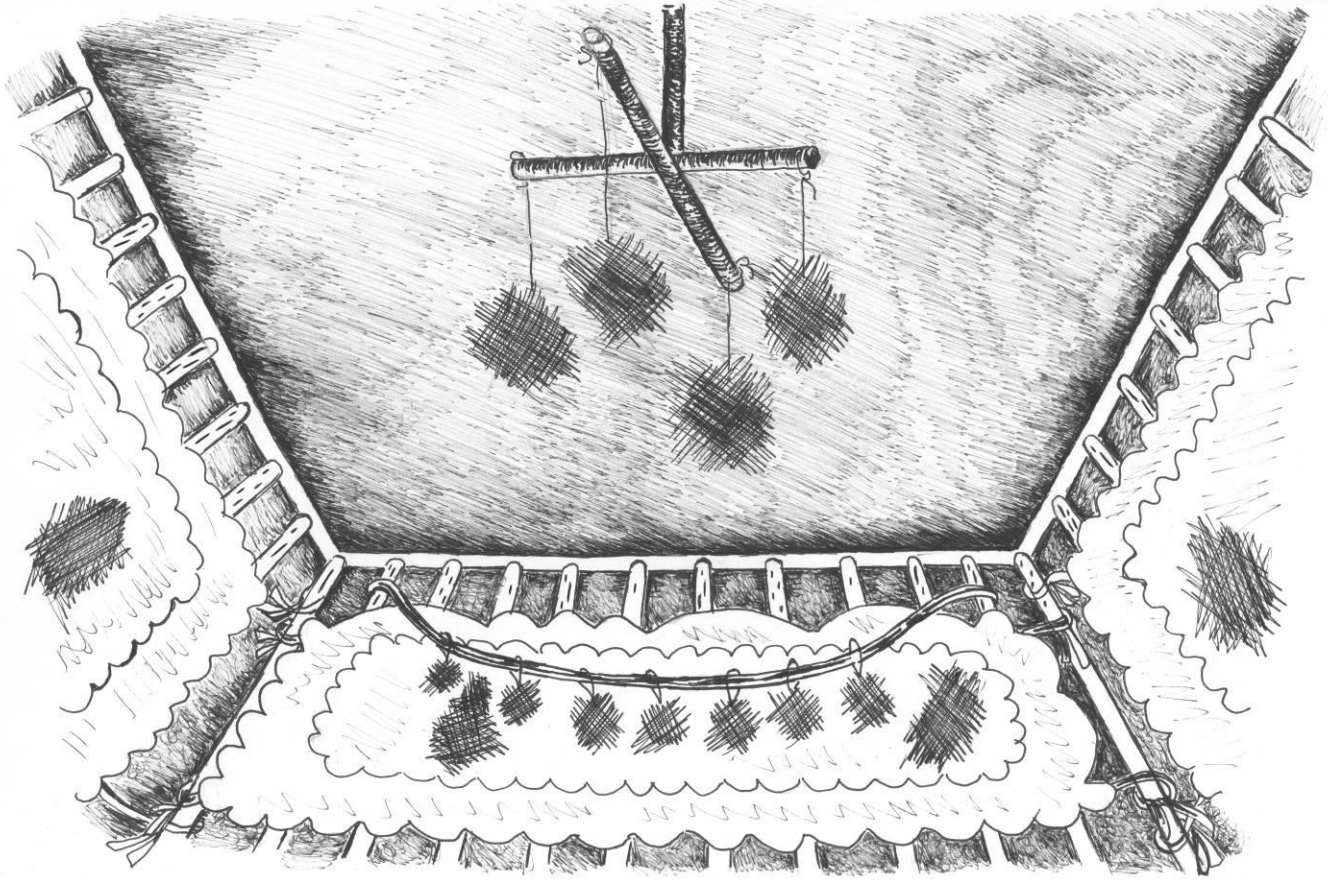
'Husssh … husssh.'

The sand is harder now. He doesn't sink in so much but it's wet. Suddenly the first tiny wave touches his knee and runs away from him making little bubbles. He laughs. When the wave comes back he pats it with his hand and makes a splash.

There are voices behind him, calling him. They want him to go back to them but he doesn't want to go back. He turns his head and sees two shapes. They are quite far away and blurred like everything else but they are moving towards him. He knows they will pick him up and he will like it, even if he struggles and pretends not to.



He has another dream. He is in his cot. He opens his eyes because there are voices nearby. He turns his head and can just see two tall forms, blurred and stripy through the bars. He looks up towards the ceiling and there are some tiny objects dangling there. He can't tell what they are but he likes them. They are

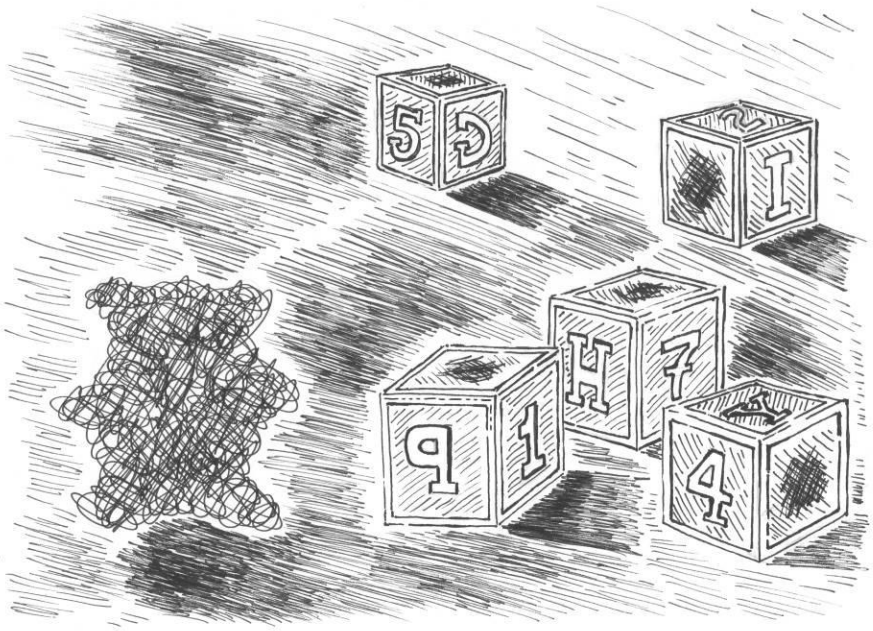


brightly coloured and they move a little. He reaches up to them but they are too far away to touch. They look like they are dancing up and down, up and down. They dazzle him and his eyes follow them even though he can't make out their shapes.

The voices he heard before are getting closer and closer. One of the figures is approaching him, stepping slowly, gradually becoming less blurred. He focusses on the part of the person that will be just higher than the bars of his cot and he sees bright white. The voice is deep and reassuring. He feels so happy. He makes a happy noise in his throat and looks up at the bright dangling objects. The person is now leaning over him, the white pressed against the rail of his cot, but he looks up and in the place where a face should be there is only a blur. Faces, and colourful objects like the ones dancing over him, are always a blur; they seem to have been cut right out of his memory. The person picks him out of his cot with strong hands. He feels so safe and so happy that he falls asleep with his cheek against the bright white.

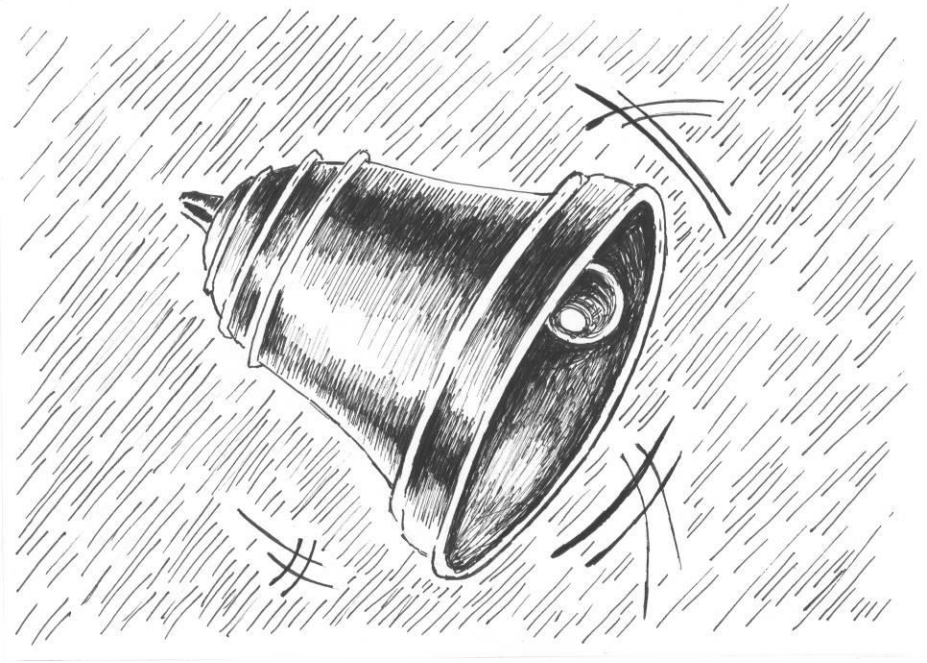
Now Muko is in the kindergarten. He is sitting on a little red chair by the window. He looks round the classroom and there are lots of groups of children playing together. A large figure, much taller than the children, reaches past him to take

something from a shelf by the window. He scans the room again, paying careful attention to exactly what he can see. Everything seems ok except … no, something is wrong. On the shelves and in the children's hands there are lots of spaces, where something is more blurred than anywhere else in the room.



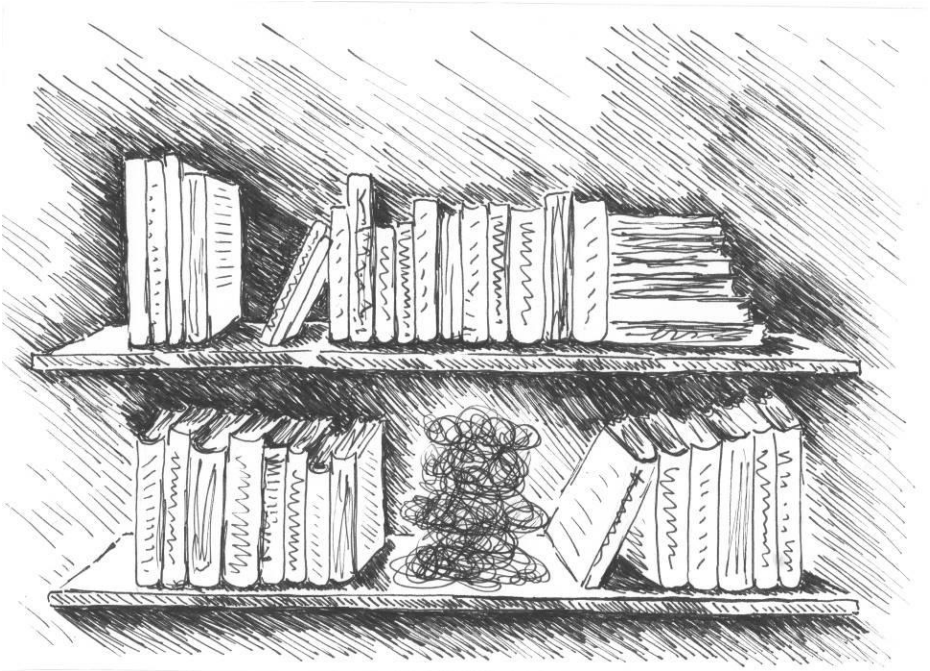
The door to the classroom opens. There is a gust of air. He hears a familiar voice and he gets up from his chair, excited because someone has come to take him home. He looks at the figure and it's so familiar – the skirt with white spots on, and the cardigan with big black buttons – but where the face should be, there is just haze; he can't make anything out at all.

The figure that was reaching past him to the shelf now has a bell in her hand and is standing facing the children. She holds the bell up as high as her shoulders and shakes it back and forth. It makes a tinkling noise. It is not very loud but the children are waiting for it and as soon as they hear it they all stop playing. The bell is telling them that they must tidy up the classroom. The bell is tinkling in Muko's head. He can hear it clearly. As he listens, the world around him becomes more and more blurred. The brightness of the classroom fades away, its colours turning to grey. Darkness fills the scene. The feelings of safety and happiness have become apprehension and gloom ...



As the dreams melted away, Muko woke up to find himself in an altogether different place and a far worse one.

A bell was ringing; not the gentle tinkle of the bell in his kindergarten teacher's hand but an insistent, ugly sound that had broken into his sleep and stripped him of his memories brutally, without any warning. He opened his eyes and propped himself on his elbows. He looked around. He didn't know this place. He wanted to burrow back into his dream and hide from the harshness of the new environment.



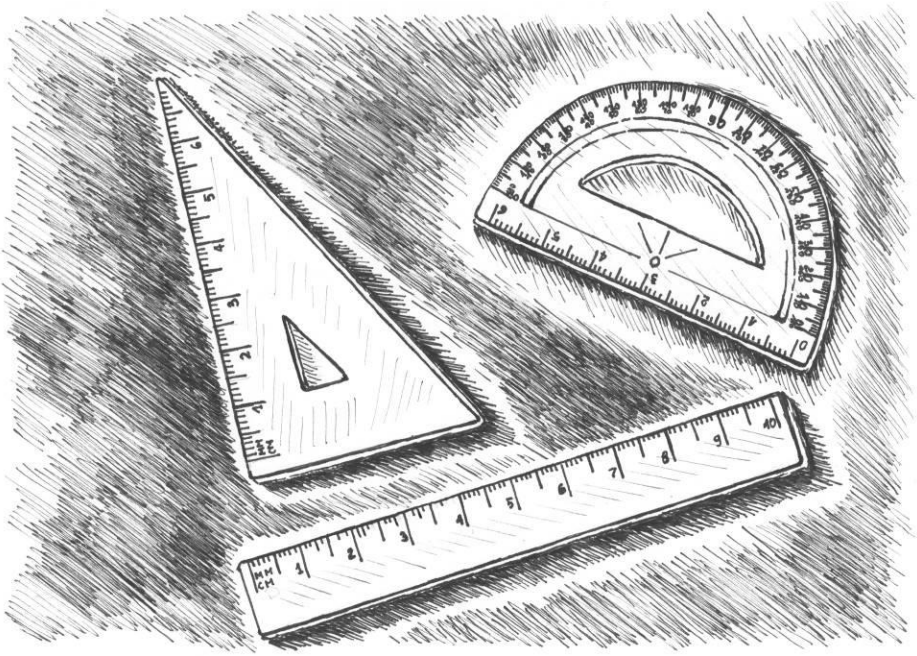
But reality hit him. He was eight years old and much too old for kindergarten. All around him in austere rows were the beds of other children and they had woken up too at the sound of the bell. The room was large; there had to be twenty or thirty beds.

The atmosphere was neither pleasant nor welcoming. The walls and floor were bare stone and scrupulously clean - they looked as if they had been scrubbed. There were windows but they were high up and barred as if to prevent escape, except that no-one would have been able to reach them even if they had climbed on one of the beds. There were no colourful objects like there had been in the kindergarten, and no cheerful, homely touches like curtains or cushions.

The beds had iron frames and each one had white pillows and sheets and a grey blanket. The children were in white pyjamas – all the same. The looks on their faces were the same too because they all felt lost and had no idea how or why they had come to this place. Muko tried to remember. He cudgelled his brains but it was no good; he had no memory of where he was before or of anything that had happened to bring him here.

There were sounds of sobbing from different parts of the

room. Some of the children had woken up crying. Others looked worried, as if they thought something really terrible was about to happen to them, and still others were sweating from fear of the unknown.



One boy stood out as different from all the others. He was the only one dressed in black and it was he who had been ringing the bell. Muko felt he was very different but he was not quite sure in what way.

Chapter 2

Muko struggled to contain and control his bewilderment. Everything around him was so strange, so precise and so cold. He wanted to run for his life but there was nowhere to go. He just didn't want to be there a moment longer. It felt like he was in some great body of water which was trying to sweep him along while he had his feet on the bottom, resisting the current. He was only a little pebble after all – or maybe more like a fragment in a vast jigsaw puzzle with no picture anywhere to be seen.

Someone must know what's going on, he thought. Someone must be in charge. But looking around he just saw frightened and lost faces like his own.

The boy in black, however, was quite different. He seemed to be endowed with some sort of authority. He tucked his fingers around the clapper of the bell so that it wouldn't sound, then in a quiet but penetrating voice commanded:

"Get up off the bed and stand by its foot, facing the head." He paused to allow the children to obey his instruction before continuing: "The cabinet that belongs to the bed is the one on the right. In the bottom compartment you will find a pair of shorts and a shirt. You will remove your pyjamas and put these

clothes on."

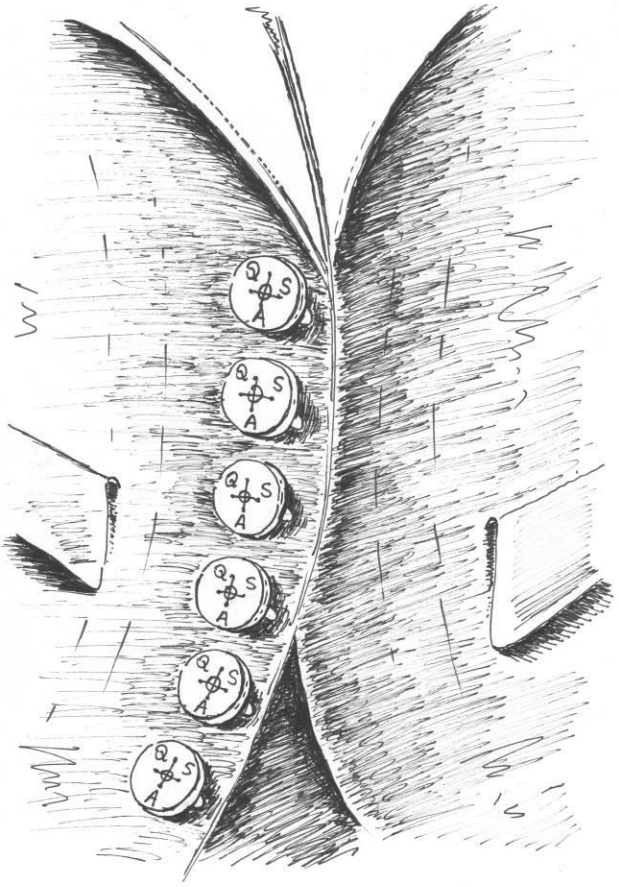
He waited patiently while the children stripped off their pyjamas and in unison, without being told, folded them neatly and put them in the cabinet in the place of their daytime clothes. Muko found that doing something, anything, was better than doing nothing, and from what he could see of the other children, they felt the same. They obeyed with a smooth alacrity that novice monks would have been proud of.

"Now follow me through this door," ordered the boy in black, before opening a rough, scrubbed wooden door set in the wall.

The children followed calmly, without either pushing or shoving, although it was evident from the set of their shoulders that they were anxious and wary. Some of them even stepped carefully, almost on tiptoes, as if there might be a trapdoor in the floor. None of them, apart from their self-styled leader, had any idea what was in store for them. Nonetheless there were soft whispers of comfort from bolder children who had wrapped an arm round a weaker child.

"It's all right. Everything's going to be ok. You'll see," they murmured - as if they could know, which of course they

couldn't. But the soothing words and touches evidently worked because none of the children were actually crying any more, although some of them were sniffing loudly.



It was at this point that Muko registered they were all dressed exactly alike. They all wore the same green shorts and the same green shirts with brass buttons engraved with a cross

superimposed on a circle and the letters QSA. Muko looked down at himself and registered that even the turn-ups on the hems of his shorts were identical to everyone else's.

