Unpublished Draft

Tommy Turtle at the Rabbit School: Book 1
By Dr. Y (AKA Bill Lauritzen)

Chapter 1: A Sad Turtle

Tommy Turtle had never missed a day of school. But this morning, as he shuffled out of the Principal's Office, his shell feeling heavier than usual, he thought angrily, "I'm not going back to class!"

Turtles swim very gracefully, but on land they walk clumsily with four webbed feet in a side-to-side way. This could be called "waddling." Tommy waddled from the school to the side of Blue Lake, the morning birds calling back and forth above him and leaves rustling in the breeze.

Today the lake surface was mostly dark gray matching Tommy's mood it reflected the blanket of clouds and the cool morning air made him shiver slightly a gentle breeze from the west small ripples across the surface surrounding the lake was a forest it's naked branches reached toward the sky like bony fingers

"Rain is coming," Tommy thought, sniffing the damp air.
Tommy plopped into the water, swam under the surface, and felt the cold on his face. Pulling the water back with his front feet, he steered himself with his back feet. He swam for a long time until he reached a faraway cove that had a floating log. Some minnows swam beside him,

their silver scales flashing in the murky water, but he ignored them as he climbed onto the log. The smell of wet wood greeted him.

He thought about the classwork, the teachers, and the students. He felt defeated by the stress and pressure of school. Tommy thought, "Rex Rabbit always gets picked to read aloud and he always gets a high score on the math quizzes. But he's such a bully!"

Some animals say that turtles don't cry, but tears came from both his eyes, mixing with the drops of lake water on his face.

1. What did Tommy Turtle do instead of going to class?
2. Why is Tommy crying?

Chapter 2: An Earlier Time

As the tears flowed, Tommy felt some relief, like rain washing away dust. His mind drifted back to an earlier time:

Near the Turtle Village where he lived, life had been easy. He chased small fish that darted and shimmered in the sunlight. He ate earthworms that wiggled between his beak, crunchy caterpillars, slippery snails, shiny beetles, and grasshoppers that tickled going down.

Sometimes, while swimming, he poked his head out of the water to look around, feeling the warm sun on his face. When he was tired, he sat on a log in the sun with the other turtles, their shells warming the insides, while their feet sometimes dangled in the cool water. The turtles felt safe from most predators because their hard shells protected them like armor.

In the spring, he watched the forest dress itself in green, tiny leaves waving like flags in the breeze. In the summer, he watched the grass along the shore grow tall and then dance with the wind. During the autumn, the leaves from the trees would float gently to the ground, sometimes swinging back-and-forth. Geese filled the sky in a giant V shape as they flew south for the winter, their

honking rolling across the lake. He sometimes tried to count the geese, but there were too many. At night, he watched the moon and the stars as they silently rounded the sky.

"I wonder how many stars there are," he often thought. When he slept, he dreamt about the stars, and he once dreamt that there were other turtles out there somewhere looking back at him through telescopes made of hollow logs.

His parents both worked for the National Forest Service and their job was to count the number of fish, animals, birds, and plants in the area of Blue Lake. His parents were very busy these days with their AI Helper and talked about many things he didn't understand such as "estimations," "models," and "clusters." This work was very important, they explained, because of the changing weather.

They had given him some paper and pencils and showed him how to count with stick marks, also called tally marks, like these: IIIIIIIIIIIIIIIII. They said that counting was a tool that allowed one to find patterns.

They pointed out to Tommy many patterns in nature: patterns in the flowers, patterns of birds flying north and

south, and the patterns in the movements of the sun, moon and stars.

His father had said, "When you see patterns in nature, you can make predictions and prepare. Counting helps to look for patterns and make predictions. So that's why your mother and I count all the animals."

One time he saw a furry animal about the size of a raccoon, with a naked tail, a white face, a red nose, and small, dark eyes. He carefully watched it while it ate some insects, its whiskers twitching as it searched the ground, and later he described it to his parents.

"That's an opossum," his father had said, his voice growing serious. "We've had reports of several of them moving into this area."
"Why are they moving here?" Tommy asked, his own nose wrinkling with curiosity.
"The climate in this area is getting warmer, and they feel more comfortable now in this area. Let us know if you see any others."

Tommy reported two others that he saw to his parents. They thanked him and explained that new animals could take food away from animals already living here, and that they would need to watch the situation carefully.

Tommy began to make marks on paper for the animals he saw, and his parents showed him how to bunch them together. After he saw 4 squirrels, he could made 4 tally marks. Then, when he saw another squirrel, he could make another mark through all four of them. This showed 5 total squirrels. By making these groups of 5, 𝍸 he could quickly see how many animals he had seen.

1. What did Tommy Turtle do in his free time when life was easy, and what did he dream about?
2. What did Tommy's parents do for their job, and why was it important?
3. What animal did Tommy see that he didn't recognize, and why were his parents concerned about it?
4. How would you write the tally marks for the number 18.
5. What pattern does the sun follow in the summer and winter: Is it lower or higher in the winter as it crosses the sky? In the summer?

Chapter 3: Peter Opossum

One day, in a late evening of summer, there had just been a thunderstorm. Tommy was waddling on the muddy ground of the forest next to the lake, heading home. His feet made soft squishing sounds in the mud, and the air smelled fresh and earthy.
He came to a clearing and startled a small opossum eating something. The wet leaves dripped around them in the growing darkness.

The opossum showed its sharp teeth and hissed at him. Tommy got scared, and he pulled his head and feet into his shell, his heart thumping against the inside.

"Sorry to scare you, turtle," the opossum said after a moment. "You scared me also. I thought you might be the coyote that killed this snake. My name is Peter Opossum. What's your name?"

Tommy slowly and carefully pushed his head out of his shell. "I'm Tommy Turtle," he said. "Are you going to eat all of our food?"
The opossum laughed, "Haha, you know nothing about opossums. Most animals are happy to have us around, because during the night we are like garbage collectors.

We eat leftover food, dead animals, and also ticks. Would you like a bite of this snake?"
"No, thank you," Tommy said, his stomach turning slightly at the thought.

Tommy reported to his parents what Peter Opossum had told him, and his father later found that the opossum was telling the truth. "That's good news," said his mother. "Those ticks are annoying and they can carry disease."

1. Was Peter Opossum good for the forest?

Chapter 4: Green Forest Elementary School

One day that summer his mother had turned to him and said, "Tommy, you are old enough now so you can go to school and learn to read, and learn about math, and study about the world." Tommy had asked eagerly, "Can I learn to count the animals like you and Dad?" She had smiled and said, "Yes."

So he had entered the lake near the water lilies covering the surface near shore. He swam across the cool lake and then shuffled over to the Green Forest Elementary School. Most of the animals called it the Rabbit School since all the teachers and most of the students at the elementary school were rabbits. At the school was a kindergarten class and a class for each grade, 1 through 6.

The buildings were special. Each grade had its own small building, and they were arranged in a perfect circle, like the moon and the sun. The school office sat in the center of the circle. The new library, with its AI Helper, was located just outside the circle. All the buildings were located about halfway between the shore of Blue Lake and the forest, in a clearing of grassy playgrounds that smelled of clover and wildflowers.

The teachers were all large rabbits, while the students were medium-sized rabbits in Grades 4, 5 and 6 and small rabbits in Kindergarten and Grades 1, 2, and 3. The rabbits lived in the Rabbit Village on the northeast side of the lake, near where the morning sun first rose above the treetops in summer.

Rarely, an opossum, beaver, raccoon, or other similar creature could be seen in some of the classes. In Tommy's third grade class there was himself, 16 rabbits, and Peter Opossum, who slept most of the day, never turned in homework, and was always late for class. Most of the rabbits were a bit afraid of the opossum because he had sharp teeth.