The front-runners in the crowd were through the doorway and could see what was beyond. Muko watched them from behind in trepidation but was relieved to see that their shoulders relaxed, which suggested at least that nothing terrible awaited them.

The room beyond was a bathroom. It had multiple wash basins, each with a little container holding a toothbrush and a tube of toothpaste, alongside a separate tooth mug. It was exactly what Muko would have anticipated if he'd trusted this new experience instead of envisaging wordless horrors.

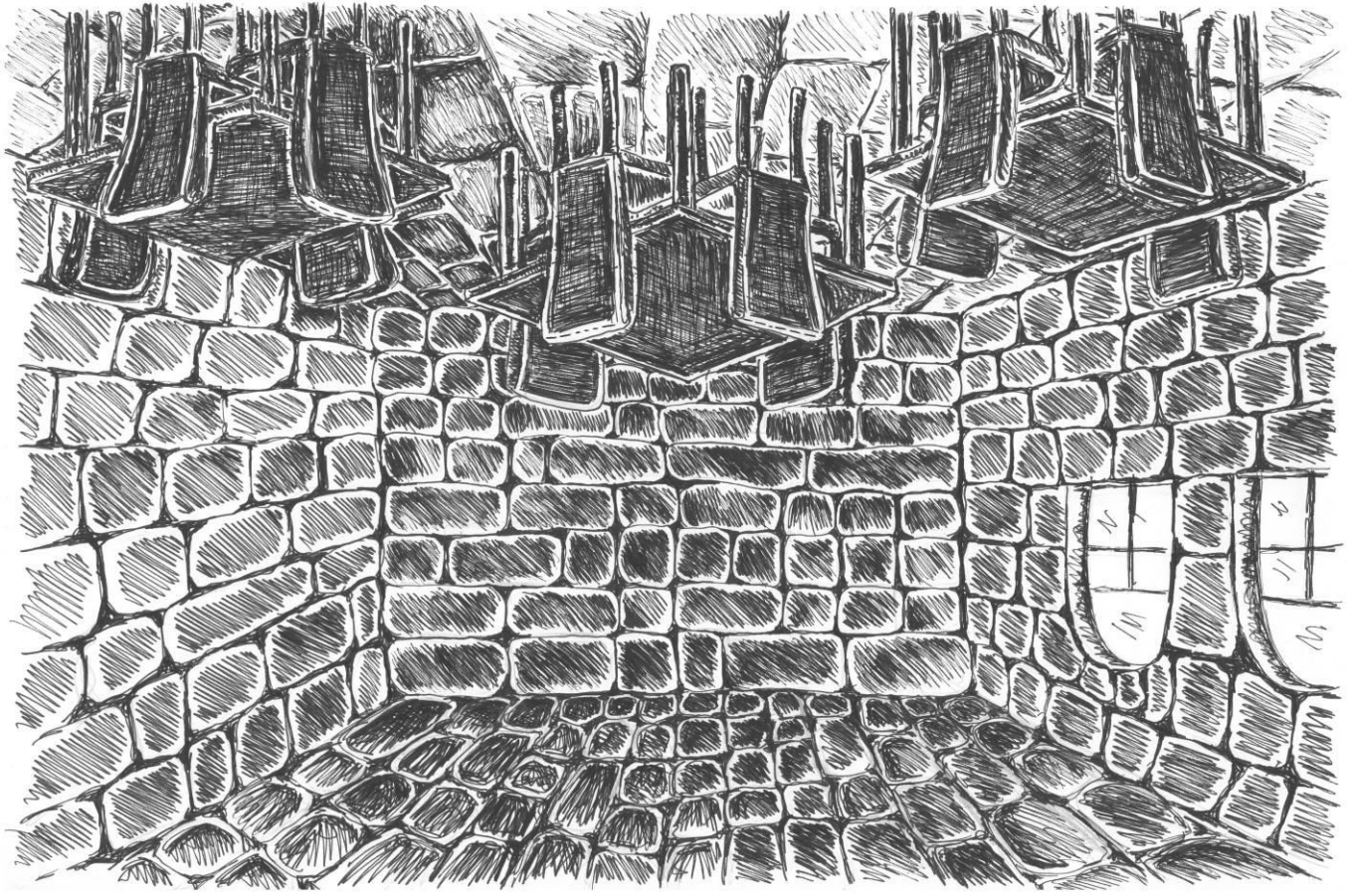
Each of the children claimed a basin. There were exactly the right number: none too many and none too few. They splashed water on their faces and necks, then dried themselves with the towel which they found on a little rail underneath the basin. Raising their heads they looked around, wondering if the other children felt as lost as they did. They concluded that most of them did.

Once all the children were inside the bathroom and were

distracted with their ablutions, the door back to the dormitory closed, starting with a grinding noise and ending with a thunderous bang. All the heads that were bowed over their individual wash basins jerked up, the children wondering why they'd been so suddenly cut off. They were aware of mysterious noises behind the door, and a sound as if of machinery moving objects around. They ducked their heads back down and concentrated on sluicing their faces, feeling as if the only correct thing was to be conscientious and not to be caught being curious.

Muko noticed one thing in particular, however: the boy with the bell was no longer there. He guessed he must have slid past the door while none of them were looking.

At length the strange noises in the next room ceased, and the door began to swing open again, creaking on its hinges in a way that suggested they'd never been oiled in a million years. As if drawn by a magnet, the children headed back through the door into the space where their beds had been. But there were no beds! They had all vanished! In their place were tables spread out across the room, each with four chairs grouped around them. On the tables were the necessaries for a meal: plates, cutlery and mugs, all for four, and food. It was a welcome sight to Muko, who was feeling hungry, but his anticipation couldn't quell his



feeling of uneasiness. Where had the beds gone? Would they be allowed to sleep in beds tonight? What other bizarre things were going to happen in this strangest of places?

As Muko drew closer to one of the tables – which he could see might equally well have been desks – he noticed that on each of the plates there was a card bearing a symbol. His eye flicked from one card to another and it soon became apparent to him that every symbol was different. He hesitated – what place should he choose? Some of the children glanced at the symbols as if seeking a particular one and then, having apparently found what they sought, sat down confidently. Muko, however, had no idea what he was looking for. He didn't even recognise many of the symbols.

Anxiously scanning the room, Muko noticed that one girl seemed to know exactly where to go. Calmly and collectedly, without looking at anyone else, she slid into her place.

'My, but she's got it together.' Muko couldn't help but admire her while at the same time recognising that she didn't exude any warmth. 'She's as cool as a cucumber,' he thought to himself.

The girl picked up the card on the table in front of her

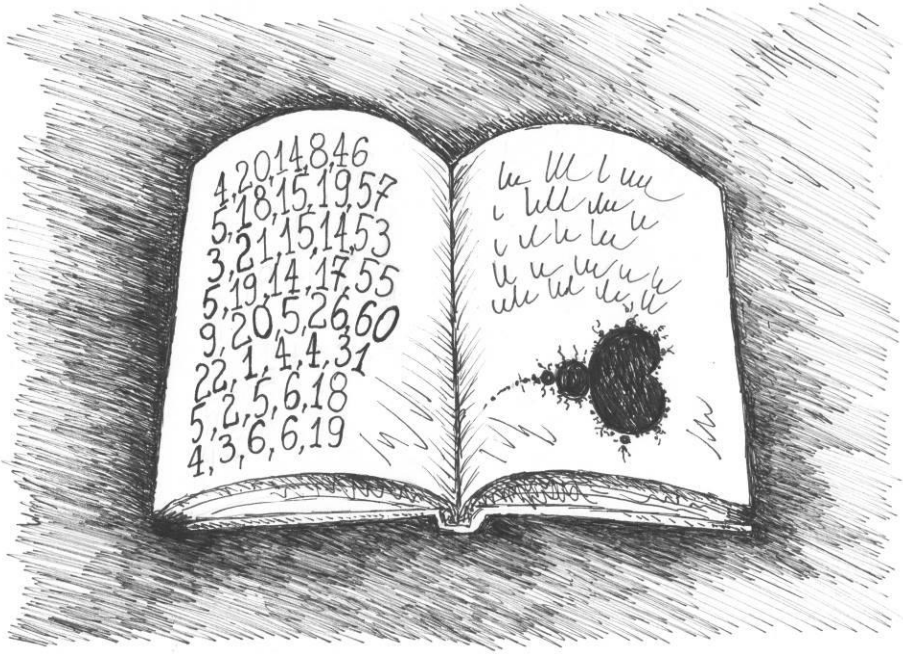
and Muko saw it had what looked like a zero, but with something inside the circle. He didn't know what it was called. He was able to name some of the simpler symbols he could see from where he stood, though. There was the 'plus' sign - a cross; a little number 2 displaced from the centre of the card which he guessed denoted the 'squared' symbol; and a jagged capital letter 'E' which he knew denoted 'summation'. But there were lots of symbols he'd never come across before: there was what looked like a doorway – two sides and a top; there was a square divided into 3 both ways; and there was something that looked like a figure of 8 except that the way the card was placed, it was lying on its side.

One particular symbol caught his eye, maybe because it didn't have the stark simplicity of some of the others but a more 'organic' look. From a distance it looked like two connected black-filled circles, one larger than the other. It intrigued Muko because it was somehow familiar. Where had he encountered it before? He pushed his way to the table where the card was lying and took a closer look. What had appeared from a distance to be similar to a large circle was in fact more like a heart, and both shapes had jagged edges.

A memory rose to the surface of Muko's consciousness.

He is sitting on someone's knees looking at the mathematical book they are holding open for him. He can't see the person's face because he has his back to them, but he can see their hands as they point to images in the book. He can feel their breath on the nape of his neck as they utter soft words of appreciation:

"Beautiful," the deep voice is saying. "A perfect mathematical structure. Fractals are pure art and pure science at the same time. This is the most famous one." And then he hears the mysterious name: 'Mandelbrot set'.



The name sparks another memory. This time Muko is

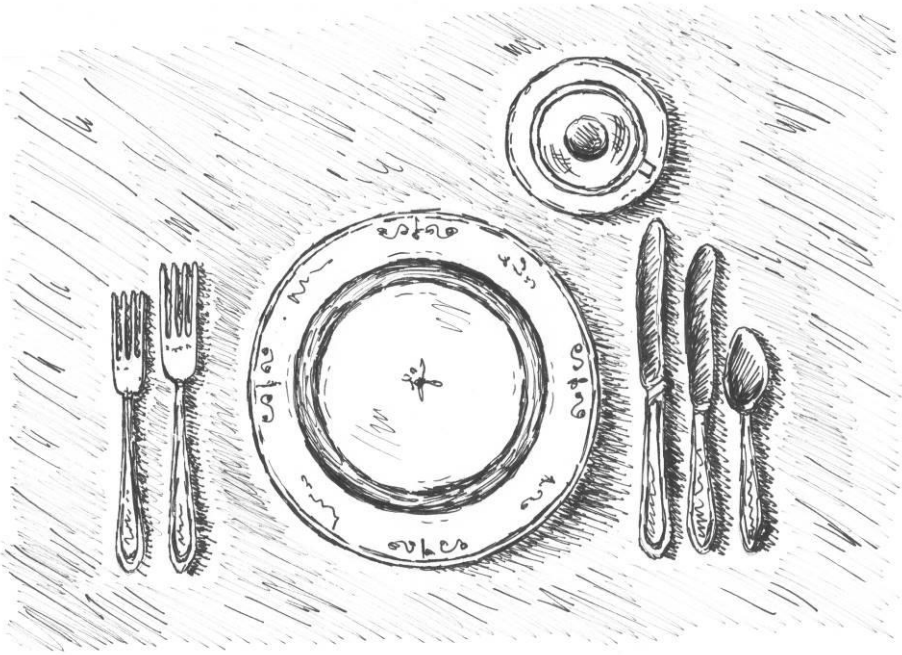
underneath the covers of his bed, shining a torch onto the pages of the same book he was shown when he was smaller. On its front cover there is the dark heart shape connected to the smaller dark circle, which he now knows is called the Mandelbrot set.

He's a curious little boy so he's holding a magnifying glass over the border of the object. To his amazement and wonder, it grows before his eyes, revealing more and more intricate details. Small Mandelbrot sets appear on the borders of the large one, and on their borders appear further ones, on and on, smaller and smaller, till his magnifying glass and the light of his torch can show him no more. He's mesmerized. He feels like he's being sucked into a world he had no idea existed. It's so beautiful that it makes him gasp and he wonders if he'll ever get to sleep.

Muko was jerked back to reality by his surroundings: he sensed it was imperative to take his place without delay. He knew, without being told, that the Mandelbrot set was his symbol and that therefore he should sit where the card was.

His place was at the table where the girl with the circle-with-something-in-it was sitting. He picked his own card up and sat down quietly. Neither he nor the girl spoke. The girl turned

her card face down before Muko could look at it in any more detail, and he was left not knowing exactly what it was like since he'd only had a glimpse of it. The two of them sat without a word, not even glancing at each other, allowing an awkward silence to develop between them. No-one else sat down at Muko's table so the other two seats were still free.



The seats remained unoccupied for a while, during which time Muko and the girl maintained their silence, but at length two more children came and sat at the table – a plump girl with long red hair and glasses, and a boy with very short red hair

and glasses also, although in his case they had no lenses since he wore them simply for the learned air they gave him and for the barrier they put between him and the world. It looked as though silence would continue to reign, the boy being quiet as well, but the girl endeavoured to strike up a conversation.

"Hi, I'm Paidia," she introduced herself.

The boy who'd arrived with her responded: "Hi, I'm Gelio."

The girl who'd originally been at the table muttered that her name was Amartia, and Muko stayed silent.

Then Paidia asked the question which must have been foremost in everyone's mind: "Do you know where we are?"

The others kept their eyes down and didn't respond except for Amartia who shrugged her shoulders slightly.

So Paidia answered her own question. "I think … maybe … we're in some kind of castle, or ... school?"

Again there was no response from the others. Paidia found herself talking because she was afraid of her new environment and couldn't bear the silence, but she was only

voicing the thoughts of everyone else. None of them knew why they were there and what it was all about.

Suddenly a bell sounded. Everyone stopped talking and looked in the direction of the sound. It was the mysterious boy, holding his hand bell. He seemed to have come from nowhere. He announced loudly:

“Now that you've all found your places, you may eat your breakfast.”

The children obeyed, tucking into the toast and scrambled egg which was on their plates.

Paidia was still trying to make conversation. “What do you all think of the breakfast? It ought to be hot, but ...” Her attempt at communication trailed away.

A bit later she tried again. “Why have the four of us sat down at this table? Why …?”

This time Gelio responded. “It's 'cos we found our symbols. Somebody meant it to be like this. It was pre- pre- pre-sorted,” he finished lamely.

“Pre-ordained,” Amartia corrected automatically, then

shut her mouth like a clam because she hadn't meant to get involved. She was piling her scrambled egg into a little heap on her plate, then spreading it out again. She hardly put any of it in her mouth. Muko could see her out of the corner of his eye. He, on the other hand, was eating everything on his plate. 'We don't know how long we'll have to wait for the next meal,' he thought to himself, 'in this weird place. Why am I here anyway?'

Paidia and Gelio seemed to be on the same wavelength. They'd started chatting and laughing, mostly about the cold scrambled egg and cold toast. But they were also poking fun at Amartia and Muko's silence.

“I wonder if they've taken a vow of silence,” Paidia quipped, cocking her head at her table companions.

“Well in that case she just broke it,” said Gelio through a mouthful of egg, “when she said 'pre-ordained'!”

“I hadn't thought of that.” Paidia winked. “Say something else wrong so that she has to correct you.”

“Like what?”

“Oh I don't know. Something like 'procrastinate'.”

“Procras- what?”

“Exactly.”

But this time Amartia didn't intervene. It was Muko who swallowed his irritation and defined the word: “Procrastinate means to put off till later what you could do straight away.”

Then he turned to Paidia and asked earnestly: “What makes you think this might be a school?”

“Well,” responded Paidia. “There's all the strange mathematical symbols. Then we look like children in a school class. We're all about the same age.”

Suddenly they were all talking, sharing their ideas about the place and trying to work out what was going on.

“Maybe it's all a dream,” suggested Gelio. “We'll wake up and it'll have disappeared. Poof. Just like that.”

Paidia had a more bizarre idea. “I've heard about people being abducted by aliens from space. Perhaps that's what's happened to us.”

They all laughed.

“Might we be in some kind of a prison?” said Muko.

Paidia responded: “To be in prison we should have done something wrong. I know I did something wrong once but I can't remember what it was.”

“I can remember one bad thing I did,” Muko told them. “There was this big clock and I tried to wind it but I ended up breaking it. I can't remember much else though, except that I was in big trouble.”

“I know,” blurted Paidia. “Perhaps this is what heaven or hell are like?”

“Well then it's got to be hell,” joked Gelio, “because you definitely don't look like an angel, Paidia.”

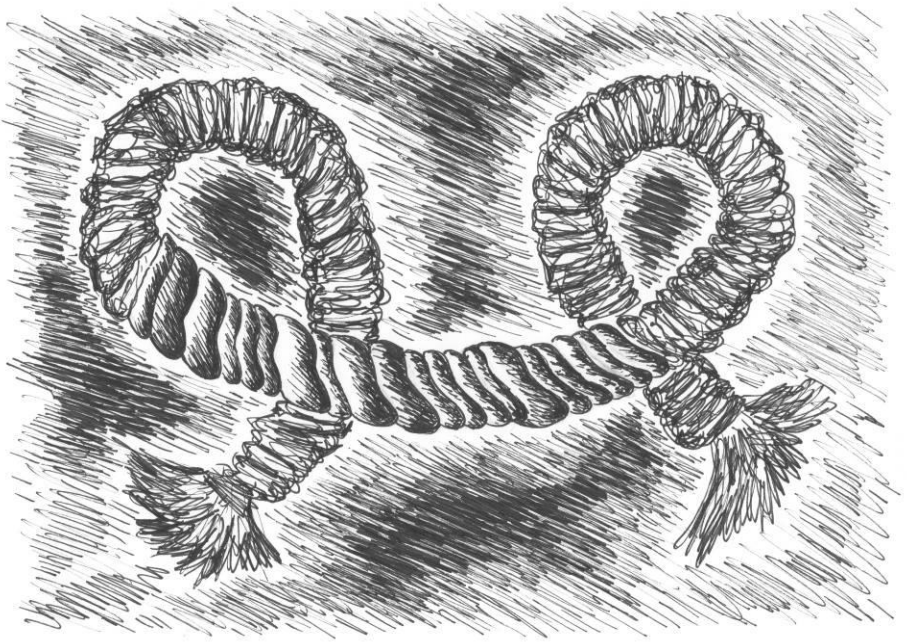
Paidia pouted good-humouredly, but looking past her, Gelio realised that Amartia was sitting in silence.

“What's your name?” he asked, hoping to open her up a little.

“It's Amartia, and I don't remember hardly anything before this morning either.”

Muko pondered the strange fact that all four of them seemed to have amnesia for practically everything up to the current day.

Just as they finished eating, the door at one end of the room burst open and in shuffled a very old man. He had a long grey beard and thinning grey hair, and wore old robes tied round the waist by what looked like string. Toe-less sandals and a walking stick completed the ensemble.



"I am Pythagoras," he announced in a rapid voice with a slight quaver. "You are in the School of Mathematics, also known

as the Queen of Science Academy. I will be your main teacher this year."

Somewhere in the room one of the children tittered and called out: "What a ragamuffin!"

Pythagoras banged his stick onto the stone floor so hard that the sound reverberated round the room. "Silence!" he bellowed. There was no quaver in his voice now.