The birds flitted here and there, while the squirrels chased each other up and down and across the tops of the trees. They both had their own schools not too far from the far western side of the lake. Meanwhile, the geese had a school on Goose Island in the middle of the lake. The geese would sometimes all march past the school, honking very loudly for the rabbits and other students to get out of their way.

At night, when all the rabbits and other Green Forest Elementary School students and their families were safe in their villages and homes, the foxes, coyotes, and

bobcats came out searching for food. Tommy always had to be home before dark.

There was an animal that hunted during the daytime—eagles. Although eagles usually eat fish, about ten years ago, during the morning break, an eagle had carried away a first grade turtle in its talons. And once, three years ago, an eagle had swooped down and carried off a second grade rabbit.

During this recent loss, the students and teachers had not seen the eagle in the sky, but some had seen its shadow as it swept across the playground, its wingspan suddenly blotting out the sun. Then, the eagle's call had pierced the air, a long low and eerie whistle. It had sent shivers through the bones of all the animals at the school, and some of the smaller rabbits had frozen in place, making the second grade rabbit an easy prey for the eagle.

So once a month, when the students were outside on the playground during the morning break or after lunch, they would have an "Eagle Drill." A teacher or the principal would shout "eagle!" and all the students would rush inside and crouch under their desks. They were supposed to "duck and cover." Also, if anyone ever saw the eagle or the eagle's shadow, they were instructed to shout "eagle" with their loudest voice.

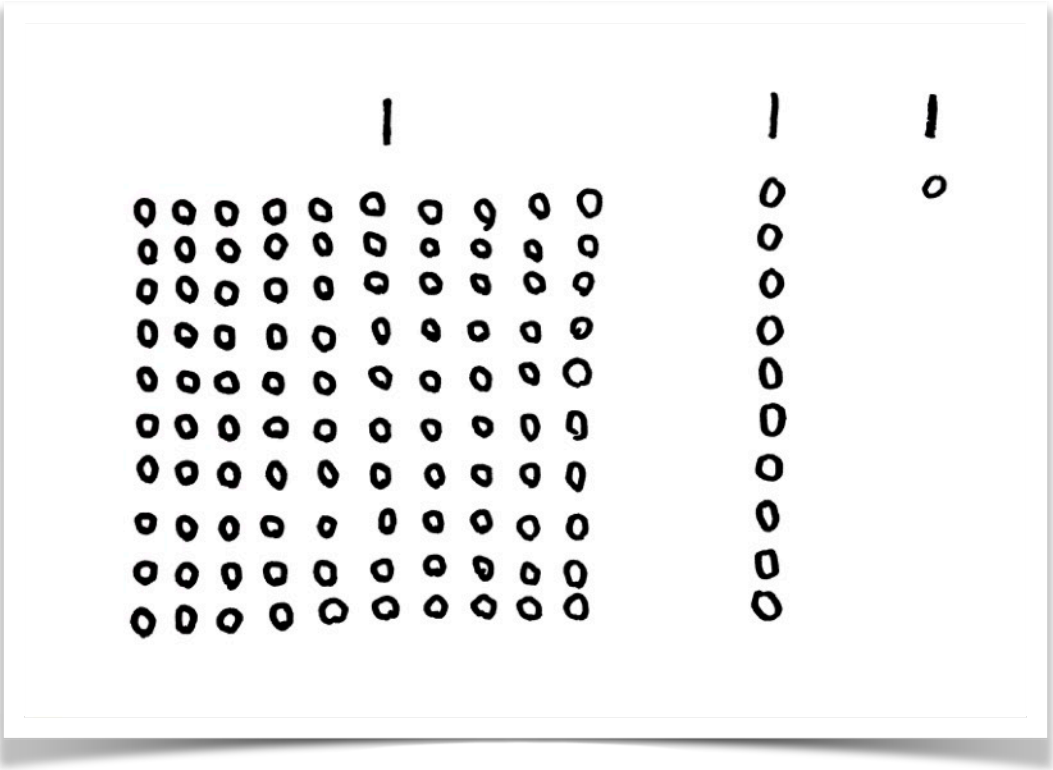
1. What kind of animals are the teachers and most of the students at Green Forest Elementary School?
2. What other animals sometimes attend the school?
3. What is an "Eagle Drill" and why do the students at Green Forest Elementary School practice it?

Chapter 5: Kindergarten and Grade 1, How Much and How Many,

A cool autumn breeze rustled through the changing leaves as Tommy waddled to school. He passed Peter Opossum heading slowly to school, looking sleepy but satisfied after a night of collecting things to eat. Tommy wondered what Peter found in the dark that he himself never saw during the day.

In kindergarten and first grade, Tommy had learned the pencil marks, 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9, and how they combined together to show "how much." His parents had been excited when he first understood this, saying it was just like their wildlife counts.

He learned that the pencil mark "1" meant different things depending on where it was located. When it was located on the far right it meant one worm, one egg or one something. When it was located just to the left of that, before a zero, it meant 10 worms, or 10 grasshoppers, or 10 things. And when it was located further to the left, before two zeros, it meant 100 worms, or grasshoppers, or things. The teacher called this the "place value."



Tommy Turtle's 111 turtle eggs.

For the three marks 111, Tommy drew a picture of 111 turtle eggs. Rebecca Rabbit, who sat nearby, noticed his careful drawing and smiled. Unlike the other rabbits who rushed through their work, she seemed to appreciate his attention to detail.

He thought, "It is quicker to write '111 turtle eggs' than to draw all those eggs or all those tally marks."

In the library, he read that in Rome they had used a different way to show "how much." The Roman letters, I, V, X, L, C, D, M, meant 1, 5, 10, 50, 100, 500, and

1000. So three, III, would mean three eggs. The two marks VI would mean six eggs.

Tommy thought for a minute, "If I saw 37 eggs in the lake, I could show 'how many' on paper in many ways. I could draw a bunch of eggs in a line."

He wrote 37 circles:
OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO

"I could write it using tally marks."

He wrote 37 using tally marks.
𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 II

"I could write it like the Romans wrote it."
He wrote XXXVII.

"I could write it using our modern marks."
He wrote "37."

"The short way is quicker, but I like to check my answers using tally marks." So when the teacher asked him if 5 + 2 equaled 2 + 5, Tommy wrote IIIII + II = II + IIIII and he could see that it was true.

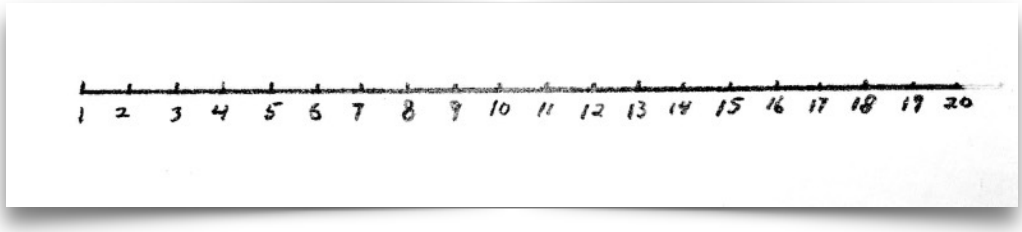
He also noticed that with the plus sign, +, two lines came together, like *adding* one and one, but with the equal sign, =, the two lines stayed apart, and had e*qual* lengths.

1. What does the "1" mean in this number: 125?
2. What are four different ways to write the number 28?

Chapter 6: Grade 1 Miss Duller, A Number Circle

One October day in the second grade, there was a chill in the air and some leaves had begun to fall from the trees. The water in the lake was cold but not freezing cold. Tommy decided to walk to school on the path from Turtle Village around the lake. He heard the geese on Goose Island honking loudly, Honk! Honk! Honk! "I should have swum," he thought. Under the water they were not so loud.

Once inside, his second grade teacher, Miss Duller, a young, plump, gray-brown rabbit with a large white cotton-tail, taught them about a number line. She said it would help them to "visualize" numbers and their relationships to each other and they could use it to do addition and subtraction.



Miss Duller's number line.

She made a line, numbered it from 1 to 20, taped it above the board. Then she told the students to make one

of their own and to be very neat, while she worked at her desk. Tommy was going to raise his front foot and tell her she forgot to put zero on the line, but he decided not to.

Tommy had never seen straight lines in the forest. However, he had seen the round moon, tree rings, the round berries and the round nuts that the birds and squirrels ate. Also, he had seen the round sun! And he knew the Earth went round the sun, and the moon went round the Earth. "Nature doesn't make straight lines," he thought, "so why should numbers only go in straight lines?" Using a circular lid from a large jar, he drew a circle, and then he numbered it.

"See," Tommy whispered to Rebecca, "the numbers go around like the sun goes around in the sky." Rebecca nodded thoughtfully. "And you can keep going around and around, just like the seasons," she added.

Tommy added, "With a straight line, if you need more numbers, you have to get a bigger paper. With a circle, if you need more numbers, you also have to get a bigger paper. So the two ways are the same for paper." "It's like you took the line and just wrapped it into a circle," said Rebecca.

Tommy felt relieved that Rebecca understood. It was the first time someone at school had really listened to his way of thinking about numbers. Tommy didn't know it then, but his number circle would help him solve an important problem in the future.

When everybody had finished, Miss Duller stood on her two hind legs at the front of the class. Her ears flopped around her head and her white belly showed. She told the students to start at the number 2, and, “Using your pencil eraser, hop four places to the right.”

When all the students were finished hopping their pencils, she wrote on the board, “2 + 4 = 6.” Meanwhile, Tommy slid his pencil four places, like a turtle, from 2 to 6. Tommy showed Rebecca how adding 2 and 4 worked the same on his circle.

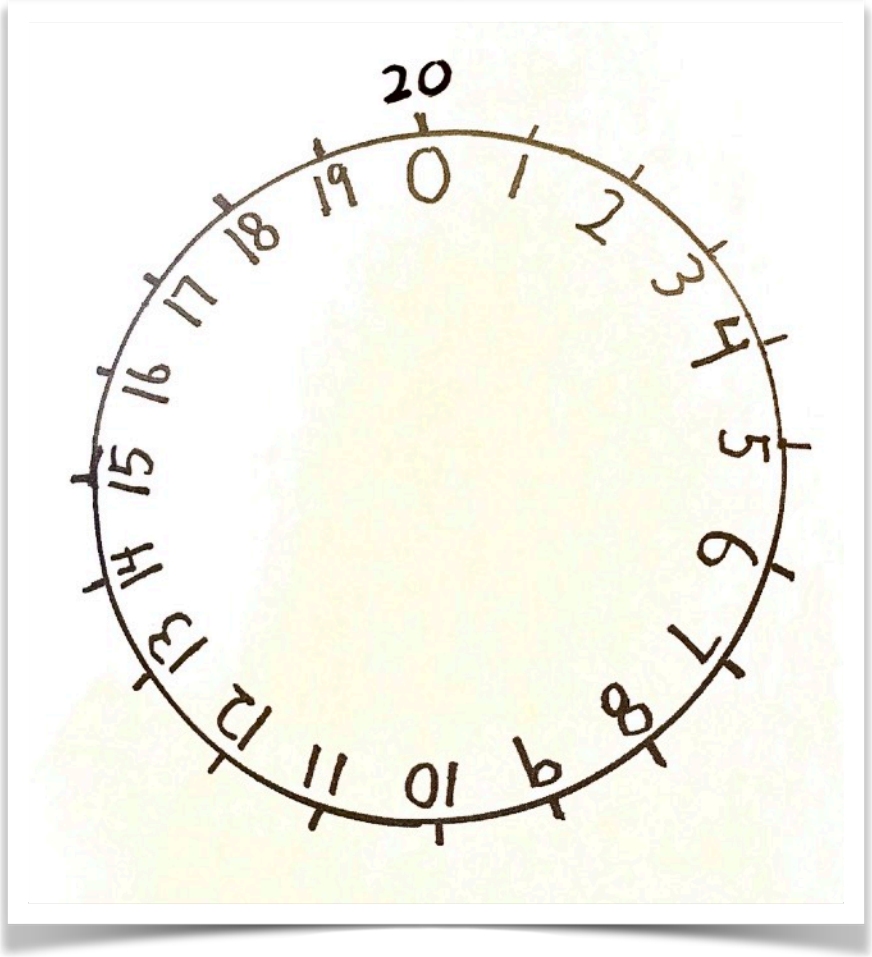
Then, Miss Duller said, "Now let's start at 6 and ‘hop like a rabbit' 8 places to the right. Where are we now?”

Tommy slid his pencil eight places around the circle and raised his front foot.

“Tommy?” Miss Duller said.

“14,” he answered.

“That’s correct,” she said as she hopped slowly toward his desk, checking every student’s work as she



Tommy Turtle's number circle.

went. Suddenly she stopped and said, "Where's your number line, Tommy?"

"This is my number circle," he said.

"Number lines aren't in a circle!" Said Miss Duller, her ears standing straight up now and her eyes narrowing.

"Number circles are," said Tommy.

"Don't get smart with me, young turtle!" Miss Duller responded. "Go sit in the corner for 30 minutes!" So

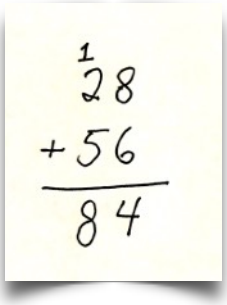
Tommy waddled over to the corner and pulled his head into his shell.

He listened as Miss Duller held up Rex Rabbit's number line and said, "Students, look here at Rex's number line. See how neat it is and how straight?" "Yes, Miss Duller," everyone answered together—except Rebecca who glanced at Tommy and then rolled her eyes.

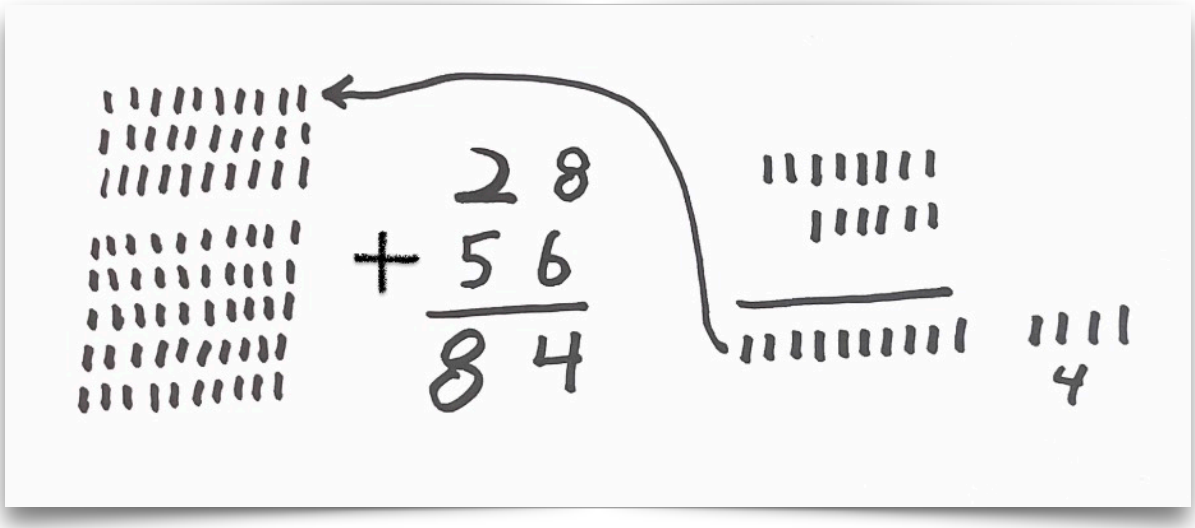
1. What did Tommy Turtle do when his teacher asked the class to make a number line?
2. Does Tommy like to think for himself?
3. Why did Miss Duller make Tommy sit in the corner, and how do you think he felt about it?