The children instantly became as quiet as mice. You could have heard a pin drop. There wasn't even a movement in the whole classroom. No-one would be making fun of Pythagoras again.

Muko was trying to remember where he'd heard the name Pythagoras before, but he couldn't place it.

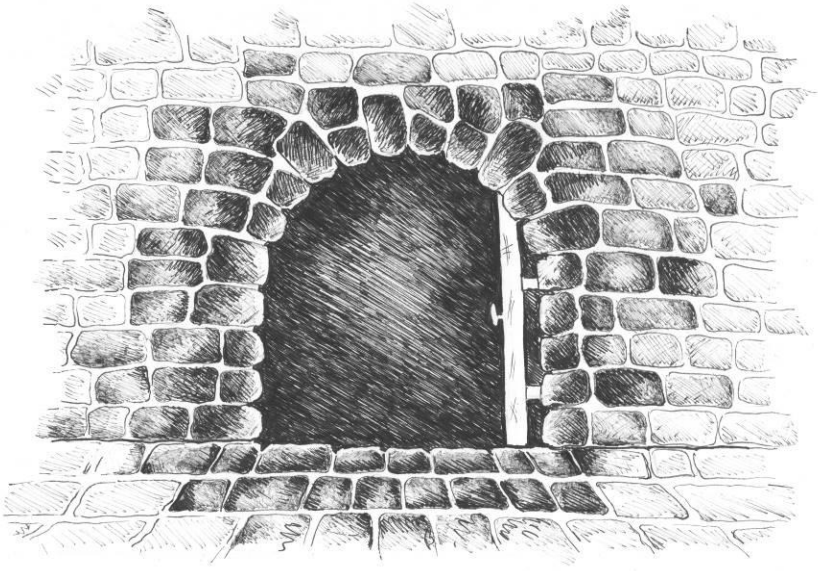
Now that he had the full attention of the class, Pythagoras continued to deliver his information.

"You are in a school and there are certain rules in this school. The first and foremost rule is that you all of you, without exception, must study diligently. You are in the class known as 'Naturals'. There are older classes, the oldest one being 'Reals'."

Just before he uttered the last word he cleared his throat as if the word 'Real' stuck in his throat and he disliked or even despised it.

Pythagoras rearranged his tatty robes a little. His audience's attention was guaranteed because since his earlier outburst the children were hanging on his every word.

“The programme of your day is as follows: Breakfast, Lessons, Dinner, Lessons, another meal, Homework, Supper, Sleep. There will be some short breaks during your day, but you should spend these studying. Anyone who does not study diligently will be severely punished.

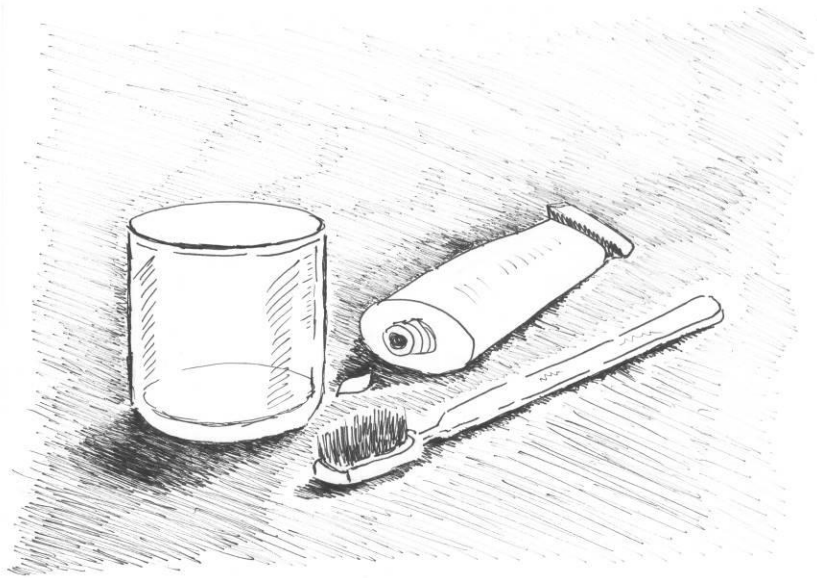


“Now finish up your meal if you have not already done so, brush your teeth, and go to Classroom 10. I must go to my new laboratory and I must sacrifice myself to ...”

No-one heard the end of the sentence because Pythagoras turned and exited the room.

Chapter 3

The children did as they were told and went to brush their teeth in the bathroom. The edge had been taken off their fear making them visibly more relaxed. So much so, in fact, that some of them mimicked Pythagoras' way of speaking. They cited 'Breakfast, Lessons, Dinner, Lessons …', giggling to accompany their comical exaggerations of the rapid voice and the quaver – although they did it quietly in case they were overheard. Muko wasn't involved because he was still racking his brains as to where he'd heard the name Pythagoras before. In any case all the laughter died suddenly when once again noises became audible behind the door to the classroom.

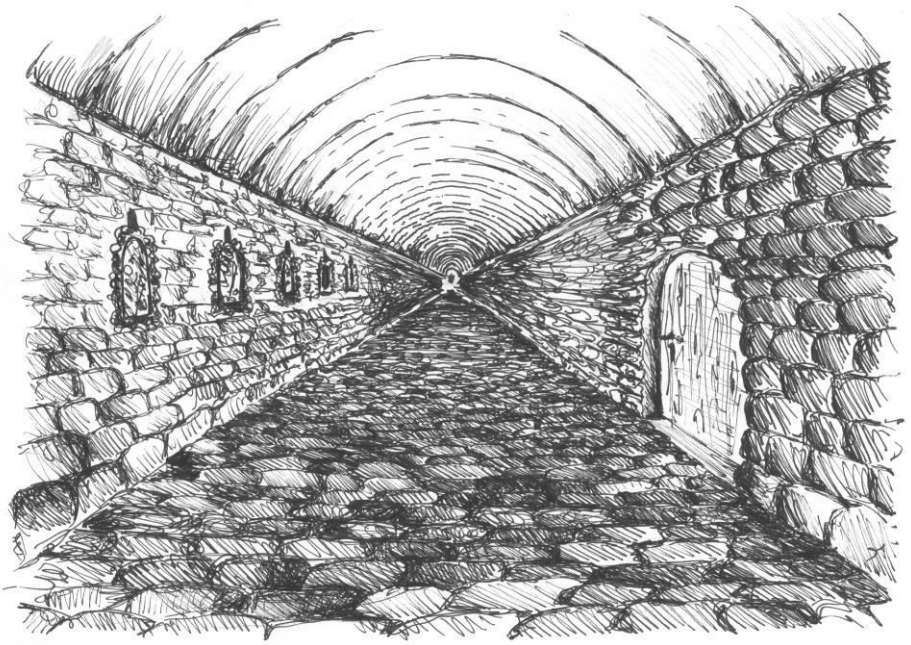


Just as they all finished at their respective basins, the door creaked open to reveal chairs and empty tables which were now evidently desks. The pupil in black had reappeared. He informed them that this classroom was where they must come to do their homework and spend their free time in private study, but for now they must go where Pythagoras had indicated.

The hallway which the children now entered made a deep impression on them. Its walls, which rose to a great height, were made of stone like those of a castle. Set in the grim stone surfaces were barred windows, and in between the windows and on every available stretch of wall were portraits of serious-looking men from different ages, each with a nameplate beneath bearing their name (Isaac Newton, Thales of Miletus, René Descartes, he read among others) and their dates. On ledges and suspended from hooks on the walls were numerous mathematical instruments. There were simple ones like protractors, set squares and compasses, and more complex ones like abacuses and sextants. Although the hallway was severe in the extreme, it was also scrupulously clean and well maintained.

The boy dressed in black moved to the head of the crowd and pointed to the room where Pythagoras could be found. The children looked to where he was pointing but by the time they

turned their heads back to look at him, he had vanished.



As they walked across the stone floors, their footsteps sounding loud and somehow eery, Paidia was talking as usual.

“Hey! Where do you think we're going? I remember there was a Mr Pythagoras who was a Greek mathematician, but I don't really remember anything else about him.”

Suddenly it came back to Muko. Of course! He'd seen a picture of Pythagoras once, most likely in a book. He was old in the picture, like he was now, but the striking thing about him

was that he was holding another man and pushing his head under the water, drowning him. Muko remembered someone saying by way of an explanation: 'Maths is the Queen of Sciences but can lead to madness'.

Muko's interest was piqued, not only by the teacher but also by the school. However meantime they all had to go to class number 10. As they proceeded along the corridor, they crossed paths with some other pupils, likewise on their way to lessons. This other class, which was slightly older, stopped to look at Muko's class. Some of them pointed and said:

“That's the new class of Naturals.”

So that's what we are, thought Muko.

“We're Integers,” explained one girl in the other class.

It immediately struck Muko that just like he and his fellow classmates were wearing green shirts and shorts, the other class wore the same garb but in blue. The Integers seemed a friendly lot, smiling and waving their hands, but the two classes soon passed each other without any further interaction, each heading to their respective destination.

Paidia and Gelio had got their heads together again, nattering and comparing notes.

Gelio craned his neck to look all around him and then commented: “This building could be hundreds of years old. Some of the stones are enormous. I wonder how they lifted them into place?”

“It's so clean,” added Paidia. “How would you get the cobwebs out of the corners right up there?” she giggled.

“They must have a feather duster on a very long pole,” suggested Gelio.

“I was thinking how gloomy a place it is, but those Integers seemed really happy. Perhaps I was wrong to be so worried.” Paidia shook her head as if she couldn't reconcile the different impressions.

Muko was walking along beside them, lost in his own thoughts. 'What sort of a place is this and why am I here?' he wondered. He didn't notice that Amartia was right alongside him because her silence was in stark contrast to the behaviour of some of the other pupils in the class, who were making a rare old racket with their crying and wailing. Muko found it irritating

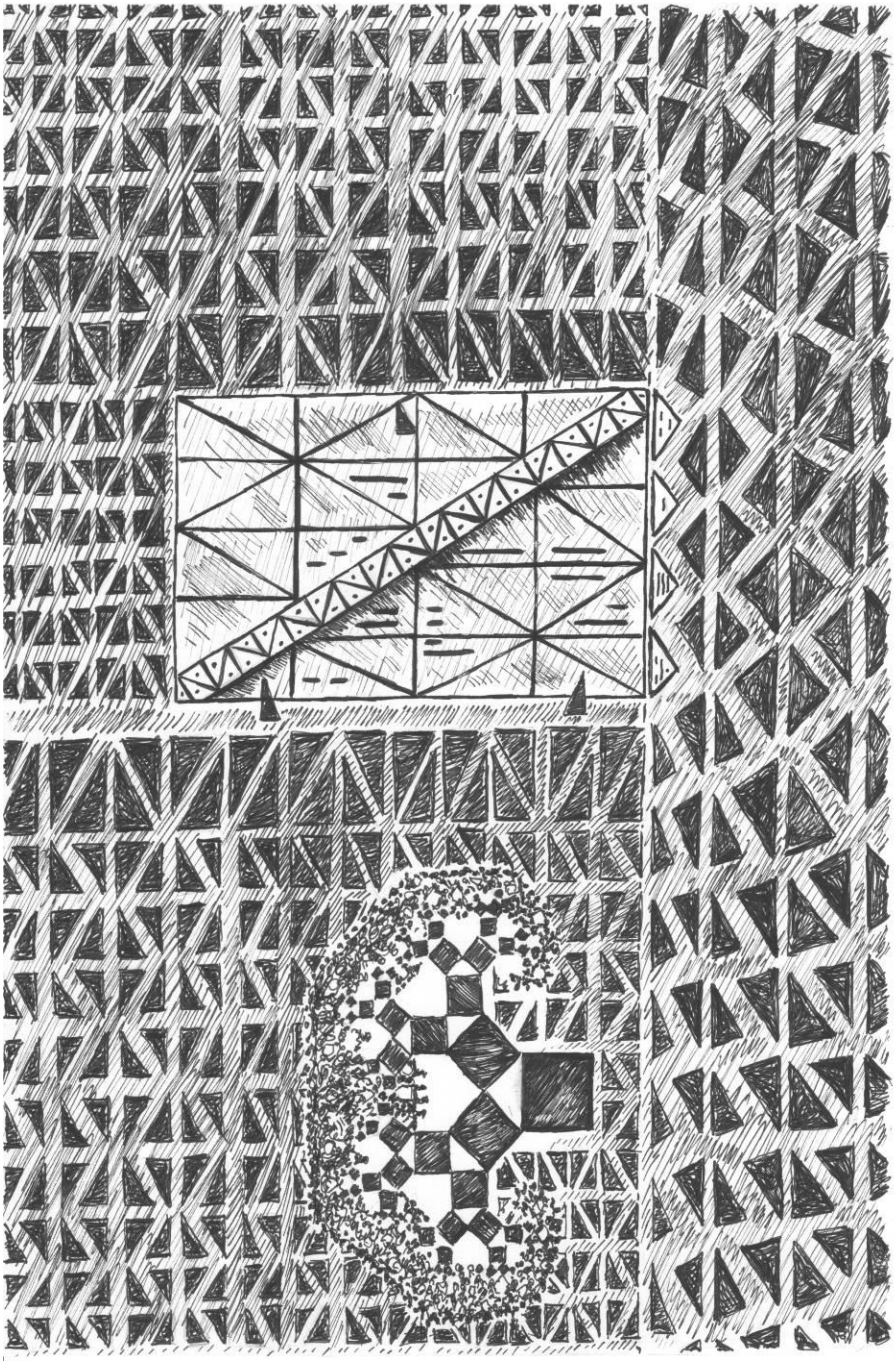
because he felt they ought to be tougher and have bucked up a bit by now.

'I can't think with all this noise going on,' he muttered to himself.

He tried to block out the words of comfort being uttered by Paidia and Gelio as well. “Sssh, sssh,” they were saying with their arms around the sobbing shoulders of the weaker ones. “Don't cry. You're quite safe. We're all here together and everything's going to turn out fine.”

The pupils reached a door which they immediately guessed must be to Room number 10. It was covered in a pattern of angular shapes. Despite the whole building being made of stone, the wall either side of the door was built out of bricks in the shape of right-angle triangles. To the left was a diagram of a tree, made up of squares, although when Muko looked at it closely he could see that in the centre of each group of squares there was a right-angle triangle.

Something stirred in Muko's memory: the image of a triangle surrounded by square flaps rang a bell with him. The effect was instantaneous. Suddenly he was transported into a quite different life in a series of vivid flashbacks.



He is once more sitting on a grown-up's knee looking at the pages of a book. A voice in his ear, the deep voice of last time, is telling him about what they see in the book. Except that what the voice is talking about now isn't in the picture; Muko is being told the story of what's behind the picture. He can remember odd phrases, and bits of sentences.

“He was treated like a god in his time, you know, but he was actually a bad person … He started up something called a cult.”

“What's a cult?” Muko heard his own high little boy's voice asking.

“You'll understand when you're older, but for now all you need to know is that cults can be dangerous. He was a dangerous person. He once killed a pupil just for showing him he was wrong.”

Muko's recollections were interrupted by a creak of hinges as the door opened. The whole class froze exactly as they were. Muko likewise was motionless, his mouth dry with terror.

'He kills pupils. I hope he will not kill us,' was the thought going round in his head.

Pythagoras appeared in the doorway. “Come, children. Come in and let's have our first lesson together,” he said in a friendly voice, opening the door wide and looking for all the world like a benevolent grandfather. He turned on his heel and preceded them into the classroom.

Muko put out a hand and grabbed hold of his three friends.

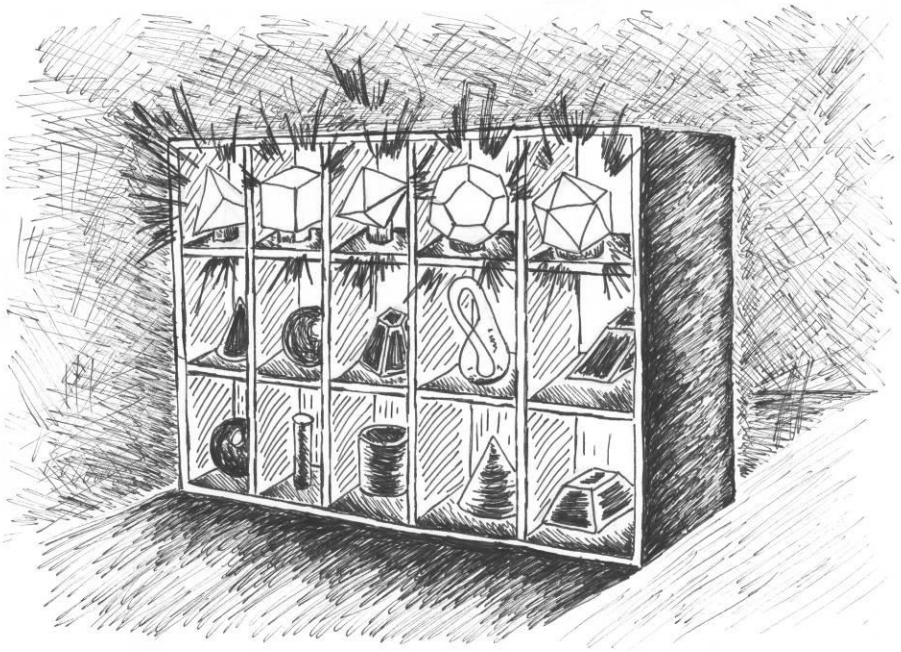
“Hey,” he whispered as they turned to look at him in surprise. “I know who this guy is. He's mad, and a murderer. I remember all about him! We might be in real danger.”

“So what do we do?” hissed Gelio.

“We keep our wits about us,” Muko hissed back. “He mustn't know that we know.”

The door through which they had entered was at the back of the classroom. Pythagoras had walked to the front and was now standing watching them as they filed in, waiting for the last one to be settled. Behind him, next to the blackboard, a curtain partially concealed the dark entrance to a passageway. The room was lined with multiple cabinets on whose shelves were ranged mathematical instruments of every sort: solids,

shapes, rulers, set squares, even musical instruments.



"Go to your places, children," Pythagoras instructed them in a calm and amicable voice.

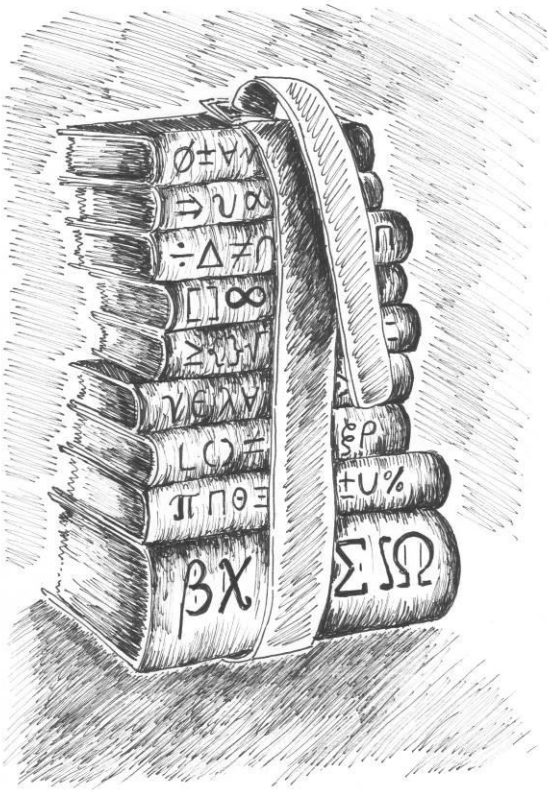
But then he suddenly appeared to realise something. His face sobered, and he pushed aside the curtain and went through the passage to his office. Muko peered after him and witnessed him take a large blanket and quickly threw it over something on the floor.