Chapter 7: Grade 1 Miss Duller, Turtle Addition

During math class, he often did the addition problems his own way, rather than the way Miss Duller had shown the class. Although he always got the correct answer, Miss Duller would take points off for not doing the problem her way.



For example, on the problem 28 + 56 the other students just moved the 1 in 14 to the left one place, above the 2, and then added, like the teacher had taught them. But Tommy Turtle drew ten tally marks and then he moved all the marks to the left, above the 2.



Sometimes Miss Duller gave them a sheet of paper with many addition problems on it. Tommy did them his way.

He thought, “There’s a lot of motion behind addition. When you add two apples to three apples you have to move some apples. I want to see the motion, so that’s why I make the tally marks.”

But Miss Duller said, “Tommy Turtle, you take too long to do the problems! Why don’t you just do them like I taught you and how all the other students do them!?”

She went on, “If you don’t go faster, you might get left behind and have to repeat second grade!” When she talked like this, he pulled his head into his shell a bit.

When Rex and some other boy rabbits saw his drawings they laughed at him and called it “Turtle Math.”

One day, Miss Duller wrote a problem on the board: 28 + 56. As usual, Tommy carefully drew his tally marks while the other students quickly wrote their answers.

"The answer is 74!" called out Rex Rabbit. “Anyone else?” Asked Miss Duller.

Tommy kept working a few seconds longer. Then he raised his front foot. "I got 84," he said quietly.

Miss Duller did the problem on the board. "Tommy is correct," she said, though she still frowned at how long he had taken. Tommy felt a small surge of pride, but kept his head down.

“Good job," Rebecca whispered to Tommy.” He noticed that Rebecca Rabbit did her work carefully also.

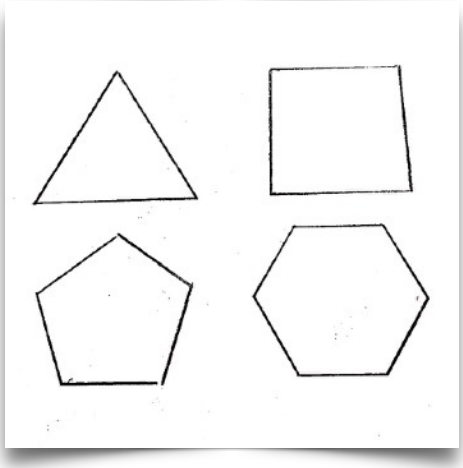
1. What did Tommy Turtle mean when he thought, “There’s a lot of motion behind addition.”
2. What did Miss Duller say to Tommy about his speed in doing the problems, and how did Tommy feel about it?
3. How did the other students react when they saw Tommy's drawings for his addition problems, and why did Tommy continue to do them his way?

Chapter 8: Grade 2 Miss Duller, Drawing Figures

One day in May, a warm breeze blew from the South and blossoms began to appear on the trees. The lotus plants floated on the lake. Tommy saw that an armadillo, another new animal to the area, had made a hole in the ground to keep warm at night. He reported this to his parents, and they told him this was called a "den."

Miss Duller drew four figures on the board.

"Three sides and three angles, four sides and four angles, five sides and five angles, six sides and six angles," she said merrily.



Miss Duller's drawing.

"A triangle, a quadrilateral, a pentagon, and a hexagon. I want you to draw and label each of them."

Then, all the students started drawing them.

Tommy thought, "These are difficult names. I need something simpler so I can remember them."

He decided to call an angle a “nik” because it could nick you if you walked past it, just like some tree branches could nick you. So he changed “triangle” to “3-nik,” and the other names also. After school he went to the library, and showed his names to Mr. Smart, the raccoon librarian. Rebecca Rabbit was there also.

Triangle	3-nik
Quadrilateral	4-nik
Pentagon	5-nik
Hexagon	6-nik

Mr. Smart’s computer printout.

"Why did you choose the word 'nik'?" Rebecca asked, her nose twitching with curiosity.
"Well," Tommy said, "when you walk through the forest, tree branches can nick you if you're not careful. And these shapes have points that could nick you too. A triangle has three places that could nick you, so I thought '3-nik' was easier to remember than 'triangle.'"

Mr. Smart's eyes lit up. "That's quite clever, Tommy. You've connected something from nature to help remember these mathematical terms."

Mr. Smart printed out a chart with the old names and the new names. “I wonder what a 100-nik looks like …” thought Tommy.

Tommy passed the second grade. In the summer, on July 21, In a sandy clearing, not far from Turtle Village, his father had put a large pole in the ground which made a shadow. He asked Tommy to notice the length of the shadow throughout the year, and to see the pattern from year to year.

His father had said, “When you see patterns in nature, you can make predictions and prepare. Counting helps to look for patterns and make predictions. So that’s why your mother and I count all the animals.”

1. What did Tommy tell his parents about what he saw, and what did they teach him about the hole in the ground?
2. What shapes did Miss Duller teach the class about, and why did Tommy change their names?
3. Who helped Tommy print out a chart with his new names, and what was Tommy curious about after that?

Chapter 9: Grade 3 Mrs. Block, Bullying

During lunchtime all the students would go outside and play. Tommy hurried to look at the shadow pole. He had now placed over 60 pebbles, which had been getting further from the pole each day.

His mother was nearby, recording the day's bird count in her notebook. She smiled as Tommy placed a pebble marking the length of the shadow.

Back in the schoolyard, Tommy turned his attention to the caterpillars at the edge of the forest. He carefully picked up a caterpillar with his front claws and brought it to his mouth. It was crunchy and delicious.

As he ate, he watched the small birds moving between trees. Their movements were quick and graceful and their motion when flying was just a blur. As he watched with his mouth open, he thought, "Wow! These animals are the opposite of me!" He wanted to count them, but they moved too quickly. He found another caterpillar under a leaf and scooped it into his mouth.

Meanwhile, the boy rabbits were having fun playing the game "tag," and the girl rabbits were skipping rope.

Suddenly, Rex Rabbit hopped up beside him laughing and saying "Turtle math! Turtle math! Tommy's gonna get left behind!" Some of the other boy rabbits also joined in the chant. "Turtle math! Turtle math! Tommy's gonna get left behind!" He just kept eating, focusing instead on the forest around him

Rebecca had watched the scene unfold. She wanted to help Tommy but wasn't sure how. She knew what it felt like to be different—she sometimes wanted to solve math problems rather than skip rope with the other girl rabbits. As she watched Tommy calmly continuing eating, despite the taunting, she admired his quiet strength.

While eating he also listened carefully to the many different bird calls that filled the forest air. He heard the high-pitched chirping of the sparrows, the sweet songs of the finches, and the harsh caws of the crows. He was fascinated by the variety of sounds that the birds made and at the complexity of nature. He listened attentively, trying to identify the birds by their songs and memorize their patterns.

When he finished his second caterpillar, he took out his notebook and a pencil, and he began to mark down the bird call patterns like this:

caw caw caw caw, caw caw caw caw. 4,4
tweet-tweet, tweet-tweet, tweet-tweet. 2,2,2
chee-chee-chee-chee-churrrrrrrr, chee-chee-chee-chee-churrrrrrrr. 4,1,4,1
tseee-tseee-tseee, tseee-tseee-tseee. 3,3

The breeze rustled through the leaves, carrying the scent of approaching rain. Getting no reaction from Tommy, the boy rabbits had left. Tommy continued writing in his notebook the rabbits' teasing already forgotten.

Suddenly, just as Rebecca rabbit had hopped up to him, Tommy looked around carefully. All of the birds seem to have disappeared and stopped calling, and all the squirrels had also disappeared and stopped chattering.

"The forest is usually so noisy," Tommy said. "But sometimes everything goes quiet—not just the birds, but even the squirrels."
Peter Opossum had been sleeping in his usual spot under a bush, but the rabbit boys had wakened him. "I've noticed that too," he yawned. "when it gets so quiet it wakes me up."

Rebecca's nose twitched with interest. "When does it happen?"
"I'm not sure," Tommy replied. "I'm trying to figure it out."

Meanwhile, very high in the sky, a small dot moved in circles. It was an eagle, and it was gliding on the air currents. Its shadow fell over the lake, so none of the students could see it. But the eagle could see all of them. The eagle circled once more, then turned toward the cliffs to the far west to look for snakes.

1. What patterns did Tommy observe in nature (shadows, birds, and forest sounds)?
2. How did Tommy and his friends react when Rex Rabbit and others teased him about "turtle math"?
3. What unusual change in the forest did Tommy, Rebecca, and Peter discuss, and what was really happening?

Chapter 10: Grade 3 Mrs. Block, Computer Games

In the third grade, his teacher was Mrs. Block, a middle-aged rabbit with reddish-brown fur around her eyes, on her ears, and on the rear of her body, and white fur everywhere else. She wore small glasses. Usually, after showing something in front of the class, she would assign classwork.

She always proudly announced who was the first to finish the classwork, "Rex Rabbit has already finished," she would say, "so he can play computer games."

Most of the rabbits loved to play computer games which could put them in an imaginary, but realistic world. Recently, the school had purchased some 3D goggles, which made the experience even more realistic than the computer screen. The boys usually grabbed all these as soon as they could.

The boy rabbits really liked to play ESCAPE! In this game a hungry animal would hunt them and try to catch them. The boys could choose a fox, coyote, bobcat, hawk, or eagle to be the hunter, and then they would have to run and hide from it. If they could escape the hunter for two minutes, they would win the game and earn points.

In a more difficult level of the game, the boys could choose, “Any,” and the they would not know which animal was coming for them. In level one, only one hunter would chase them, in level two, two hunters would chase them, and so on up to level five. No boy had ever reached levels 4 or 5.

Most girl rabbits usually played WARREN. In this game, the girls would get points for building a rabbit shelter, called a warren. It was made of underground tunnels and rooms. The girls would gather soft material, such as fur, grass, or leaves, and put them in the rooms for raising young rabbit avatars.

Tommy watched the other students playing their games. He noticed that while the rabbits were absorbed in their virtual worlds, Peter Opossum continued sleeping and Rebecca sometimes stared at the boys' screens. Tommy wondered how she felt—perhaps she also felt different than the other students.

Although Rebecca Rabbit enjoyed playing WARREN, after some time she found it boring. She sometimes watched the boys’ screens as they played with the goggles. So one day, Rebecca Rabbit hopped to the front of the class and said to Mrs. Block, “I want to play

ESCAPE!" Several of the students chuckled, but not Tommy.

Mrs. Block smiled nicely, "That's a boys' game, Rebecca."
Rebecca was firm, "I don't care. It looks like fun. The other game is boring."
Mrs. Block said, "The boys' game is very competitive and fast-paced. I think you should stay with the girls' game."
Rebecca doesn't move, "I want to ask Mr. Stern."
Mrs. Block's ears get suddenly stiff and her nose begins twitching very quickly, "Certainly, go ahead and ask him!"

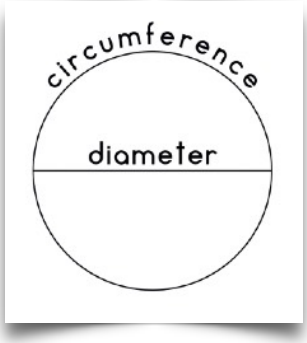
Five minutes later, she returned looking sad, and as she looked at Mrs. Block, she thought she saw a slight smile on her face. As she hopped toward her seat, Rex Rabbit whispered to her, "You would have gotten eaten every time." She ignored him, but her sad eyes suddenly disappeared and became more focused again.

1. Why does Rebecca Rabbit want to play the computer game ESCAPE!?
2. What do you think will happen to her?

Chapter 11: Grade 3 Mrs. Block, Circles

As usual, Tommy Turtle did his classwork slowly and made drawings to help him. "If I learn carefully, I can count things and see patterns, like my parents, and maybe learn to count the geese and even to count the stars," he thought.

So Tommy Turtle was usually the last one to finish his classwork. Mrs. Block would say, "Tommy Turtle, if you don't do your work faster, you might get left behind." He remembered his last teacher, Mrs Duller, telling him he might get "left behind." Tommy thought, "Not again."



As usual, Peter Opossum mostly slept.

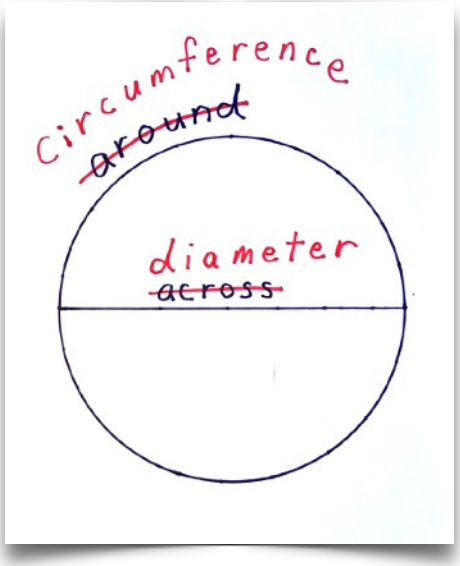
When Mrs. Block taught them about circles she explained that the line around the circle was called the circumference. And she said that if you drew a line from one side of the circle through the center of the circle to the other side, it was called the diameter. She showed them a drawing she had made.

She passed out twelve round lids of different sizes and told the students to use them to make circles. Then, they

should draw a line through the center, and finally, they should label the circumference and diameter.

As Tommy traced the around lid, he thought, "These big names must also be Greek names. Why do we have to use names that were made 2000 years ago by dead animals?" When he finished tracing around the lid, he thought, "My pencil goes around, so that's what I'll call it. The *around*." When he drew the line across the circle, he thought, "My pencil goes across so that's what I'll call it. The *across*." These words made sense to him—they described what the pencil did.

He was still the last one done. When he finished, everyone was already playing computer games.