"Maybe he's just covered up the body of another

murdered pupil," he whispered in Amartia's ear.

Just at that moment the door banged closed behind the pupils. Amartia didn't bat an eyelid but Muko screamed out loud, attracting the curious attention of Paidia and Gelio.

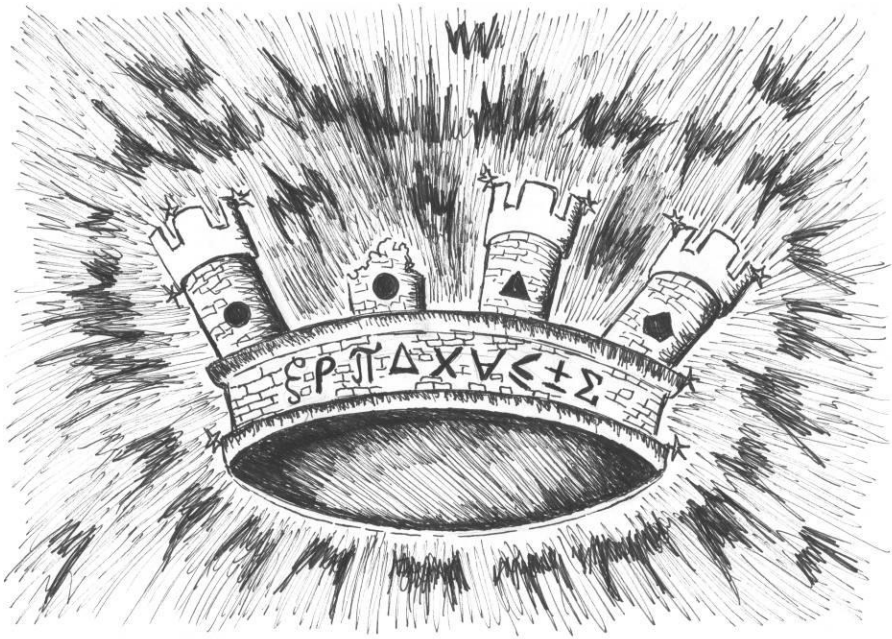
Realising he must have made a bit of a fool of himself, Muko covered up by saying angrily: "Well? You heard the man. We'd better take our places."



They approached the desks, eager to find out if their own individual seats would be designated, and saw that each desk was intended to accommodate two pupils, there being two chairs and two cards. The cards were exactly the same as the ones that had indicated their places for breakfast. Muko found that he would be sitting next to Amartia and behind Paidia and Gelio. They all sat down at their desks and looked around them. Each desk had a tall stack of books on it, tied with a belt. It seemed that each stack contained the same set of books - thick, dusty-looking tomes with leather covers which Muko reckoned would make for a very heavy bundle.

The curtain across the mouth of the passage was thrust to one side and Pythagoras reappeared.

“Right,” he said in his rapid old man's voice. “We can now start the class proper. But first,” he held up a finger to emphasise his point, “I have some important information to impart to you. You may or may not be aware, but you are in the Queen of Science Academy. What do you have in common? Well, you all have extraordinary mathematical minds. You will never be set easy tasks for homework. You are here for a reason. You will find out why when the time is right.”



Muko sat there mulling it all over. 'So that's why there's so much maths in my memories! But why am I here?' He was no longer listening to Pythagoras. 'Every one of us has an extraordinary mathematical mind? How can they possibly know if it isn't self-evident enough for me to know?' He surfaced from his reverie when he heard the teacher posing a riddle.

“Now. Let me give you one simple task to start the ball rolling. What is 230 minus 220 multiplied by a half?”

“It's 5!” shrieked one excited pupil, putting extra stress on the '5' so as to show how confident he was of his answer. He

had large glasses and looked very know-it-all.

Muko opened his mouth to contradict. “It's ...” he began but he was interrupted by Pythagoras who was addressing the pupil who had answered first.

“You're right. Extraordinary answer,” the teacher was saying.

Muko's feathers were ruffled. '5?' he thought to himself irritably. 'What's going on here? It's most definitely the wrong answer and yet the teacher's saying it's right.'

Paidia and Gelio were both laughing up their sleeves about the wrong answer being accepted. Muko opened his mouth again to object, and to query why the teacher should say 5 was correct, but then he bit his tongue.

'Oh I see,' he said to himself. 'Now I understand what's going on. Yep, I accept the challenge.' And then the thought came to him: 'I think I'm going to like being here.'

Chapter 4

Muko was right; he did like being there. In common with most of the children in the class of Naturals, he adjusted quickly. Everything was new and different from whatever had gone before, although of course he had no recollection of what had gone before other than what turned up in his dreams or broke through in the occasional glimmer of memory.

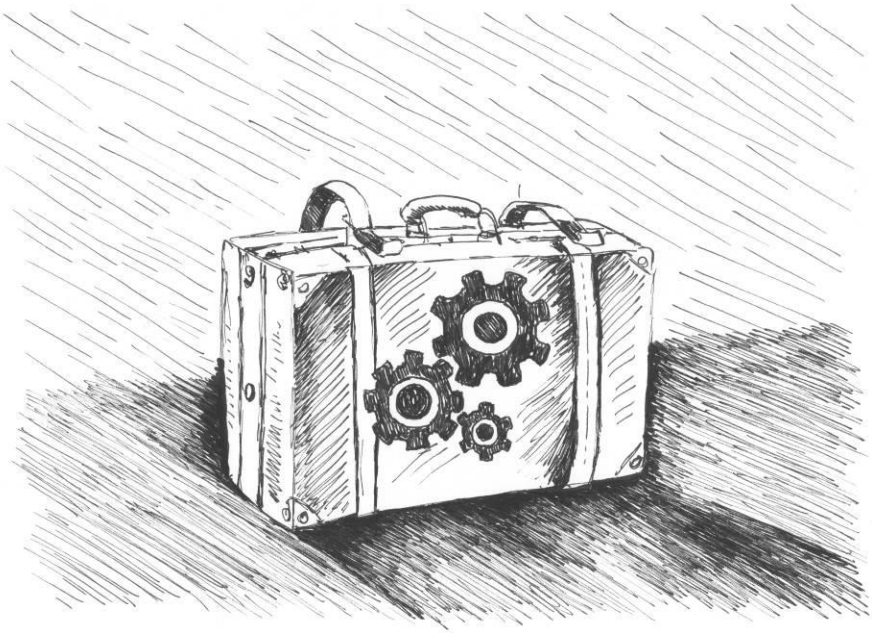
Time flew by for all of them. One day was generally like another, its routine consisting of breakfast, lessons, meals and homework with a few additional activities. The children gradually developed relationships with their friends and their teachers who maybe, in some sense, took over the role of siblings and parents respectively – but such a comparison would never have occurred to them; there was very little parent-like about the teachers in any case. The school wasn't seen as their home, either; words like these had vanished from their minds as completely as they had from their vocabulary.

Muko was in his element. The lessons grabbed his interest and he applied the same diligent attention to all lessons and assignments, even if they were optional. He was always punctual, not only in his attendance at classes, but also in

handing in his homework. He was a model pupil.

One day, when he and his friends were just exiting the classroom where they had had an arithmetic lesson, they ran into an entirely different kind of student. They were struck immediately by the difference in the uniform. The cut and style of the outfits in the Academy were standard, with only the colour differentiating one class from another. Thus Naturals wore green, Integers blue, Rationals green shirt and blue shorts, Irrationals blue shirt and green shorts, Reals red, and Imaginaries (regardless of age) black. The teachers were in clothes appropriate to their era and character – Mr Pythagoras wore shabby old robes and someone like Mr Rejewski was smart in a clean, well-cut suit.

But the uniforms of these students who had appeared in the corridor had a quite different style. They were fastened with zips – unheard of in the standard uniform which relied on buttons - and their shirts had round necks without collars while their trouser legs had no turn-ups but hung casually loose. They weren't carrying books fastened together with a strap, either, but instead had large suitcases with a picture of interlocking cogs on the side. All the suitcases bore the same design.



Pupils in the Academy were discouraged from talking to strangers, but the more senior classes often did it anyway. One of Muko's class had heard an older pupil talking about these strange students and calling them 'Machinists'. The Naturals quickly took this name on board since it tallied with their notion that the suitcases contained tools being used to build machines.

The Machinists were accompanied by a teacher who was unknown to Muko since the class of Naturals never had lessons with him. This piqued Muko's curiosity further, so he asked an older pupil in the Reals class for more information and was told

that they were from a different school - a school called the University of Processing Machinery.

Muko turned these details over in his mind until he could no longer bear to keep them to himself. As soon as he'd shared the information, everyone became interested because up till now they hadn't been aware of the existence of any other schools. They weren't even allowed to leave the grounds surrounding their own place of learning, after all. In fact, the penalty for leaving the permitted area was so terrible that not only had no-one ever incurred it, but it was entirely unknown what the penalty actually was.

Muko took it upon himself to follow the students that so intrigued him, and he saw them enter Pythagoras' classroom. The two teachers, Pythagoras and the one Muko didn't know, stayed outside and immediately began an animated conversation. Muko tried hard to hear what they were saying but only caught snatches of dialogue.

The Machinists' teacher leaned towards Pythagoras and whispered excitedly: “I would say we're close, pretty close.”

Pythagoras thrust his head back in a disbelieving 'get away with you' gesture. “It's not possible. Are you telling me

that you're going to finish the whole riddle?"

"Aah." The Machinists' teacher winked and tapped the side of his nose with his forefinger. "We're on the right track, you know."

"Bah," Pythagoras shrugged his shoulders. "It was designed to be solved only by an open mind" (he put great emphasis on these words) "not by some machine whirring away in a corner applying its limited logic ..."

Muko could see that the teachers were posturing more than really arguing. They probably weren't exactly rivals, but felt the need to make a display of force to each other. It was a conversation, however, that fascinated Muko, and since the two teachers had turned away now, making it impossible for him to hear any more, he abandoned his post and went to find Amartia.

"I've just heard Pythagoras and that other teacher - you know, the Machinists' teacher - saying the weirdest, most mysterious things," he told her.

Surprisingly for someone normally so deadpan, Amartia's eyes lit up. She loved a good mystery, and she was beginning to become attached to Muko as her only friend.

“We have to find out more,”she urged, “but how? Who would know about it?”

Paidia and Gelio recognised that their friends were excited about something and came running up.

“Tell me!” squeaked Paidia. “What are you talking about?”

Gelio nudged her with his elbow. “There you go again,” he remonstrated jokingly. “You just have to poke your nose into everything, don't you?”

“Hey!” Paidia was offended but quickly recovered herself. “I'm just curious, ok? All the best scientific discoveries arise out of curiosity.”

“Are you a cat, though?” Gelio asked with mock seriousness.

Paidia was puzzled. “A cat? Why?”

“Because curiosity killed the cat.”

“And a cat has nine lives!” Paidia stuck her tongue out at Gelio.

While all this joking was going on, Muko and Amartia stood there quietly. They were getting used to their friends' behaviour towards one another and were amused but not drawn to join in.

Suddenly the four friends were almost knocked down by someone bursting through their midst like a tornado. That would have been bad enough, but this apparent nutcase of a pupil was clad only in his underpants! To make matters worse still, he started screaming at the top of his voice:

“Let epsilon be less than zero!”

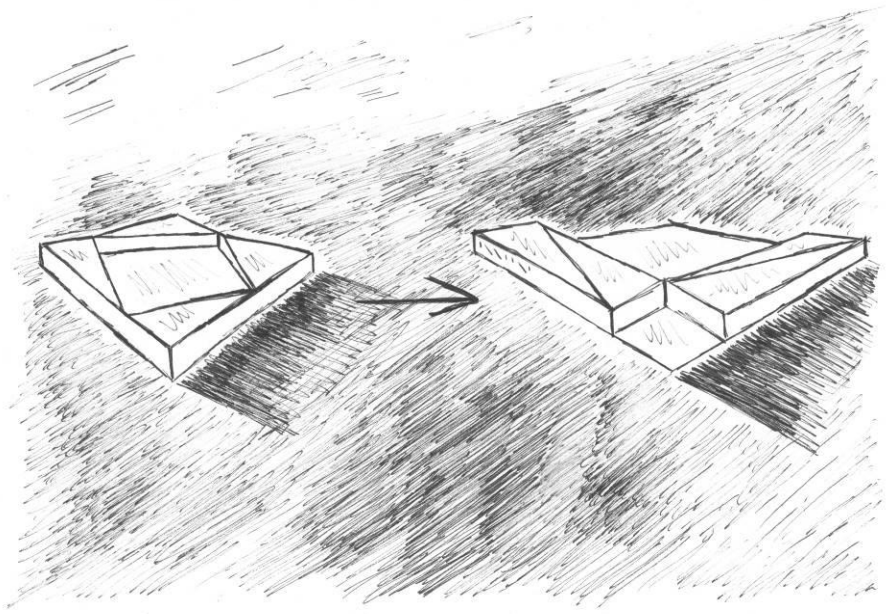
He repeated this strange mantra as he ran through the courtyard, then up onto the wall where he made a complete circuit above the courtyard. Finally he disappeared from view inside the building although his crazy voice could be heard for a few moments afterwards.

Muko and his friends were shocked speechless. They had no idea what was going on.

Gelio of course had to make a joke of it. “If that was an epsi-loincloth, just as well it wasn't less than zero!” They all laughed.

Just then the bell rang, calling them back to classes. The next class was with their own teacher – Mr Pythagoras. They all filed in and took their places.

Pythagoras emerged from behind his curtain and announced: “Today's lesson will be about the most important theorem in maths: the Pythagoras theorem. The Pythagoras theorem!” He raised his hands to the ceiling so that his sleeves fell away from his scrawny arms and at the same time raised his voice to nearly a shout. “I heard the voices of the gods echoing my triumph when I found out the proof of the theorem!”



He turned to the blackboard and pulled on a handle at the bottom. To his pupils' surprise, the black surface shot up smartly to reveal a green, furry surface. Pythagoras placed a right-angled triangle made of thin yellow card on the felt, then three more identical yellow triangles so as to form a large square surrounding another, tilted square. He placed a red square over the blank square in the middle of the triangles. Quickly, while his pupils leaned forward in their chairs to watch, he removed the red square to another part of the felt board and rearranged the four yellow triangles in two blocks in a disjointed 'L' shape. Then he put two new squares, blue and pale green, interlocking with the triangles to form a square. After that he removed the yellow triangles and equated the blue and pale green squares to the removed red square as being two versions of the left-over area from the original large square.

"That, my friends, is one of the proofs of the theorem," he summarised. "And one of the simplest and most beautiful. By just moving the triangles and equating the squares, we can prove that $a^2 + b^2 = c^2$. You don't need to measure any sides or angles – although you can if you wish."

Most of the class was aghast with the neatness of the proof, but Paidia whispered to Gelio that she'd read the theorem

was known long before Pythagoras.

"It was the principle behind the construction of the Egyptian pyramids!" she hissed.

Gelio whispered back: "I knew something was wrong with him."

He started to draw a cartoon of Pythagoras standing beside a pyramid and slid it over to Paidia. She grinned and passed it to Amartia who was sitting behind her. Amartia acknowledged the drawing with a minimal smile and handed it on to Muko.

At this moment Pythagoras spotted a distraction in his classroom and stalked over. He saw the drawing on Muko's desk and snatched it from him, furiously. He stood menacingly over him for a couple of seconds without saying anything, then glared at him, thrust his arm out towards the door with index finger pointing, and shouted:

"Get out! You are not worthy to be in this class!"

Muko burned with indignation at the injustice but couldn't say anything. He was angry at Paidia and Gelio for landing him in it and causing him to be sent out. He didn't blame Amartia, though.

He did as he was ordered and exited the classroom, standing for a while near the door. He hadn't been there long before he heard voices round the corner. He wrestled with his conscience, which was telling him it was none of his business, but in the end his conscience lost and he tiptoed towards the corner. The voices were now louder but he still couldn't see anyone – he guessed they were round the next corner. He crept closer and peeked very cautiously past the end of the wall, immediately snatching himself back. He'd seen two teachers gesticulating vigorously, deep in earnest conversation.

Muko recognised one of them as the Machinists' teacher but he'd never seen the other one before, although he was soon to hear his name.

The teacher unknown to Muko said: “I heard that you're trying to solve the riddle. Have you got anywhere with it?”

The Machinists' teacher replied: “ My dear Mr Girolamo. Such matters should not concern you. You have given ample proof that you are not to be trusted with sensitive matters.”

The man referred to as Girolamo huffed audibly; he was clearly offended. “Well, all I can say is that there is no conceivable way that the Machinists will be able to solve it. Even that traitorous Pythagoras won't be able to help you. But be warned. There is something dark in Pythagoras' past and someone could get hurt. You will need to be very careful.” The Machinist teacher tried to interrupt him but he continued: “The Sculpture will ...”

Suddenly a door opened and the machinist pupils trooped out of their classroom right by where Muko was standing.

“Hey!” called out one. “You were eavesdropping on our

teacher!" His accusation was quite gentle, but not so that of another pupil whom Muko soon realised was called Trupacius. A self-styled leader in the class, this boy had such an air of authority that no-one ever tried to interrupt him.

"No-one does that and gets away with it," he declared pugnaciously. Then he advanced on Muko, first pointing at him and snarling "You rat," and then, with the same finger, poking him hard in the chest.

A line had been crossed. Out of nowhere but clearly audible to everyone came the voice of an Imaginary.

Over the couple of weeks that he'd been in the school, Muko had gleaned a certain amount of information about the Imaginaries. First of all, they always appeared out of the blue and disappeared into thin air. No-one from the normal classes knew where they lived nor how they moved about through the school. But the absolute most important thing to remember according to the older classes was that:

'You never mess with Imaginaries, and you never go against what they're saying. Even when they're younger than you.'

Imaginaries said very little, but they kept order in the school. On top of that, they were exceptionally smart.

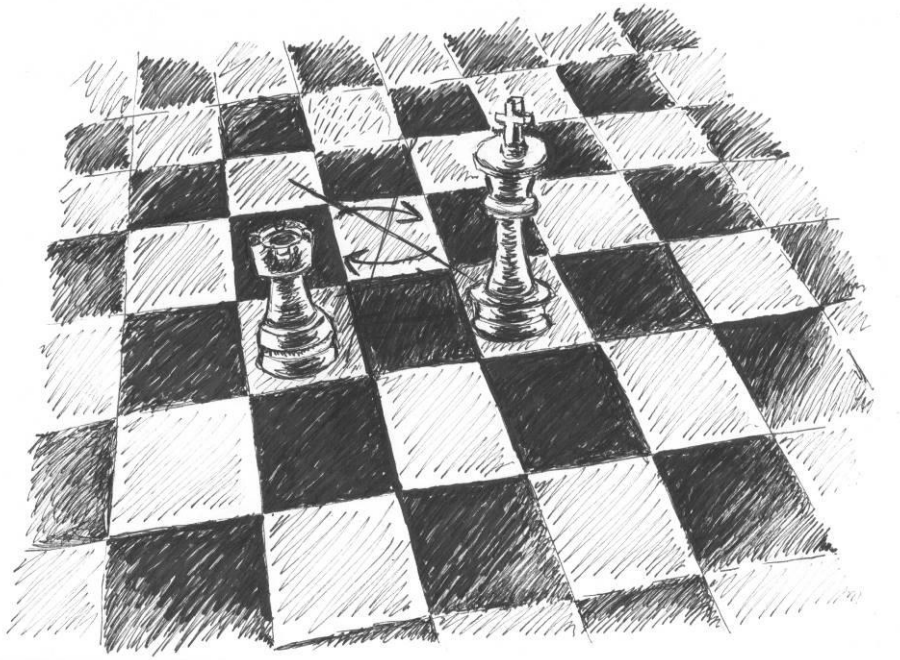
So this particular Imaginary confronted the aggressive pupil.