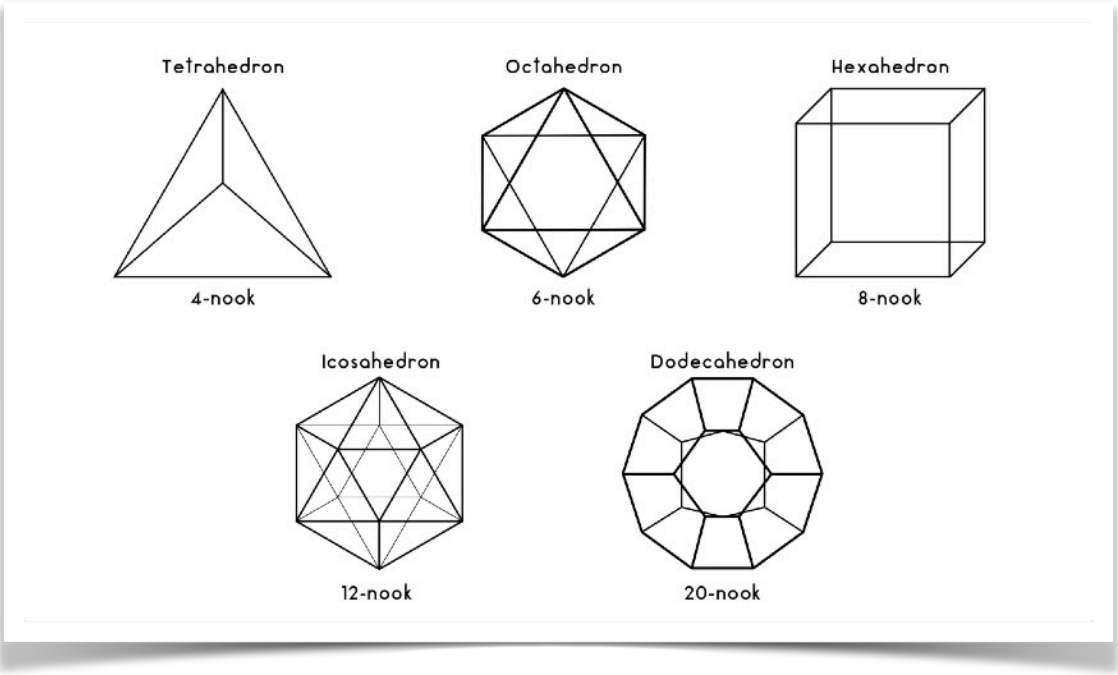
The next day Mrs. Block passed back all the papers. Tommy's paper had his easy words crossed out, and the big words written in.

1. Why did Tommy Turtle do his classwork slowly and carefully while the other rabbits rushed to finish?

2. What were the words that Tommy Turtle used instead of circumference and diameter?
3. How do you think Tommy felt when he got back his paper?

Chapter 12: Grade 3 Mrs. Block, The Eagle

One hot May day, on his way to school, Tommy passed the tall shadow pole his father had placed, noting all the small pebbles he had placed at noon each day showing the length of the shadow. Since December 21, the



Computer printout of the Greek names and Tommy Turtle's easy names.

shadow had been getting shorter, so he had a row of about 150 pebbles that were getting closer to the pole. At this hour, the shadow was way off to the west and disappeared into the trees.

During the morning break, Tommy took a dip in the lake. The water was so warm that he dove down deeply to where it was cooler.

Afterwards, on the playground, he ate two worms. Suddenly, he felt a large weight on his shell. Weight, no weight, weight, no weight, weight, no weight ... He turned his head around.

Rex Rabbit had hopped up on Tommy's shell and was bouncing up and down. Rex started laughing and saying, "Turtle math! Turtle math!" A few other rabbits came and joined in the chant, "Turtle math! Turtle math! Turtle math!" He felt like his snack of worms was going to come out of his mouth. It did. Some of the rabbits said, "Yuck!"

Then someone yelled loudly, "Eeeeagle! Eeeeagle!!" At first, all the animals froze and then rabbits searched the sky looking for an eagle. Then all the rabbits began sprinting toward the school building. Tommy was going to pull his head into his shell and pretend he was a rock, but suddenly Peter Opossum was beside him. Peter said, "Don't worry, Tommy, that was me who yelled 'Eagle.'". Tommy and Peter watched the rabbits run, sometimes tumbling over one another, and they both laughed. "Thank you, Peter,"and then Peter Opossum and Tommy Turtle walked calmly together to the classroom where they found all the rabbits huddled under their desks covering their heads and eyes. Later, the teachers somehow discovered what Peter Opossum had done,

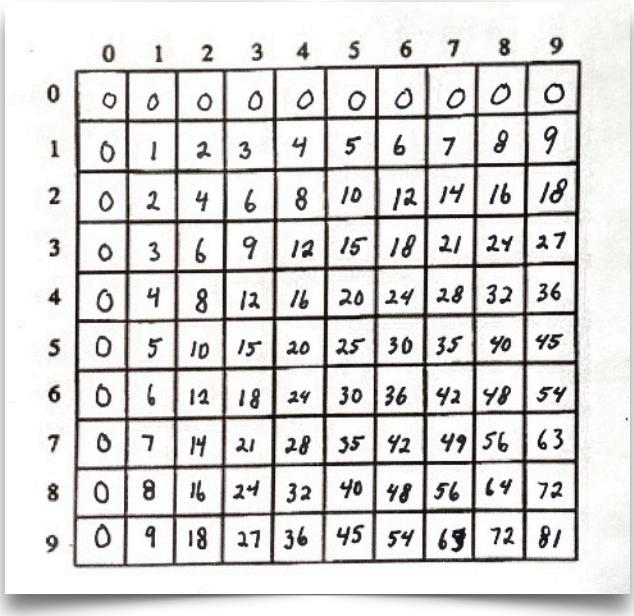
and they ordered him to sit in the corner all the next day.

On the way home, Tommy spotted Peter in his usual spot under the bush. Peter winked at Tommy, yawned, closed his eyes, and was soon asleep. Tommy smiled slightly as he continued on around the lake.

1. What did Tommy do during the morning break on a hot summer day?
2. How did Rex Rabbit make fun of Tommy?
3. Why did Peter Opossum yell "Eeeeagle"?

Chapter 13: Grade 3 Mrs. Block, Multiplication Triangle

One cold and cloudy December day, a strong wind blew in from the west, making waves across most of the lake. As he swam to school, Tommy stayed under the surface

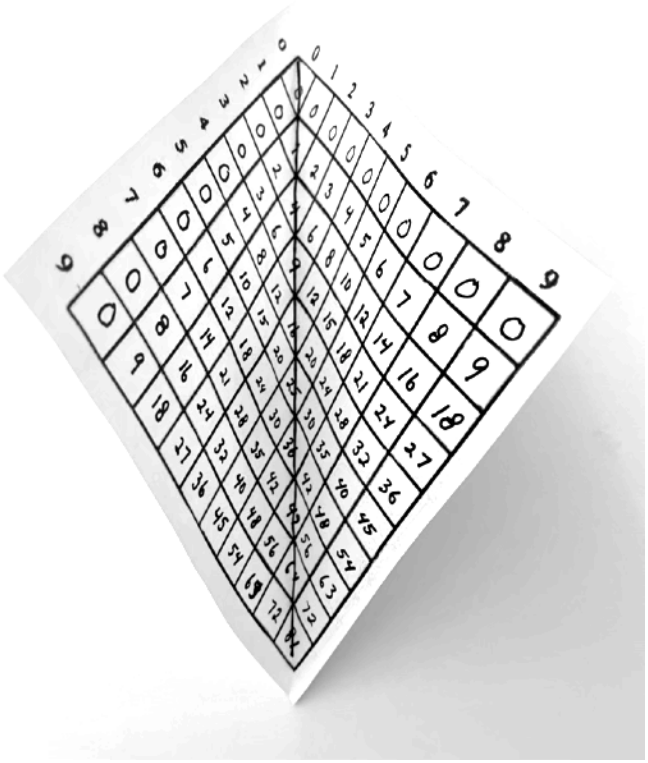


	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9
2	0	2	4	6	8	10	12	14	16	18
3	0	3	6	9	12	15	18	21	24	27
4	0	4	8	12	16	20	24	28	32	36
5	0	5	10	15	20	25	30	35	40	45
6	0	6	12	18	24	30	36	42	48	54
7	0	7	14	21	28	35	42	49	56	63
8	0	8	16	24	32	40	48	56	64	72
9	0	9	18	27	36	45	54	63	72	81

where it was calm. In class, Mrs. Block showed them a multiplication table she had made, taped it to the board, and told them to make one at their desk, "very neatly!" and fill it in. The students started to work, while Mrs. Block wrote report cards to send to their parents.