"You must behave," he told him calmly but in a voice that brooked no argument, "especially since you are a guest in this school. If you wish to challenge your fellow student, then you must do it according to the only way that is permitted in this school. Through the Game."

This was another area of school lore which the pupils got to know about. Every year the Director chose one game to be the Game of the Year. This game was the means through which students were obliged to resolve any quarrel likely to lead to physical violence, since physical violence was strictly forbidden. Opponents fought through the game – although of course anyone could play without having a quarrel to settle. There was also a huge competition at the end of the year when anyone could play the game in the hope of winning a big prize.

This year the Game chosen by the Director was Art of War Chess. The rules of this game were not very different to those of standard chess – after the first move, that is - with the

exception that castling was not permitted. The game started with each player being given his part of the board and his pieces. Then each player placed his pieces on his part of the board in any position that was permitted by the rules and – this is a vital point – in secrecy from his opponent. After that the two parts of the board were put together and the game began.



The official version of events was that the winner of the game won the quarrel and the loser of the game lost the quarrel. That was how the Directors had succeeded in eliminating

violence from the school. The unofficial version was that the loser had to suffer a standard penalty. This penalty consisted of running along the walls of the Academy barefoot and wearing only underpants, shouting loudly over and over again as you ran:

"Epsilon is less than zero!"

If you lost and didn't undergo the penalty – well, no-one actually knew what happened then. There were rumours that the alternative penalty was so terrible that no-one even wanted to know what it was.

When Muko heard the Imaginary tell him that things needed to be settled through the Game, he declared that he hadn't got a clue about how to play it. What's more, he'd heard that Machinists were way better in nearly all games that involved complex strategy.

Suddenly Amartia, Paidia and Gelio appeared on the scene. Amartia immediately looked for a way to support Muko, and offered to play in his stead.

Trupacius objected: "I thought chess wasn't for … girls." He glanced around expecting appreciation for his wit but none

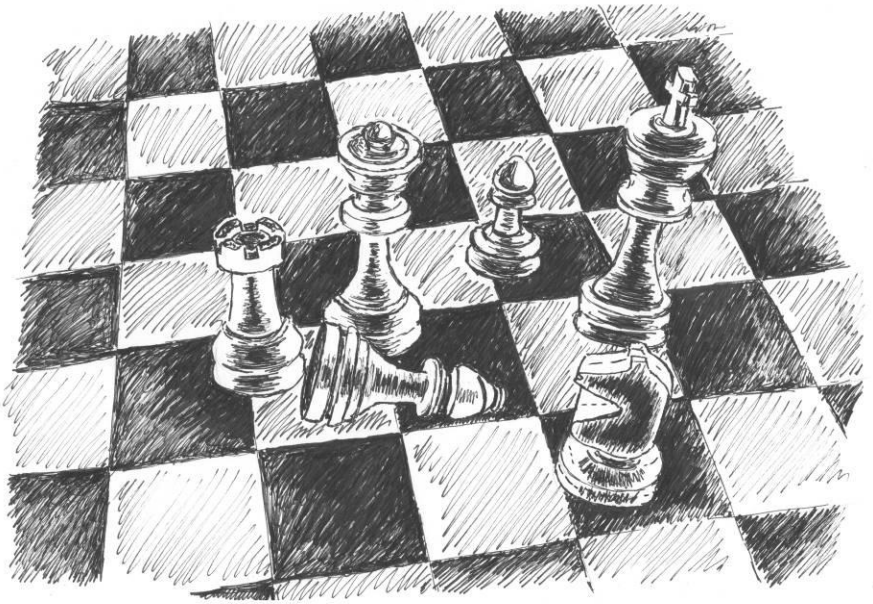
was forthcoming.

"Then why are you playing?" Amartia retorted.

There were cries of "This insult must be avenged!" from the crowd of Machinists.

"Let's do it," agreed Trupacius, preparing for battle.

Someone pulled out a chessboard. He and Amartia each took their part of the board. Amartia arranged her pieces quickly, but her adversary took his time and changed his mind a couple of times before he was also ready.



They connected the two parts of the board and Trupacius instantly went rather green about the gills. Amartia's pieces were positioned extremely aggressively: queen, rooks, knights and bishops were poised to kill in the first line while the king was sheltered in a back corner behind a line of pawns.

The initial challenger realised at once that he had no chance of winning. There wasn't even a possibility of a draw. Check-mate would probably happen in the second or third move. His king was blocked and couldn't be saved.

But there was to be no game. Trupacius' hand swiped the board and knocked it off the table. He froze. Everyone around the board laughed at him while his classmates stood riveted to the spot, knowing full well he had lost. Amartia stood up and gave him her hand.

“It's a draw,” she declared.

Trupacius was momentarily dazed, but then he seized his chance to get off the hook.

“Ye-yes,” he stammered. “It's a draw. Well, I did think your positioning set us up for a quick draw.” He smiled sheepishly.


E=mc²

The crowd dispersed. Muko was utterly bewildered by what had happened and turned on Amartia.

"What did you do that for? Why ever did you declare a draw?"

Voices from the retreating crowd explained: "There was no point in playing the game because the positioning of the girl's pieces gave her such an advantage that Trupacius couldn't possibly have won."

Amartia said quietly to Muko: "It was the best way out of a bad situation."

They left the scene quietly with Paidia and Gelio following in their wake.

Chapter 5

Muko could hardly wait to tell his friends what he'd heard. He pulled them together so that their heads were almost touching and spoke to them in an excited whisper.

“You'll never believe what I heard those teachers saying. They were talking about some kind of a mystery, which they called a riddle. The Machinists and their teacher, and another teacher that I didn't recognise, are trying to solve it.”

“Wow,” breathed Gelio.

“You know I told you Pythagoras was talking about something mysterious?”Muko continued, still in the same whisper. “Well I think he's in with the Machinists because he seemed all buddy-buddy with the Machinists' teacher. But there's something else I found out. It looks like the riddle's got to do with some kind of sculpture.”

“How can we find out more?” wondered Gelio.

“I know!” Everyone turned to look at Paidia. “You know I like books ...”

“Yeah, you're a regular bookworm,” ribbed Gelio.

“Let's hear what she has to say.” Muko put a hand on Gelio's arm.

“Yeah,” Paidia resumed, “well I've either heard or read that there's an ex-teacher in charge of the department of collections in the school. Maybe he'll know something about it. He and his wife have a huge collection of all different kinds of mathematical objects, including puzzles. Maybe they'll know what it's all about.”

The department of collections was run by Professor Hedgehog and his wife Professor Gamezynka. They were an

elderly couple, and very friendly. The husband got his name from the fact that he had a small hedgehog for a pupil. This hedgehog also collected things – apples, the difference being that as soon as an apple came into his possession he promptly ate it.

Muko and the sleuthing team arrived outside the door to the department. Muko knocked – once fairly softly and a second time loudly – but there was no answer. As he knocked more vigorously the second time, he noticed that the door wasn't quite closed, so he gently pushed it open and looked inside. His friends crowded round to peep in as well. What they saw was a large office with lots of cabinets, in which were ranged a huge selection of strange and wonderful objects.

They tiptoed into the office and began to look around them. They quickly spotted that each cabinet had a large symbol at its base.

“They're Roman numerals,” hissed Paidia. “Look! They're on the shelves of the cabinets as well.”

On many of the shelves were solids, 2-dimensional figures, small sculptures and paintings. But the first shelf they looked at was full of books. Muko read a couple of titles:

'Collections of Fibonacci numbers'

'Collection of perfect numbers'

'Collection of prime numbers'

'Collection of …'

Then his eye drifted away.

Another cabinet contained a variety of 3-dimensional solids. Muko could see a neat little label under each one, and looking along the shelves he read:

'Prism'

'Cube'

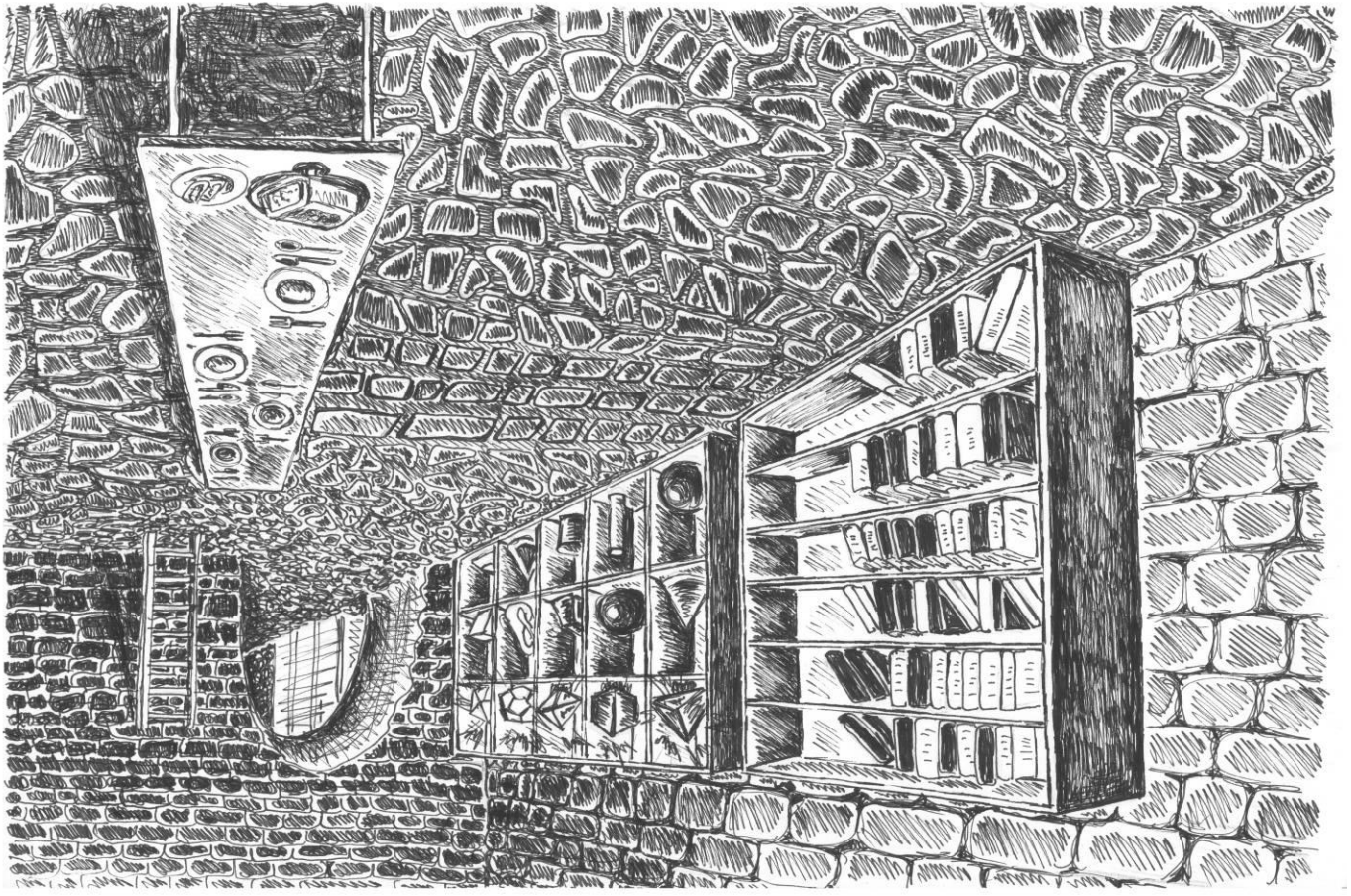
'Pyramid'

'Tetrahedron'

'Octahedron'

'Dodecahedron'

Then, on another shelf, some extraordinary objects caught his eye. They were like the solids in being symmetrical



and contained, but at the same time they were so complex and … deep ... that they mesmerised him. He had no idea that such things existed! He read their labels:

'Tesseract'

'Klein bottle'

'Hypersphere'

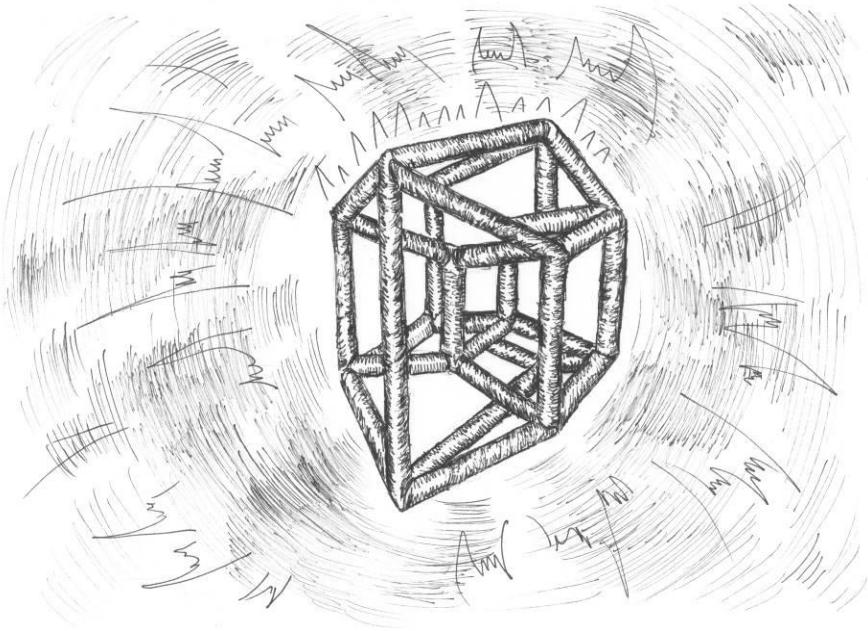
and there was also a general label for the shelf: '4-dimensional objects'. Was such a thing even possible?

Gelio was looking at the labels on the previous shelf, squinting through the glasses he wore, not from necessity but to make him look learnèd: they were very plainly an affectation since they had no lenses. He ran his finger along each word and tried to read it, but he was stumbling.

“Pyramid, tetr…dedron,” he went, then he gave up.

Muko was irritated that his friend couldn't read properly but closed his mind to the distraction and returned to the 4-dimensional objects. He hadn't noticed before but they were constantly transforming without changing position. It was as if, not being able to express their true selves in 3-dimensional space,

they were trying to exhibit all their different intersections with reality in a continuous loop. Muko couldn't believe his eyes. He'd never seen such amazing objects before.



A fragment of memory flashes through his mind. He recalls a pair of hands showing him a trick. Two balled fists are opened to show that there is an object in one of them – all Muko can see is something unrecognisable with scribbles on it. The other hand is empty. A masculine voice says: “One, two, three, abracadabra!” while simultaneously the hands are made fists again, shaken about, then opened again. The object has moved

from one hand to the other.

“Wow, it's magic!” Muko hears his own child's voice saying. Then he was back in the Department of Collections.

Suddenly an elderly man dashed into the office. He was yelling joyfully:

“I found it! I finally succeeded! Nine, nine, eight, one, zero four.” He paused briefly and continued: “One, zero, four, three, zero, nine, six.”

The children were watching him, fascinated, but it was clear that on the other hand he hadn't seen them. He made a bee-line for the cabinet containing books and started looking through the lower shelves, swiping his finger along the spines and muttering:

“It should be here somewhere.”

But whatever he was looking for wasn't on the lower shelves. He fetched a small ladder and clambered up to the top shelves to look there. He still didn't notice the children.

“Ah,” he finally uttered with deep satisfaction. “Here it is.” He pulled 'Collection of beautiful numbers' out from

between its fellow books, tucked it under his arm and descended the ladder. Once he was down, he opened the book, balancing it on his forearms.

Muko, who was standing nearest, edged closer and peered over the professor's shoulder to see what he was looking at. He had opened the book at the chapter entitled 'Collection of perfect numbers'. There was a column on the left in which were the numbers 6, 28, 496, 8128. There was another number next to these but it was so long that Muko didn't have time to read it.

Now the professor turned to a chapter called 'Collection of sociable numbers', then quickly went back a couple of pages till he got to the chapter 'Collection of amicable numbers'.

“Here it is,” he grunted with suppressed excitement.

Muko could see that there were numbers arranged in pairs on the page. The first pair was 220, 284, and then 1184, 1210. There were more pairs. The old man scanned the rows repeating 998104 and 1043096 over and over. He went to the end of the third page where there was the pair 947835, 1125765.

“Yes. The next one's mine. Thank goodness for that,” he sighed. He was beaming with delight.

After a few moments of basking in the pleasure of his discovery, he had a sudden thought and turned over the page. In an instant his mood changed and he drooped with dejection. He sat down on a chair. His numbers were the first pair at the very top of the new page, and worse still, there were many more pairs of numbers on that page and subsequent pages. He repeated once again 998104 and 1043096 in a subdued voice and then closed the book.

Mr Hedgehog hadn't noticed the children, even though there were four of them and they made no attempt to hide. He was far too wrapped up in his numbers. Now he sat with vacant eyes, staring at nothing.

Gelio caught Paidia's eye and revolved a finger on his temple to indicate that he thought the professor had a screw loose, but Muko held up a hand to silence Gelio and cleared his throat to attract the Professor's attention.

"Ahem," he went.

The professor remained oblivious to them.

"Ahem!" said Muko a little louder.

"AHEM!"

"Wha … who .. who are you?" asked Mr Hedgehog with a startled look on his face. He'd come back to earth with a bump.

He wagged his index finger in front of each of them and counted: "One, two, three, four. There are four of them and ..." - there was now a note of excitement in his voice as if he'd uncovered some remarkable fact - "four is the smallest composite number! What a coincidence!" He scrutinised them a little closer. "What are you doing here?" he demanded.

The children had done their homework about Mr Hedgehog and had worked out a strategy among themselves as to the exact way they would talk to him. They'd all agreed it would be a bad idea to blurt straight out about the sculpture because Mr Hedgehog was liable to send them packing.

Instead, they buttered him up with a bit of flattery.

"We've heard all about your great collections," said Muko.

"Yeah! We've heard they're fantastic!" Gelio echoed.

Mr Hedgehog went rather pink in the face and made a

funny little dance on the spot he was so delighted. If he'd had a tail he would have been wagging it nineteen to the dozen. As it was, he could barely contain himself.

"Well, children," he panted, "let me think what I could show you." He twirled his arms around expansively, indicating how spoilt for choice they would be among such riches.

"Please, Mr Hedgehog," Paidia piped up. "What are these sculptures in the cabinet?" She pointed to an array of solids and figures.

"Oh ah erm yes," fluttered the professor. He put down the book that he'd picked up, wanting to show them some numbers in it, and pottered over to the cabinet. He pulled one of the solids off the shelf and cradled it reverently against his chest, stroking one of its faces.

"This is a hexahedron. A regular hexahedron, which you may know by another name: a cube. It forms part of this great collection of Platonic solids! But make no mistake: the collection's greatness doesn't lie in its quantity. There are only five such solids, you see … and five of us in the room! What a coincidence!" His head wagged up and down and he gave a little hop on both feet.

Paidia was the one who again brought him back on track. “This is a fantastic collection, but we've heard that you have other great collections of sculptures.”

Mr Hedgehog nodded, delighted with the compliment. “Yes, that is true, young lady. But I wonder what you could have in mind.” He scratched his chin a moment. “I know!” he exclaimed. “It must be the 4D sculptures. Now this one” - he moved to another cabinet - “this one is a Klein bottle. Not really a bottle. Silly name actually.” He picked it up and the four friends, craning to see, observed that in the instant he took it out of its special holder, its otherwise ceaseless transformation stopped dead and it froze, maintaining its last appearance.