Tommy thought that Mrs. Block was giving them this work just to keep them busy while she worked on the report cards. Tommy started to make one, but then he stopped. He noticed that all the answers were listed twice. The answer for 1×0 was the same as the answer

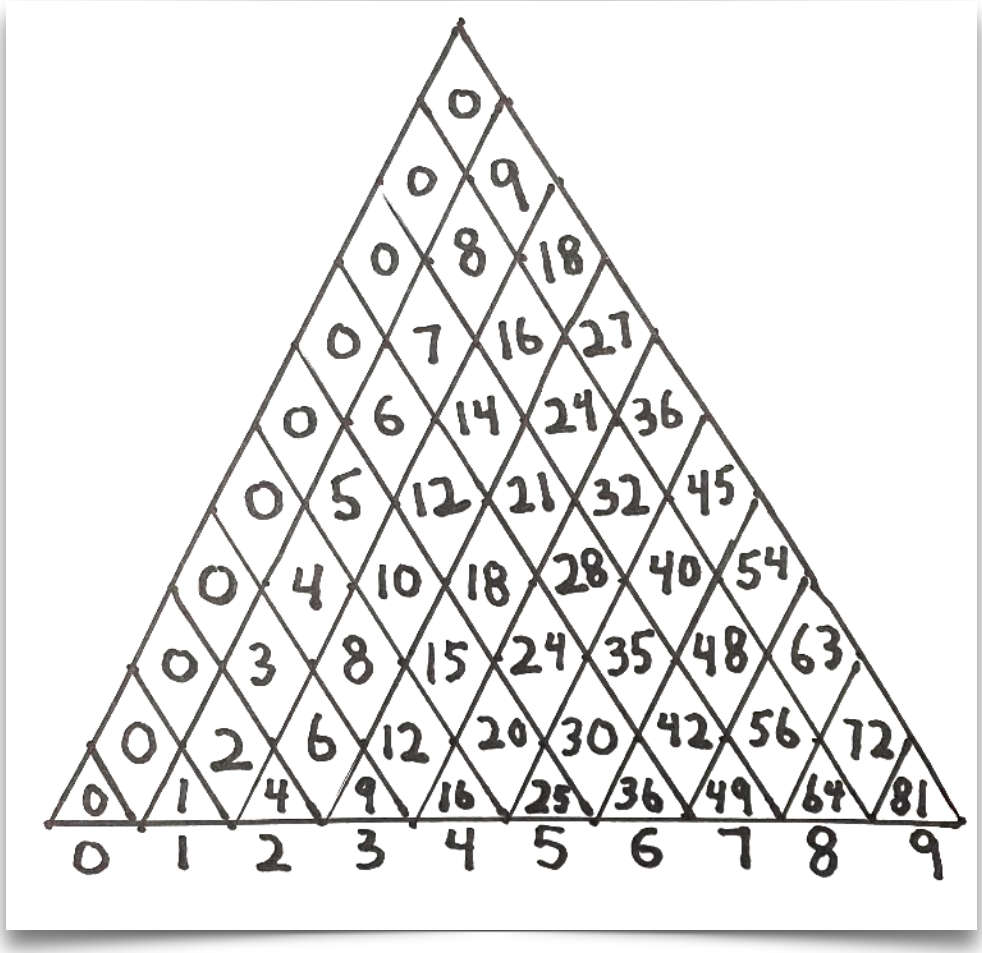
for 0x1, the answer for 2×1 was the same as the answer for 1×2, the answer for 3×1 was the same as the answer for 1×3, and so on.



He looked at the times table taped to the board and imagined folding it, so that each answer matched the other half.

Then he tried to make a simple multiplication triangle.

At first, he didn't know where to put the answers for 0x0, 1x1, 2×2, 3×3, 4×4, and so on. But then he saw that he could fit them in the little spaces at the bottom, so he did: 0, 1, 4, 9, 16, 25, 36, 49, 64, and 81.



Tommy and the students stayed busy for some time. When Mrs. Block had finished the report cards, she walked around the room and began collecting all the papers. When she got to Tommy's desk, she froze and said, “What’s this?!”

“That's my multiplication triangle,” said Tommy, nervously. “The number times itself is here at the bottom, and to multiply two numbers together, for example, 2 ×

8, you just slide one pencil up from 2, like this, and one pencil up from 8, like this, until they meet at the 16."

She lost her temper, "Tommy, you think you know everything! You take this to the principal's office and show him!"

Tommy took his paper and shuffled down to see Mr. Stern, who was a large, heavy rabbit. Tommy guessed he would be almost three feet long if he stretched out on the floor and about 20 pounds. He had glasses and gray whiskers and was sitting behind a desk with a lot of papers on it. "What's this?" said the principal, after Tommy handed him his paper.

"That's my multiplication triangle," said Tommy nervously.

"You can't do multiplication on a triangle!" said Mr. Stern. "Multiplication tables are square! Everybody knows that!" Tommy said quietly, like a mouse, "I like triangles. My multiplication triangle works as well as the square one."

The principal squinted his eyes and stared at the triangle. "I don't like it!" he finally said. "Make your

multiplication table like you're supposed to! Or you are going to have to repeat third grade! Go back to class."

That was when, instead of going to class, Tommy thought angrily, "I'm not going back to class!" And he waddled over to Blue Lake.

1. What did Mrs. Block ask the students to do in class on the cold December day?
2. What did Tommy notice about the multiplication table he was supposed to make?
3. What did the principal say to Tommy when he showed him his multiplication triangle?

Chapter 14: Grade 3 Mrs. Block, Parent Talk

Sitting on the log on the far side of the lake, he stopped crying and sniffled. He thought about his class, "Maybe I should try to be more like the rabbits and do things like they do."

Suddenly, he saw two turtle heads sticking out of the water and looking directly at him. He was about to jump off the log and swim away when he recognized his parents. He stuck his head inside his shell and just waited.

But when they arrived they didn't scold him. His mother said, "Tommy, are you alright? The school said you disappeared today and we were very worried. We looked all morning for you."

"I'm OK," he lied, slowly sticking his head out of his shell. But he couldn't fool his parents. They could tell he had been crying.

His father said, "Son, your teacher told us you are moving slowly in your class. Is that true?"

"Yes," he said, not able to lie. "And I usually finish last on the classwork and quizzes. The rabbits always finish before me."

"Well, congratulations," his father said smiling. "You're a true turtle." His mother was smiling too.

"You're not mad?" asked Tommy.

"Mad?" said his father, "Heck no! That's the way we turtles are. I never told you this, but it took me two years to finish second grade."

"Really?" asked Tommy, sniffling.