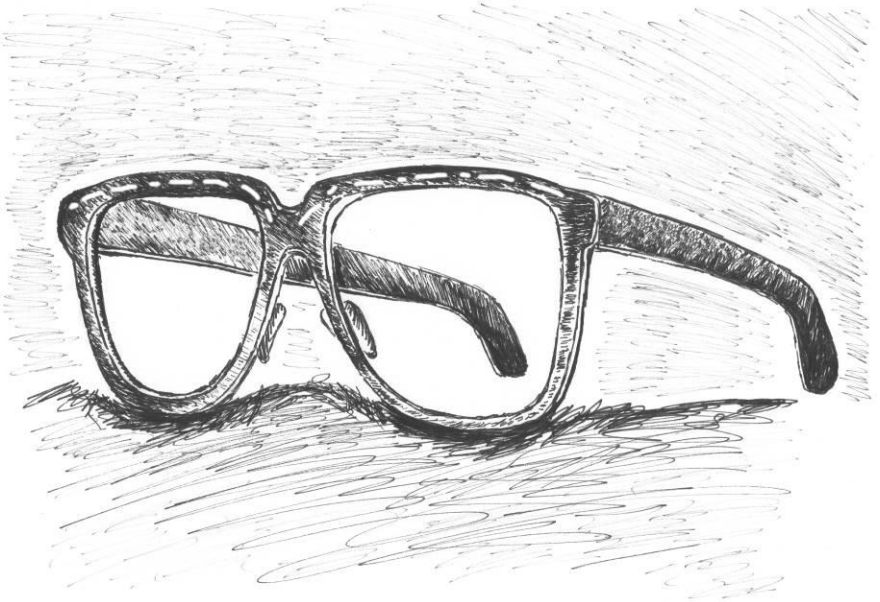
“Gather round, children,” instructed the professor. “This is a 4D object. It exists in other dimensions that we can't see, and normally it moves unceasingly between them. But as soon as it's touched, it stops transforming.”

Paidia was still in her role of spokesperson for the group. “It's great. I love it. But I was actually talking about something else.”

“Ah!” exclaimed Mr Hedgehog. “You're talking about the collection of 'other sculptures'. It so happens I just recently

made some changes in the catalogue. Now let me see … I have it here somewhere … Ah yes." He pointed to a large old volume on the top shelf entitled 'Great collection of other sculptures.' "I added some information, why, only the other day, about a mysterious and dangerous sculpture." His voice dropped to a whisper. "It's somewhere close by in the school but nobody knows where, or why ..."

He moved the ladder over, swarmed nimbly up it, tugged the book off the shelf then came back down and opened it on the table.



“My, my, I need you young people to keep me on my toes,” he chuckled. “Now take a look at these images. These are the beautiful sculptures of Mr Hart. And this is the three-dimensional Sierpinski triangle. Look at this icosahedron, and this … Oh dear, I need my glasses. Such is old age … Now I wonder where they are. I had them a minute ago!” He stepped away to search for them.

While Mr Hedgehog had his back turned, the children crowded round the book, impatient to find some clues. Gelio noticed that the corner of one of the pages was turned down and they eagerly opened the book at that place and found some draft information about a mysterious sculpture. The word 'cryptogram' jumped out at them and they could see some random letters organised in blocks of four squares. They also glimpsed a sculpture with the title printed under it: 'Hidden'.

“That's what we've been looking for,” said Amartia in her typical flat, economical fashion.

Mr Hedgehog returned waving his glasses, which were heavy horn-rimmed ones with little mathematical symbols on the earpieces. He put them on his nose.

“Ah, I see you found it,” he approved, peering keenly at

the page. “This is the sculpture I've been adding to recently. I remember now. I needed some additional information about it so I went to the library to do some research. As you see, it's not yet finished.”

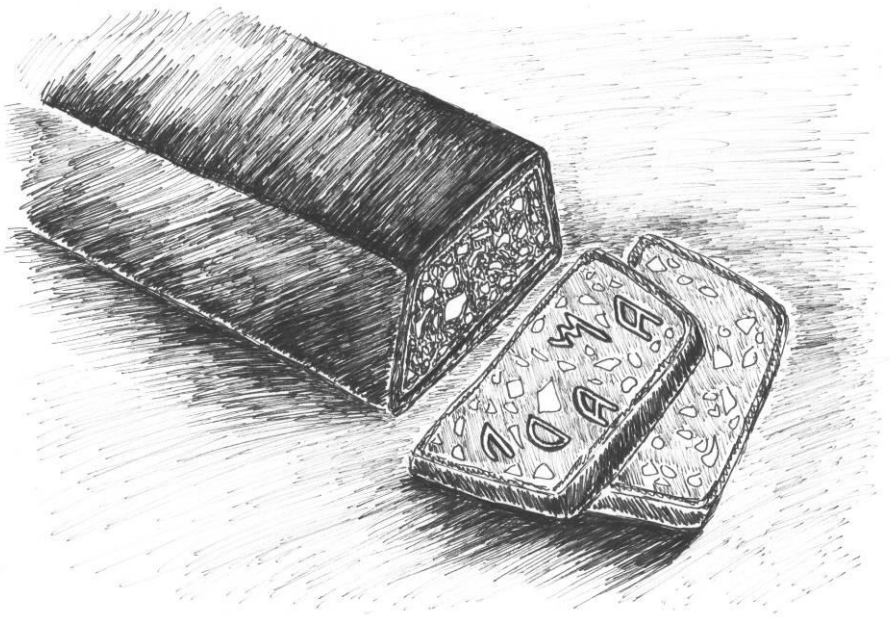
“Yes,” he went on. “The sculpture was made by the crypto-artist Mr J. Moondie in collaboration with a master of secrets called E. Lightt. Mr Moondie was invited into our school to make the sculpture with Mr Lightt, who was a teacher in the School of Machinists. In those days our school co-operated closely with the University of Machines across all the disciplines, but now it's different. They made the sculpture but all knowledge of its present whereabouts is lost.”

There was a little tap on the door and in came Mrs Gamezynka. She was carrying a tray with teacups and a strange dark oblong shape sitting on a doily.

“I thought I heard children's voices,” she said cosily. “So I said to myself: they simply must try some of my block cake.”

Paidia's eyes lit up. She had heard about Mrs Gamezynka's block cake with its unique, exquisite flavour. She approached the tray slowly and shyly then cut herself a huge piece of the cake, even slicing at an angle so as to make the piece

bigger.



The other three children looked at her in surprise. She'd taken such a large slice! Paidia was conscious of their looks and remarked: “Why? What are you all gawping at? I've only taken a tiny bit of it. There's far more than that left!”

When the children had finished their refreshments of cake and blackcurrant tea, Mr Hedgehog began to talk to them seriously about the sculpture.

“This sculpture you are looking for, you need to

approach it with extreme caution. There's something not altogether right about it, you see." His pleasant face had become very sombre, and the children knew he was in deadly earnest. "One amateur tried to solve it but he was so absorbed in his discovery that he stole the locomotive and went a long way away. Nothing has been seen of him since."

“What's the Locomotive?” Muko whispered to Amartia.

Amartia gave her head a quick vigorous shake to indicate she had no idea. Gelio meantime was doing the screwing motion again, to show he thought Mr Hedgehog was off his rocker.

“Or maybe,” mused the professor, “it was not the locomotive but some kind of a vehicle. Yes, thinking about it … it was called 'Kaszlak' - something like that.”

“You know,” he continued, pressing his knuckle against his lips to aid concentration, “there's another amateur who's supposedly lost in a labyrinth of some kind. I've heard – that is to say, my sources tell me – that in order to reach the sculpture you have to go through a three-dimensional maze … or was it four-dimensional? Any road, he disappeared and was never seen again.”

“In fact,” said the professor, warming to his tale, “there are lots of amateurs who tried to solve the riddle hidden inside the sculpture and most of them are lost. What's possibly worse,” he added shaking his head sorrowfully, “those who aren't lost, have lost their minds.”

He paused for a moment as if to let this grave fact sink in, then resumed cheerfully and somewhat tongue-in-cheek: “But thanks to them, we now have more information about it. A case in point: recently someone found a new clue hidden by the creator of the sculpture ...”

The old man at once fell into a reverie and lost all sense of what was around him. He slumped back in his chair, fast asleep, and started counting: “11, 18, 25, 42, 46, 67, 71 ...”

Gelio touched his finger to his forehead and gave a knowing wink, then with a sharp inclination of his head, indicated it was time for them to leave.

Chapter 6

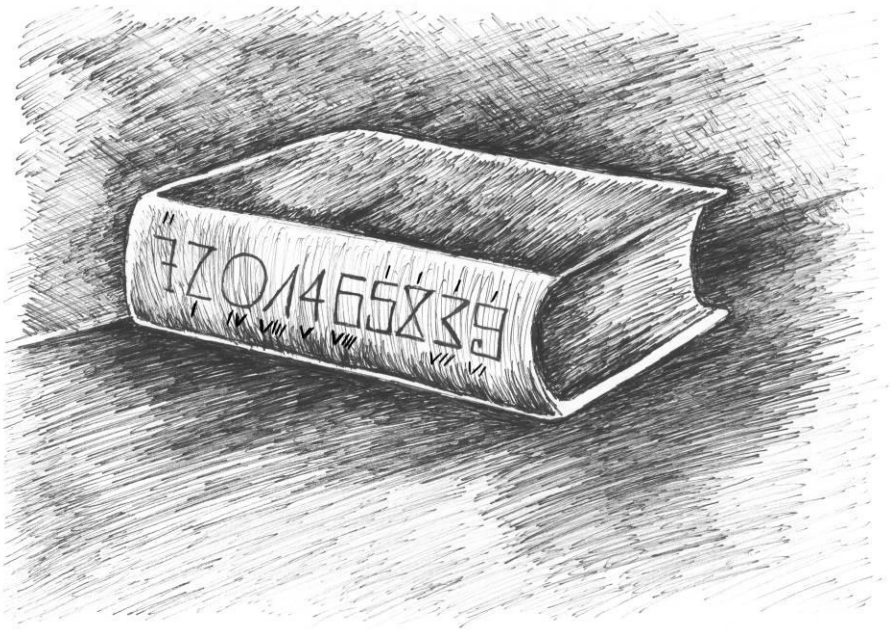
The next lesson for the Naturals was a lesson about numbers and sets. It was given by Professor Cantor in his office. He was a proud-looking man with a receding hairline, neat beard, and big nose. He paced up and down with his hands behind his back and explained:

“There are many notations for the numbers in mathematics. You will all be familiar with the Roman system, which denotes 'one' with a single vertical stroke, 'two' with two strokes, and 'three' with three. It gets more complicated after that, of course, which is one of the reasons it isn't used so much any more. Arabic numerals are more economical – there's a single symbol for all the numbers up to 10 – but it's not intuitive like the Roman system, so how can you remember which symbol is which?” He proceeded to answer his own question. “The key is in the number of angles. One has only one angle, two has two, three has three, and so on.”

'Nice one,' reflected Paidia, 'but it only goes so far. How would he explain 6 and 9 which are the same as each other but just the other way up? It's neat, but rather far-fetched.'

Professor Cantor took a few more turns in front of the

class to allow his aphorism about Arabic numerals to sink in, then continued. “There is, however, a different way of explaining numbers and this is the method which I prefer. It is that of sets. To my mind it is a more natural interpretation. Numbers are virtual objects; you cannot, for example, own the number two.”



He waited a moment for the ripple of laughter to die down, looking rather pleased with himself. Then he continued: “Sets, as I say, are more fundamental. Zero can be explained as an empty set. In other words, 'You have nothing'. One is a set of one element which contains only an element that is an empty set.

Proceeding naturally from there: two is a set of two elements. It contains an element that is an empty set and an element that is a set containing an empty set. Three is a set of three elements: empty set, set containing an empty set, and set containing a set containing an empty set. It's as simple as that. I'm sure you're all capable of projecting further numbers."

A murmur ran through the class as the students muttered to themselves, endeavouring to grasp the new concept. The professor held up his hand.

"I have a riddle for your homework. While it's true that I believe sets are far more interesting than numbers, I want you to prove that all natural numbers are also 'interesting'.

As soon as the class was over, our four friends agreed that they needed to go to the library. They raced along the path, full of anticipation, but as soon as they entered the building, they realised there was an obstacle. The strict Librarian was lurking near her desk, ready to pounce. She looked them up and down, registering their uniform.

"Naturals are forbidden to enter the library because they are known to deface the books. They are only allowed in the company of a Teacher."

The Librarian, whose name was Mrs Agnesssi spelt with three 's's, was a young, slim and beautiful lady. Her face was partially concealed by large glasses which were rumoured to enable her to read faster. She could invariably be found at her desk, wielding a big stamp which she stamped onto every page of every book. It was believed to be her way of marking books and keeping track of the pages she'd read, but nobody knew for sure.

The group of friends tried to wheedle past her. “We'll be so careful, and so quiet,” promised Muko, “that you won't even know we're here”.

“No. My rules are not made to be broken,” Mrs Agnesssi declared peremptorily.

It should be noted that while the three 's's of the librarian's name were highly unusual, there was a meaning behind them. The first 's' belonged to the normal spelling of the famous mathematician Maria Gaetana Agnesi who was also in fact working in the library, making handbooks for children. The second 's' of the name had a very appealing significance: it stood for 'sympathetic' because Mrs Agnesssi always had a ready ear for children who came to her with their problems, and would

offer advice if they were having difficulties with their teachers. The final 's' was the most powerful: it came from the fact that she acted like a poisonous snake coiled around her books, protecting them from all-comers and hissing “Sssssstop doing that!” if ever she caught anyone misusing a book.

The pupils who used the library loved playing with Mrs Agnesssi's name. They even sometimes increased the number of 's's to five, but five were difficult to count! The extra two 's's stood for 'scrummy sandwiches' because Mrs Agnesssi allowed herself the unique privilege of bringing food into the library. The wonderful, fresh smell of her sandwiches pervaded everywhere, making all the readers feel desperately hungry.

The children were just turning away from the library entrance in disappointment when Pythagoras appeared. He was slinking along with his head bowed as if he didn't want to be noticed.

The children waved to try to attract his attention. “Hey, Mr Pythagoras,” Gelio called softly.

But Pythagoras wasn't at all happy at having been spotted. “I really can't stop,” he said grumpily. “I don't have time right now.”

“Please can you escort us into the library?” asked Muko, but Pythagoras frowned angrily at him and started pushing past.

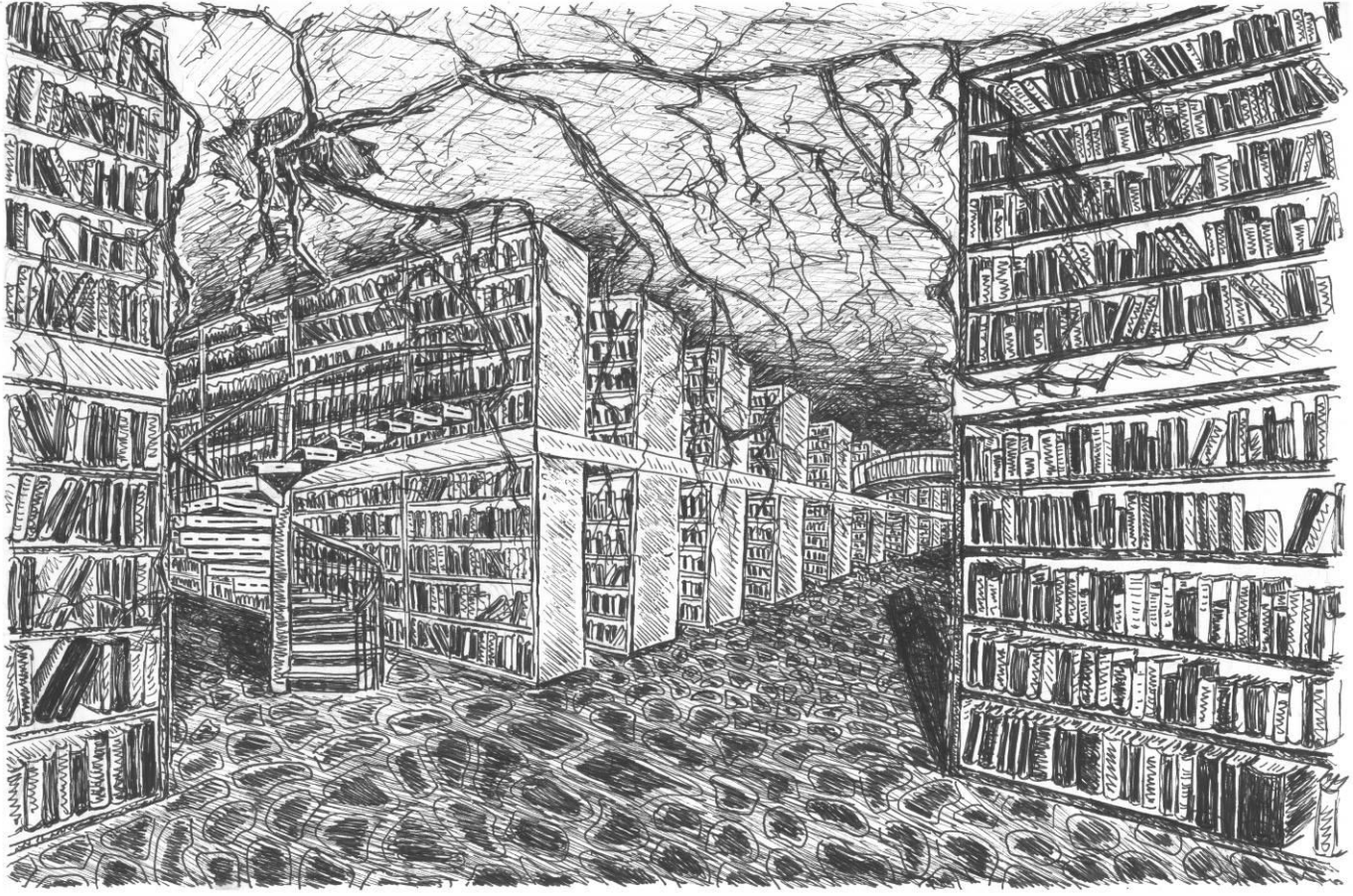
Paidia, however, came up with another one of her brilliant ideas. She turned to Muko. “It's just SO SAD,” she whispered emphatically, making sure that Pythagoras could hear every word, “that we won't be able to investigate all those interesting variations of the proofs of the Pythagoras theorems.” Then, with a theatrical gesture of resignation, she turned away from the library entrance “We have to go, Muko, seeing as NO-ONE will help us get access to the library.”

Pythagoras took the bait. He turned to the children, his face glowing with excitement.

“Please excuse my earlier testiness.” He inclined his head in a little bow. “I know the perfect book for you. Come with me, children. We shall go into the library together.”

Mrs Agnesssi couldn't argue, but her steely gaze followed the four friends. They could feel her eyes on their backs.

The library was an extraordinary place. Every time the children visited it they were overwhelmed. There were cavernous spaces with immensely high ceilings from which



different levels of the library could be seen. In the centre of the library was an impressive curved staircase leading to the second level and it was here, in the very heart of the building, that the Tree of Wisdom had inserted its roots through the ceiling and was drawing life from the books, the cabinets and the library, its coils connecting directly with the stairs and forming part of the structure. On each of the levels were row upon row of bookcases, their shelves bowed by huge, heavy mathematical tomes. Order reigned; everything was in its correct place. There were lots of pupils sitting at the tables, intent on their studies, but none of them were from the first class.

Pythagoras led the way to the far end of one of the wings of the building. He took the stairs to the level for Geometry and Topology, and found the alley for Ancient Geometry. It was obvious he knew exactly where to go. He took hold of a ladder, climbed up, and grabbed a massive volume entitled 'Beauty and Perfection of the Pythagoras theorem'. It was a heavy book but he handled it reverently, almost tenderly, with an expression of great pride on his face.

He descended the ladder and carried the book to a nearby desk, motioning to the children to gather round. Then he opened the book.

"Here you can see all the proofs you want, but the opening of the book in itself is a great and simple visual explanation of the theorem. Take a look."

They all tried to see, but it was difficult to get a good focus past the robes and the protective arms of their teacher.

“You can peruse it by yourselves,” Pythagoras told them, “but you are to treat it with the utmost care and respect. I must leave you now because I have something very important to attend to.”

He shuffled away, and as soon as he was out of earshot, Muko hissed excitedly: “I thought he was never going to leave us alone!”

Gelio looked at Muko. “This is the most perfect day of my life,” he enthused. “I'd like to live here, all the time, and spend my whole life looking at these books.”

Paidia was not to be outdone. She leant back and closed her eyes in ecstasy. “Reading a book is like … like eating a warm chocolate muffin with a cherry on the top.”

Muko glanced at Amartia to see if she shared any of these sentiments, but she had a look on her face which said: 'Don't ask me what they're talking about. I haven't the faintest idea.'

Gelio and Paidia wanted to study the book, but Muko snapped: “Have you forgotten why we're here? We've got other fish to fry!”

But where to find the book on sculptures? They had no idea where to start looking. That is, until Paidia had a sudden thought.

“I don't know how I know,” she mused, “but I kinda know what to do. We need to look it up in the catalogue.”

“What's a catalogue?” Gelio wanted to know.

“It's like the key to the library,” said Paidia.

“So where is it?” Muko demanded.

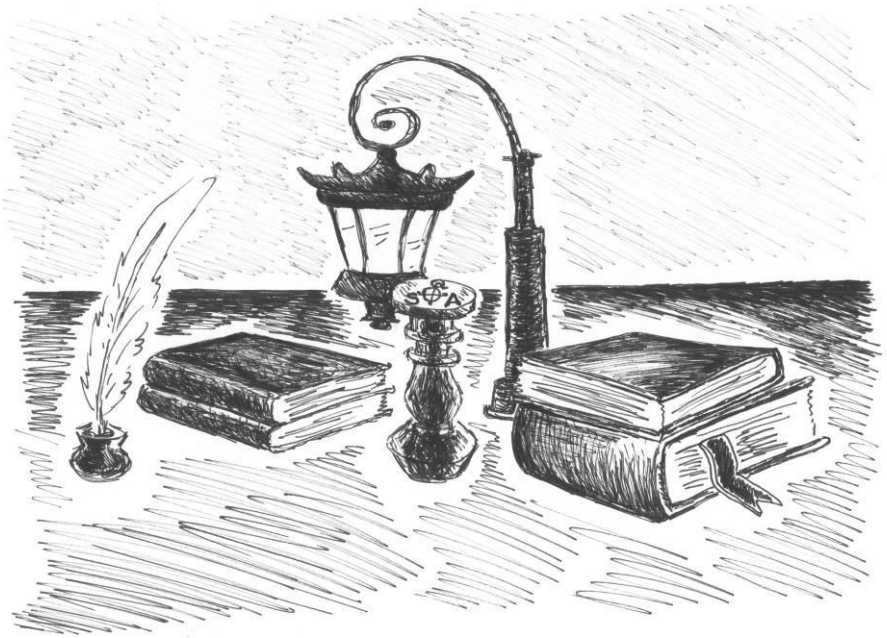
“Well, um, it's that great big cabinet over there with all the small drawers. Next to Mrs Agnesssi's desk.” Paidia looked sheepishly at the others.

“Oh great,” said Muko. “If she sees us looking in there we'll be kicked out of the library. We'll have to wait till she's not at her desk.”

They waited, and waited, but Mrs Agnesssi never left her desk.

Then Gelio came up with a plan. He crept into a nearby alley and pulled books off the shelves, piling them randomly all

over the floor. He took one book and slid it along the floor in such a way that part of it could be seen by Mrs Agnesssi from her desk. He made a 'hoo-hoo' noise, loud enough for her to hear, then like lightning scampered back to his friends who were waiting with baited breath in another alley.



Mrs Agnesssi heard the noise and looked up from what she was doing. She turned her head in the direction the sound had come from and saw a book lying on the floor in an alley. She pursed her lips and frowned, obviously annoyed at the interruption. Pushing her glasses up her nose, she stood up and

walked over to the alley. When she saw the books strewn all over the floor she straightened her arms down her sides and clenched her fists with rage.

“This is impossssssible. Why would someone do that?” she hissed.

“You didn't need to do THAT,” Paidia grumbled in Gelio's ear. Gelio just made a grimace as if to say: 'It worked, didn't it?' Amartia looked at Muko and shrugged as if she was indifferent to the whole situation. Muko, however, was quick to seize the opportunity. He looked at Paidia and put his finger to his lips to silence her, then mimed that he wanted her to show him how to use the catalogue.

They all approached the catalogue and Paidia opened one of the drawers. Inside were hundreds of small cards standing on their edges. Each one bore the name of a book and some symbols. The first one they looked at had the title:

'The Nine Chapters on the Mathematical Art' followed by 'S.111.Theta.D.20'.

Paidia quickly flicked through the cards and read another one at random:

'Sunzi Suanjing W.11.Tau.T.18'.

“How ever are we going to find our book in here?” Muko asked Paidia in a desperate whisper. It all seemed total gobbledygook to him.

“There's got to be some system here,” Paidia whispered back. “Let's keep looking!” She closed the drawer and stood pondering for a moment.

Muko meantime was scanning the labels on the drawers themselves:

'Maths in Greek BCE'

'Maths in China BCE'

and there were hundreds of other drawers.

“Do you remember?” Muko murmured in Paidia's ear. “Professor Hedgehog mentioned something about sculptures.”

“Oh, yes!” replied Paidia.

So they quickly scanned all the names on the drawers and found 'Fine Art and Math I'. This must be it! But then they saw there was a 'Fine Art and Math II' ... and all the way up to

'Fine Art and Math X'.

“There must be thousands of different books in just these drawers,” groaned Muko. “Let's each take a drawer to go through – that way we'll be quicker.”

So they each pulled out a drawer and began the task of leafing through the cards. Everyone made slow progress apart from Amartia who within a few seconds was asking, “How about this one? 'Sculpting mathematical plates'.”

“No, I don't think so,” said Muko.

One more second and a couple of cards later Amartia reported: “'Sculptures from triangles'.”

How is she doing it? How can she be so quick? thought the others, feeling intimidated.

“No, that doesn't sound right,” Muko decided, but they all stopped to watch what Amartia was doing.

She was supremely fast. Her method was to glance at a card and if there was the word 'sculpture' on it, or something connected with 'sculpture', to call out. Muko, Paidia and Gelio looked at each other in total disbelief. How was it possible to

work at that speed?

A couple of seconds more and Amartia had finished the first drawer. Then the second. In the third drawer she found a card 'History of Peculiar Sculptures'.

“That's it! That's the one. It must be!” said Muko gleefully.

The code on the card was: 'N.II.Sigma.N.19'.

They all had a quick peep at it in order to memorise it. They were just in the nick of time because at that moment there was the sound of Mrs Agnesssi's footsteps coming towards them. They scampered into one of the nearby aisles where they flattened themselves against the shelves. Then it struck them. In their haste they'd left one of the catalogue drawers open!

Mrs Agnesssi reached her desk. The children listened intently. Instead of hearing her pull out her chair and sit down, there was an ominous silence. Then:

“Sssstrange!” she exclaimed.

She must have seen the drawer! The children held their breath. They heard her footsteps and the sound of the drawer

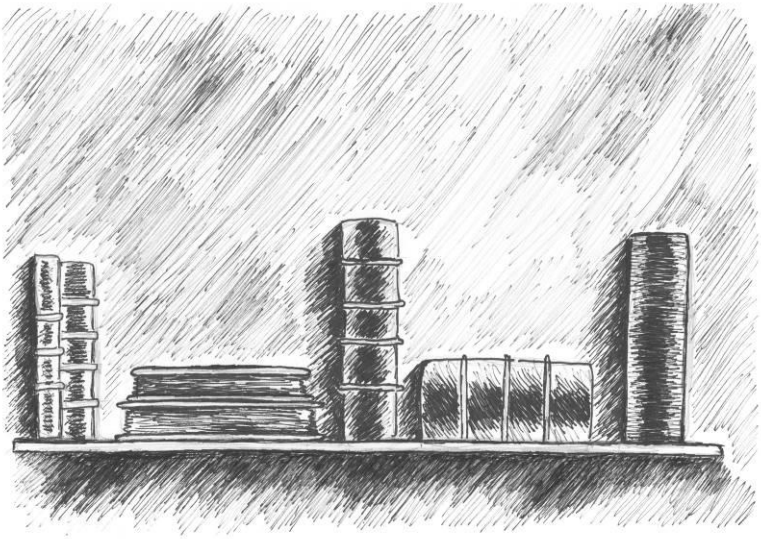
being closed, followed by footsteps returning to her desk. This was confirmed by the chink of her china teacup in its saucer and the rhythmic stamp ... stamp … of her progress through a book.

"Phew!" They let out their collective breath so loudly they were afraid they might give themselves away.

Now they repeated the code they'd found – N.II.Sigma.N.19 - and wondered what the numbers, letters and symbols could stand for.

They decided to start in the centre of the library and so off they trooped, Muko leading the way. Once they were there, they saw again the great gnarled roots of the Tree of Wisdom poking through the ceiling, branching out and worming their way into the shelves. It really did look like the tree was sucking its strength from the books.

From this central part of the library, which had only two floors, four corridors branched out towards the four wings of the library. Each wing had two extra floors – four altogether – and they were all similarly lined with bookcases full of books. The second floor in the central part was reached via a curved staircase. Its balustrade had been thoroughly invaded by tree roots which had had wound themselves thickly around it.



The children went up the curved staircase, found a bench, and sat down.

“Maybe we should ask someone for help?” suggested Gelio.

“No!” Muko was adamant. “We need to figure it out. C'mon you lot, it's got to be simple! Think about it. The library has four wings – North, South, East and West - like the points on a compass. Our code starts with 'N'. It must stand for North, so we need to go to the Northern Wing.”

Amartia gave her approval to this interpretation. “Yes, the other cards I saw had only four distinct values in first

position on the code: N, S, E, W. You must be right."

They found the North wing, which was clearly marked.

Muko was beginning to get the bit between his teeth. "Now that we know what wing it is, the next thing should be the floor. That Roman II in the code must indicate the floor. We're on the first floor so we have to go up to the second floor!"

Amartia nodded. "All the cards had one of four distinct values in second position: I, II, III or IV."

They found the staircase and ran up it.

"The next one's tricky," owned Muko. "I didn't recognise the symbol."

"But I did," Paidia piped up. "It's the Greek letter 'Sigma'. I know the Greek alphabet so I can convert it to a number. Each alley has a number on the floor at the entrance - have you noticed? We need to find the right alley!"

They rushed down the corridor looking at numbers and finally reached the one they wanted.

"What was the next symbol?" panted Muko.

“It was another 'N',” Amartia told him.

Muko, Paidia and Gelio had been so absorbed in solving the riddle that a strange phenomenon had entirely escaped them. When they'd looked down the corridors that connected the wings of the library to the centre, it had looked as if there were only one or two bookcases in the alleys branching off them. But now, when they looked down the alleys themselves, it was like magic! The bookcases seemed to go on for ever! Amartia noticed there was something peculiar about it all but she didn't say anything.

Gelio pointed out: “Look! Each bookcase has a big letter on the top. It starts with 'A', then 'B' – we need to find 'N'!”

They arrived at 'N' and Gelio spotted that each shelf was also labelled with a value. The last element of the code, 19, must therefore indicate the shelf. They found the 19th shelf and eagerly scanned along it, reading the titles. Amartia as the fastest reader was the first to reach a conclusion.

“There's no such book on this shelf,” she reported matter-of-factly.

But Muko didn't take kindly to the news. “We must have done something wrong,” he said irritably. “Amartia – could you have made a mistake?”

Amartia wasn't in the least put out by this implied criticism. “I remember the code perfectly,” she said calmly. “One hundred per cent. I can see it in my mind's eye. That's the way I remember things.”

Muko turned to Paidia. “You said that one of the symbols in the code is from the Greek alphabet. One is a normal letter, one is a normal number, and there's the compass point. But what's the origin of the second symbol?”

“It looked like a Roman numeral,” Amartia replied for Paidia.

“Hold on a minute,” said Paidia. “I once heard that the Romans didn't have a numeral for zero ...”

“Which means,” Muko continued excitedly, “that the floor is the problem!”

“What are you on about?” grumbled Gelio.

Paidia explained patiently: “We're on the second floor, right? We thought that was correct because of the 'II' symbol. But seeing as the Romans didn't have a zero, we have to start counting at 'I'. The ground floor would have the symbol 'I' and the first floor would be 'II'. In other words, we need to go down a floor.”

They sped to the stairs and … froze. There was Pythagoras, making a hasty exit from the library. He looked furtive, as though he was trying to escape from something, and he kept glancing over his shoulder as if to check whether he was being followed.

The children waited until Pythagoras had gone and then

quickly found the correct alley, bookcase and shelf. Amartia had identified the book they were after before anyone else had come anywhere near the shelf. She pointed to: 'History of Peculiar Sculptures'. It was a massive tome of huge proportions.

"This has got to be it," she said.

Chapter 7

Muko pulled the volume off the shelf and staggered with it to one of the empty tables in the wing. They all crowded round to look. He opened it right at the beginning and the first thing they saw was that the main title page had been ripped out, leaving only a tantalising snippet which read: 'Sculptures in …'. The next page, however, was complete. It bore the heading: 'Sculptures in the Citadel of Aivirai'.

The children looked at each other, puzzled and intrigued.

“What is Aivirai?” breathed Gelio.

“Look at these names,” said Paidia, pointing at some more strange words. “What do they mean?”

They looked down the page at the list of chapter titles and Amartia spotted a name which meant something to them. She tapped the title with her finger: “'Sculptures in the Queen of Science Academy',” she read.

“And here!” exclaimed Muko, scarcely able to contain his excitement. “There's a chapter called 'Unsolved riddle between the Qu …'. Oh no. Someone's torn away this part of the page.”

“But we can find the chapter itself,” Paidia pointed out.

Muko carefully leafed through the volume till he found the page where the chapter started. “It's … it's this one,” he said wonderingly.

And there it all was, laid out in front of them: more information than they could readily absorb. There were biographical and other details about the artist who created the sculpture. After that was a section about the riddle, saying that part of it had been solved while another part remained unsolved. The most interesting paragraphs followed on from there. They stated that the sculpture had been created a long time ago and that every year it fell further and further into oblivion. 'It is not even known,' wrote the author, 'where the sculpture is currently located nor how to gain access to it.'

The children looked at each other, wide-eyed. None of them said anything. They continued reading and Muko turned the page.

'There are various ways of reaching the sculpture. The principal access point is through a series of hidden chambers full of danger in the form of countless deadly traps. There are other ways in through secret passages.'

The text went on to mention that the sculpture was created in an era when the Queen of Science Academy and the University of Processing Machinery existed side by side in harmony.

The friends kept on reading. They found a sub-chapter about unsolved parts of the cipher, and then they were brought up short because the pages after that had been torn out.

“Mrs Agnesssi wouldn't be a happy bunny,” Gelio pointed out.

“I reckon it was Pythagoras,” said Muko. “You know I saw him talking with the Machinists about the sculpture? Well maybe he wants to be the first to solve it and pip everyone else to the post!”

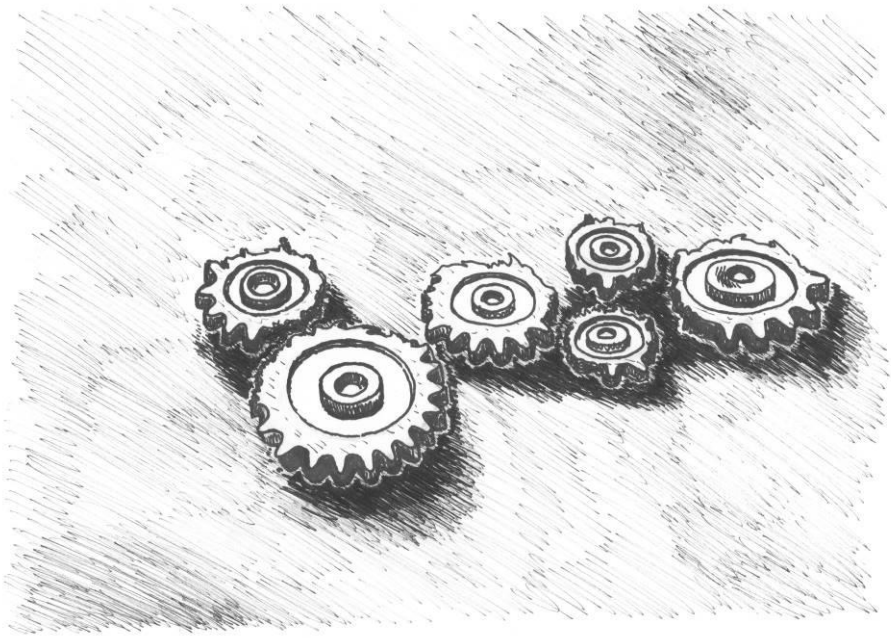
Paidia had spotted something. “Look, there's some writing here.”

They all peered closely at where she was pointing and sure enough, there were handwritten words on the page next to the torn out pages because someone had pressed so hard as to leave an imprint.

“Has anyone got a pencil?” asked Muko.

They all felt around in their clothes and finally Paidia produced one which had been lying at the bottom of her shirt pocket. Muko seized it and lightly sketched over the writing using the side of the lead, so as to reveal some mysterious words. Unfortunately not all of the text was legible, but parts of it stood out very clearly:

'… at midnight … ancient artefact ...' and there was a strange symbol showing circular objects of different sizes with teeth connecting them together.



They were so intent on their discovery that when a voice

behind them suddenly demanded: “What are you doing here?” they all jumped out of their skins.

They turned round and there was Trupacius from the Machinists' school – the one who had played chess with Amartia. He had brought his friends along, and so our four protagonists found themselves surrounded.

“What did you do to the book?” one of them asked.

“Butt out. It's nothing to do with you,” Muko responded.

The Machinists were not so easily discouraged. They began looking more closely at the page the book was open at and one of them said mockingly:

“Well, well, well. So you're going to solve the RIDDLE are you?” and he laughed heartily.

All the Machinists were now making fun of Muko and his friends. Then they went one step further:

“We'll take the book off you before you get hurt,” they said, and one of them grabbed it, closed it with a clap that produced a great cloud of dust, and lifted it onto his shoulder.

The Machinists then departed, laughing and cracking

jokes about puny Naturals who thought they could wade in and do what their betters hadn't managed …

Muko was furious. He muttered to himself that he would show them. He would solve that riddle no matter what.

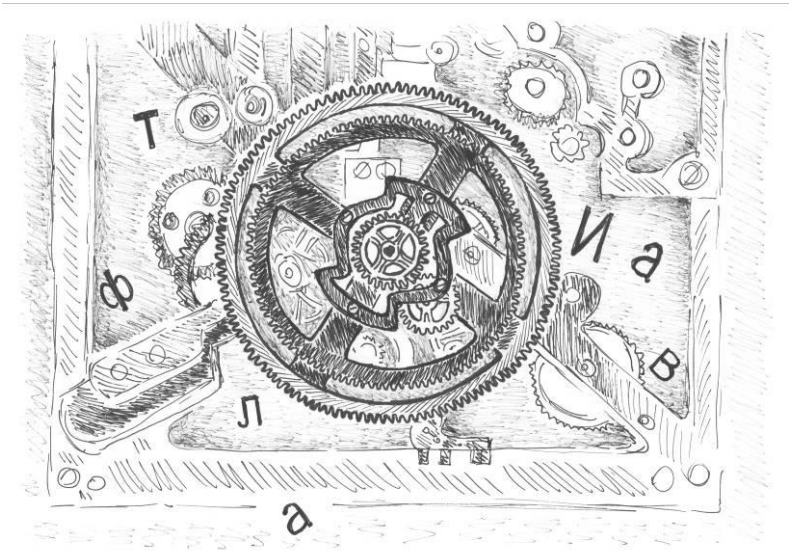
The children were utterly despondent but the inexorable routine of their studies had to continue. The next class was about the cosmos and the stars and it was to be given by a teacher from another school. Sometimes this happened: that teachers went around different schools and gave lectures about their area of expertise. On this occasion they were to be taught by Mr Copernicus, and the four friends soon found themselves pleasantly distracted because he had scheduled his class to take place after dark and the lesson consisted of a walk under the night sky.

It was wonderful to step outside and look up at the starry heavens, but even more wonderful to have the stars and constellations explained and named, to be shown how to use a compass, and then to be introduced to the teacher's own telescope and have its function demonstrated. He showed them a couple of stars and planets through the telescope and explained that every heavenly body was catalogued.

“I have a riddle for you to solve, children,” said Copernicus. “For your homework, I would like you to work out the first non-cosmic number that does not lead to a cosmic number.”

After planting that teaser in their brains, he continued the walk, leading them to a courtyard where he paused to explain their surroundings.

“You have just entered the Passage of Antikythera. It was built between the Queen of Science Academy to the South of us and the University of Processing Machines to the North. There is no other route because there are mountains to the East and the West, and it has been cut into the rock.”



He paused for effect then continued, wagging his finger for emphasis: “Remember that you must never go further North without being accompanied by a teacher. Otherwise you may end up in serious trouble.”

Another pause, to let his words sink in.

“The courtyard where we are standing now is like a pass between the two mountains. In the middle please observe an artefact, which in truth you should not go near without a teacher either.”

The children were already gazing at the artefact, making little 'oohs' and 'aahs' of amazement. In the middle of the round courtyard, it rose as high as a tall tree. It had multiple moving gears - small ones driving larger ones - and it made a tremendous clanking and thumping noise.

Muko caught Amartia's eye but she couldn't tell what he meant. He also glanced at Paidia and Gelio but they were laughing and joking about whose snoring was as loud or louder than the noise made by the gears. So Muko turned back to Amartia, pointed at the artefact and said:

“This could be what the book was talking about.”

Amartia nodded.

The courtyard where they were standing had twenty-four pillars around its walls. Each pillar had a symbol on it, carved into the stone. As he examined them carefully, one by one, Muko's eye was drawn to a design which showed circular objects of different sizes. It looked familiar. Where had he seen it before? Then it came to him: it was identical to the one in the book – the one he'd revealed by shading over the imprint on the page! It was a picture of interconnected gears.

He pointed it out to Amartia who gave her usual cool response of a tiny smile and a slight nod, but Gelio and Paidia, who had noticed something was going on with their friends, were more openly curious about the discovery.

The lesson was over and Copernicus led his class back to the school. Muko pulled his friends to one side and said in an urgent whisper:

"I think this is the artefact where there's the way in to the sculpture."

"Then we need to come back, at night," Paidia whispered back.

“It's night now,” Gelio pointed out. “So what about we take the bull by the horns?”

“I'm up for it,” Amartia said, quietly but with decision, and they all looked at her.

“Me too,” said Paidia.

“That's settled then,” Muko confirmed.

During evening supper, the children readied their provisions. All the while munching away at their food, they surreptitiously helped themselves to more and slipped it into their pockets. They didn't manage this unseen; some of the other children saw them and clapped a hand over their eyes to indicate they thought they were bonkers. An Imaginary student suddenly appeared. Walking through the aisles of benches, he caught sight of what our friends were doing and asked:

“Why are you stuffing food into your pockets?”

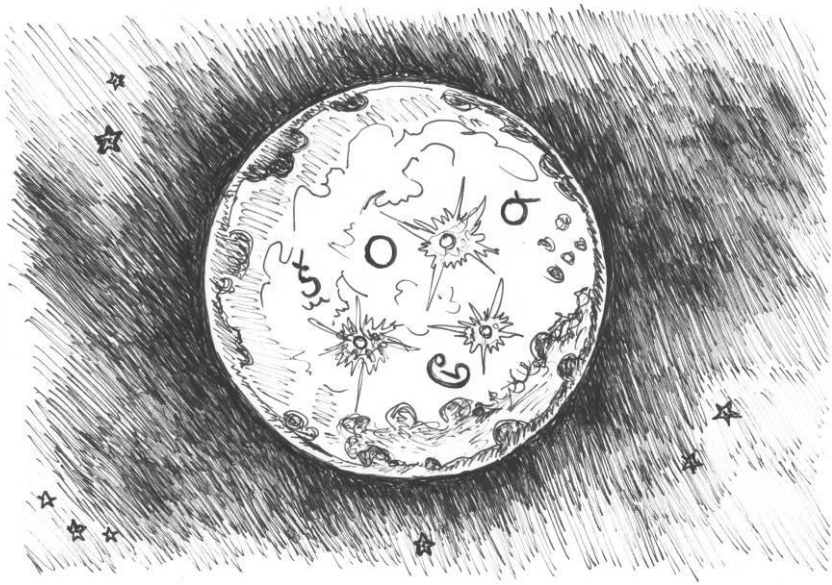
This might be the end of the adventure! Luckily Gelio was quick-witted enough to think of a reason:

“We thought we might spend some time outside the dormitory tonight, consolidating what Copernicus taught us about the stars and all that.”

“Ok,” said the Imaginary blandly, and walked on.

The children breathed a huge sigh of relief. The excuse had worked!

They went to brush their teeth and while they were in the bathroom, they heard the accustomed rumbling noise which meant that the school's unseen, benevolent power was converting the classroom into a dormitory for the most important part of the day – sleeping. The room was transformed when they went back – no more desks, only beds. The four friends tucked themselves fully-clothed each into their own bed, but lay awake until the other pupils had fallen asleep.



When the dormitory was filled with soft snoring from all quarters, the children tiptoed quietly out into the night. They were surprised at how bright it was, but immediately attributed it to the fact that there was a large moon rising and no clouds. They set off in an easterly direction, towards the moon, passing near the library and then over the bridge to the oval path which surrounded the whole area. When the way divided, they went north toward the passage leading to the University of Processing Machines. They walked along happily, sometimes skipping or breaking into a run from sheer excitement. It felt like they were embarking on a great adventure.

They came to the passage that would take them to the artefact. They could even see, sticking up into the moonlight, the artefact itself, just the other side. However as they drew near to what should have been the way through, they realised that it was blocked. The whole passage was completely plugged by what looked like a door made out of stones.

They were a couple of metres away from the passage when they drew to a halt, overcome by a feeling of defeat. “I don't believe it,” all the children said, over and over, one after the other.

After all the good luck they'd had, it was hard to accept

that they were now going to have to withdraw, frustrated.

“P'raps we should come back during the day, when the passage is open, and hide in it till it's closed,” suggested Gelio.

“Yeah, but there's nowhere to hide,” said Muko.

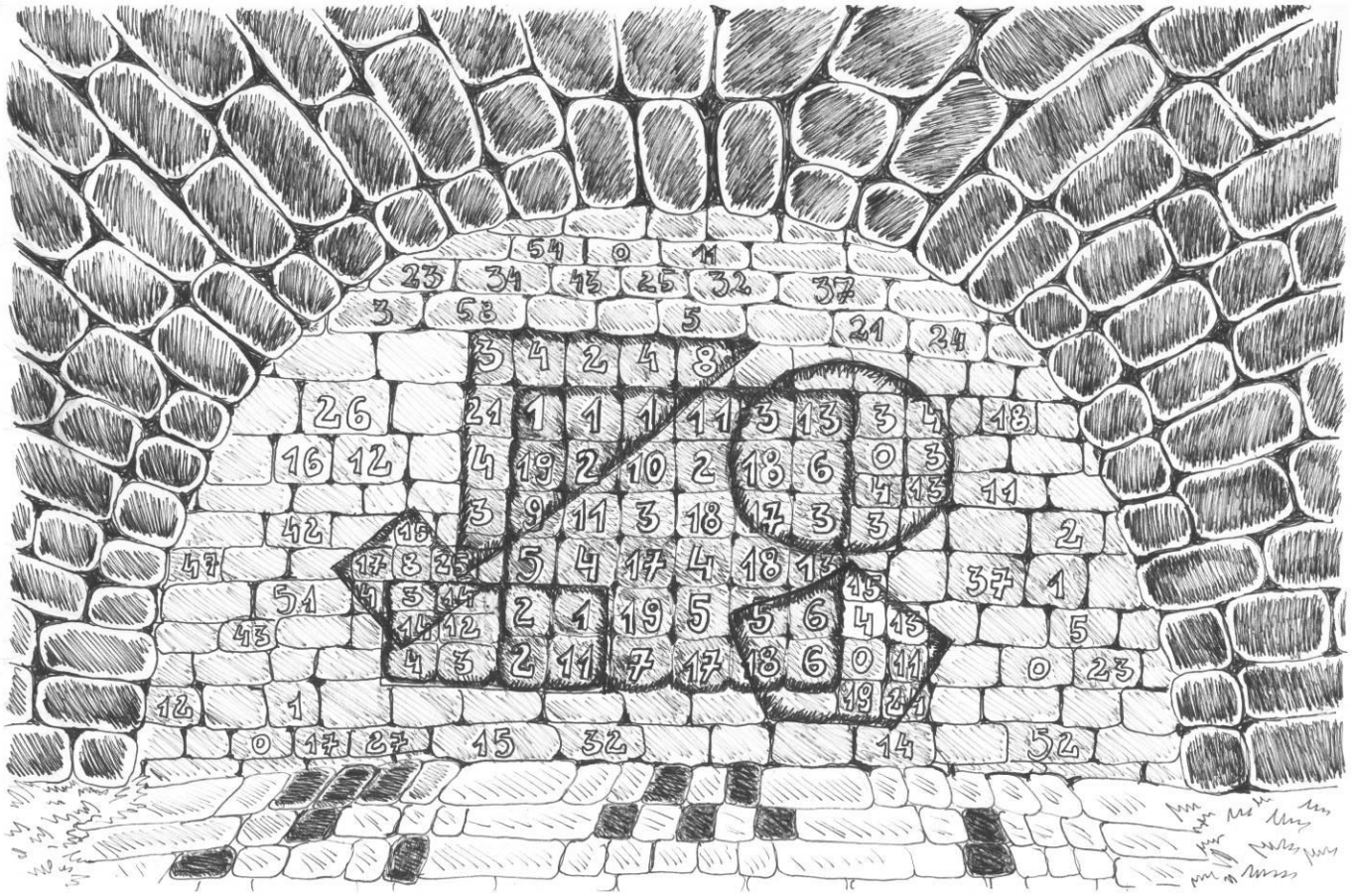
They dragged their feet as far as the stone barrier and sat down on some loose rocks. Muko didn't take easily to being thwarted so he spent the time having a good look at exactly where the entrance to the passage had been before. It was in this way that he made a discovery: some of the stones in the wall had numbers written on them.

“Come and look at this,” he called out to his companions.

None of them had noticed any writing before, but now they could see some words written at the top: 'Only magic will let you through', and underneath a whole load of numbers carved into the stone.

There was something odd about all those inscribed numbers and letters. When viewed from a particular angle, they seemed to reflect the light.

“I've heard about this!” exclaimed Paidia, and on the instant she was transported back to a day in her past.



There are two hands open in front of her. In the palm of one of them lies an object she has never seen before, with some scribble marks on it. The hands close. A voice says in a dramatic way:

"Abracadabra!" and shakes the two fists up and down. "Now tell me where it is!"

Paidia looks at the hands. Easy! She points to the hand where the toy was a moment ago. Slowly the fingers uncurl and the hand opens. It's empty! She hears her own delighted giggle. The voice says:

"You see? It's magic!"

So maybe that was the answer, Paidia thought: they needed to work some kind of a spell, or say a magic word.

"Abracadabra!" she said out loud. Nothing happened. "Open sesame!" "One, two, three, open up!" Again nothing happened. "Kufungua mwenyewe!" Paidia had heard this somewhere but had no idea what it meant.

"What was that?" asked Muko, intrigued by the foreign-sounding words. He heard her pronounce more incantations but was himself intent on examining the numbers. They were all arranged in columns and rows. There were a couple of shapes

carved into the stone and some of the numbers were inside them and others outside.

Muko had a sudden brainwave. “Do you remember that class we had with Mr Yu?” he asked his friends. “He told us about various mathematical riddles and also about the Magic Square. Look! I think there's a Magic Square carved in the wall! It's got 6 rows and 6 columns with numbers in them.”

Gelio started giggling. He was teasing Paidia about her incantations. “You haven't managed to get a rabbit out of a hat,” he told her, laughing so hard he had tears in his eyes. “Maybe you can conjure up something for me to drink?”

However very quickly they were all focussing on Muko's discovery and congratulating him.

“It's tremendous,” Amartia said with unaccustomed enthusiasm. “It's a mathematical riddle but it's not a magic square. Look! The sum of the numbers in the first row doesn't equal the sum of those in the second or subsequent rows. Which makes it definitely not a magic square. In any case, some of the numbers are duplicated so it could only be a pseudo magic square.”

Muko got right up close and peered at the numbers. He

lifted up his hand and passed it along the gap between the stones which formed the edge of the square. Then he moved his hand inside the square and this was when the real magic happened. He touched a number and it shone as if there were a bright light being projected onto it. When he touched a second number, the two of them changed places.

He jumped back from the wall, startled. “What was that?”

“Only magic will let you through,” Gelio quoted.

“But there must be millions of possibilities,” objected Paidia. “How are we going to solve it?”

“I have an idea,” said Muko. “If we add up all the numbers and divide by the number of rows, we'll have the sum of the numbers that there should be in each row and column. Do you see?”

While Muko was explaining his idea, Amartia had stepped quickly up to the wall and touched a couple of numbers. There was a loud CLANG and the magic square appeared before their eyes. All the numbers in the square and the square itself shone brightly – so brightly that the children were forced to close their eyes and turn away.

When the bright light had gone they looked again, and lo and behold there was the passage in front of them. The wall had disappeared and the way to the artefact was open.

“We were going nowhere,” said Amartia. “There were far more than millions of possibilities.”

“But how did you do it?” the others chorused excitedly.

“I just saw the solution.” Amartia was very low-key about it all. “It was only a matter of adding some numbers. We had to suss it out quickly because it's almost midnight.”

The went through the passage and into the courtyard. They walked right round the artefact and back to the front again.

“What should we be looking for?” asked Muko in a hushed voice. “When will we know it's midnight, anyway?”

All of a sudden the whole mechanism went into motion, making a tremendous racket. The gears rotated and somehow the walls around the courtyard also moved. The symbols on the pillars changed places. Then, just as suddenly as it had started, all movement ceased and everything went quiet.

In the abrupt silence Amartia's calm voice could be heard clearly: “I'll know when it's midnight.”

“How will you know?” the others asked in unison.

“I can tell the time by the moon,” Amartia explained.

After a couple of minutes the whole surroundings moved again.

“Why didn't we hear this when we were outside the courtyard?” Paidia wondered.

“It must be magic,” said Gelio.

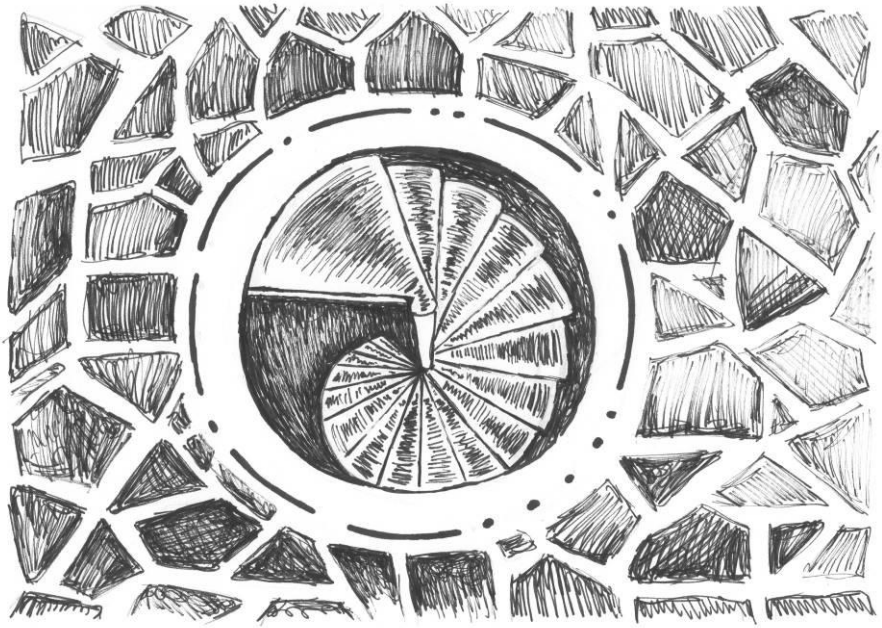
“The next change will be on the stroke of midnight,” Amartia informed them.

The children braced themselves but had no idea what they should be looking out for. In order to have a better view when the moment arrived, they positioned themselves one on each of the four sides of the artefact.

It started up again. Everything was shifting around but this time it was different. Muko, on the south side, shouted that the passage they'd come down was closing. Amartia called out that it wouldn't be long before the next change, which definitely put the wind up them. They looked at the pillars and at the machine but they couldn't see any new clues. They panicked and shouted louder and louder, trying to make themselves heard above the noise of the machine, until Muko yelled at them to be quiet. He went over to the pillar that had the symbol from the book, touched the carving, and everything stopped. There was a grave silence.

Silence expect for a very quiet ticking, like that of a clock. Muko tried to find where it was coming from. He put his ear to the wall, and the pillar. Feeling along the pillar, he put his hand on a loose stone. There was a loud CRACK and the courtyard floor in front of him split open to reveal a passageway with a

spiral staircase leading down.



The intrepid Muko led the way down the stairs, the others following. They were now under the courtyard but there was something wrong. Looking up, they could see the artefact through the ceiling as if the floor of the courtyard were made of glass. And yet when they'd been above looking down, the floor had been solid rock. They looked into the chamber ahead of them and saw a whole load of different mathematical symbols and what looked like … skulls. Suddenly they were very frightened. Paidia held on tightly to Gelio.

The artefact started to move, this time very slowly. They looked up, through the glass floor, and saw a bird flying over. It, too, was moving very slowly – flapping its wings at snail's pace as if it were suspended in some kind of viscous liquid. Muko pointed the bird out to the other children. None of them had any idea what was happening.

Then they noticed another passage leading away from the chamber on the other side. Just as they did so, both the entrances started to close. The children hurled themselves across the chamber and into the far passage just in the nick of time. They'd done it! The entrance closed behind them. They were now in a narrow corridor in the heart of the mountain.

They weren't in total darkness because there were some symbols which shone out brightly and showed the way they should go through the tunnel. It wasn't silent, either. They could hear a distant rumble – as if a heavy wheel were being rolled along on hard ground. There was something sinister about the tunnel.

“There's no way back now,” said Muko.

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Just a couple of MD5 hashes.

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Please, do not try to reverse them.