"Really," said his mother. "And I took two years to finish the third grade. All the turtles have had to repeat at least one lower grade and sometimes two grades. When we went to the school today, I realized that if you finish third grade, you would be the first turtle from our lake who hasn't had to repeat a lower grade. You must be working very hard and we are quite proud of you."

Tommy smiled and sniffled again.

His mother said, "We're sorry that we have been so busy with our work these days. We should've been watching your progress more closely.

Tommy replied, "I guess I didn't want to bother you with my problems because I know the work you do is important."

"It is. But our son is more important," said his father. Turtles sometimes rub their necks together, and they all rubbed necks together and cried and laughed.

"One more thing," said his father. "Turtles may go slower in school, but they often understand things better than rabbits, and they sometimes invent new things, like your triangular multiplication table, which we really liked! In fact, there was once a famous turtle named

Albert, who invented a whole new way to think about the stars and the universe."

In the days after this, Tommy Turtle felt much better, and, as soon as he could, he went to the library and asked Mr. Smart for a book about the stars. Mr. Smart showed him a book about our planets and stars. Tommy learned that the Sun was really a star! "That's amazing!" thought Tommy.

The next day he thought, "Stars are very tiny compared to the Sun. The Sun must look bigger because we are very, very, very, very, very, very, very close to it and the stars are very, very, very, very, very, very, very far away." He went back to the library to learn more.

He learned the light from our Sun took about eight minutes to reach the Earth! Before this, he had never realized that light took time to travel! And he learned that the light from the nearest star took over four years to reach Earth! When he went home he realized that he was right about the sun being much, much, much, much, much, much, much closer than the stars. He decided that he should call the sun the "Home Star." He told his parents about his new name for the sun, and they thought it was very clever. He went back the library the next day to learn more.

This time he learned that the light from some stars had been traveling for millions of years through space! And he learned that no one knows exactly how many stars there are, but there might be about one septillion stars. One septillion was written like this: 1,000,000,000,000,000,000,000,000. "The universe is a lot, lot, lot, lot, lot, lot, lot, lot, lot bigger than I thought," thought Tommy.

He also learned about the turtle named Albert, who had figured out a better way to understand the stars and the whole universe, called "Relativity Theory," but Tommy didn't understand much about it.

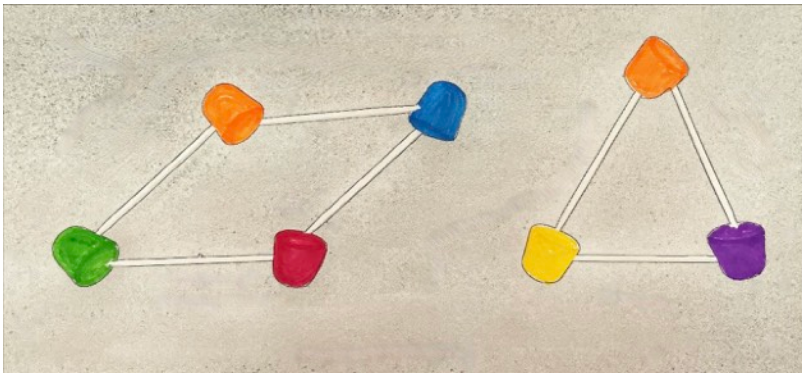
Then, he asked Mr. Smart, "What's the biggest number?" Mr. Smart said, "There is no biggest number. Whatever big number you can say, I can add 1 to it, to make it bigger."

1. How did Tommy feel when he saw his parents after he ran away from school?
2. What did Tommy's parents tell him about turtles in school?
3. What did Tommy learn about stars and the universe from the library books?

Chapter 15: Grade 3 Mrs. Block, Making Shapes

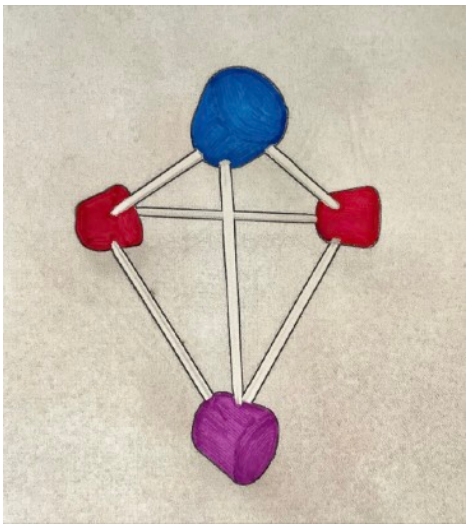
In spring, the weather was warm. The forest was alive with activity, and school was almost over. As Tommy plodded his way to school, he watched the squirrels scrambling up the oak trees and then jumping through the air to the next tree. "It makes me dizzy watching them," thought Tommy. He marveled at their acrobatic feats, but he was glad he was a turtle with a hard shell to protect him. The five minute warning bell rang for the start of school and Tommy hurried.

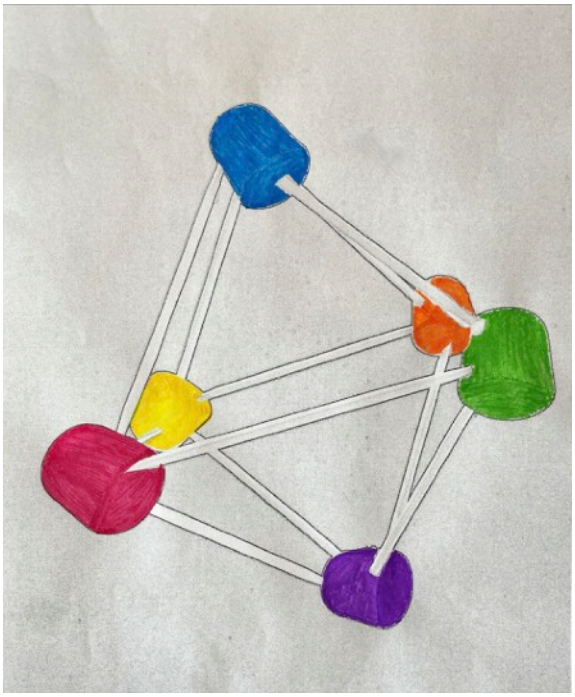
In class, Mrs. Block gave all the students some toothpicks and gumdrops and let them build shapes. Most of the students immediately tried to make square houses, or square buildings. The houses or buildings would sometimes lean over to the side.



Tommy made a 4-nik and 3-nik. He discovered that the 4-nik could bend out of shape easily but not the 3-nik. The

3-nik, or triangle, was stronger. So he made some larger, 3D shapes using 3-niks on the outside.





Mrs. Block and the other students didn't know what to think about these unusual shapes. They scratched their

heads with their paws. Tommy wondered why the others didn't make strong shapes—strong like his turtle shell.

While Mrs. Block walked back to the front of the class, Rex Rabbit pushed Tommy's shapes onto the floor. They remained firm. So Rex hopped onto the large one to try to crush it, but one of the toothpicks stuck in his foot and he began to yell, "Ow! Ow!" All the students started laughing, and Mrs. Block suddenly turned around and said, "Rex Rabbit! Get back to your seat!"

It was the first time Tommy had seen Mrs. Block shout at Rex Rabbit. Rex Rabbit hopped back to his desk, using one hind-foot and two fore-feet. All the other rabbits began to make triangular shapes like Tommy's.

Afterwards, Mrs. Block let the students take apart the shapes and eat all the gumdrops. Tommy did not take apart his shapes.

During lunch, after Tommy had checked the length of the pole's shadow, he couldn't stop thinking about his shapes. "These feel important," he thought, "like my shell." After class, he carefully packed his shapes into a bag and headed to the library.

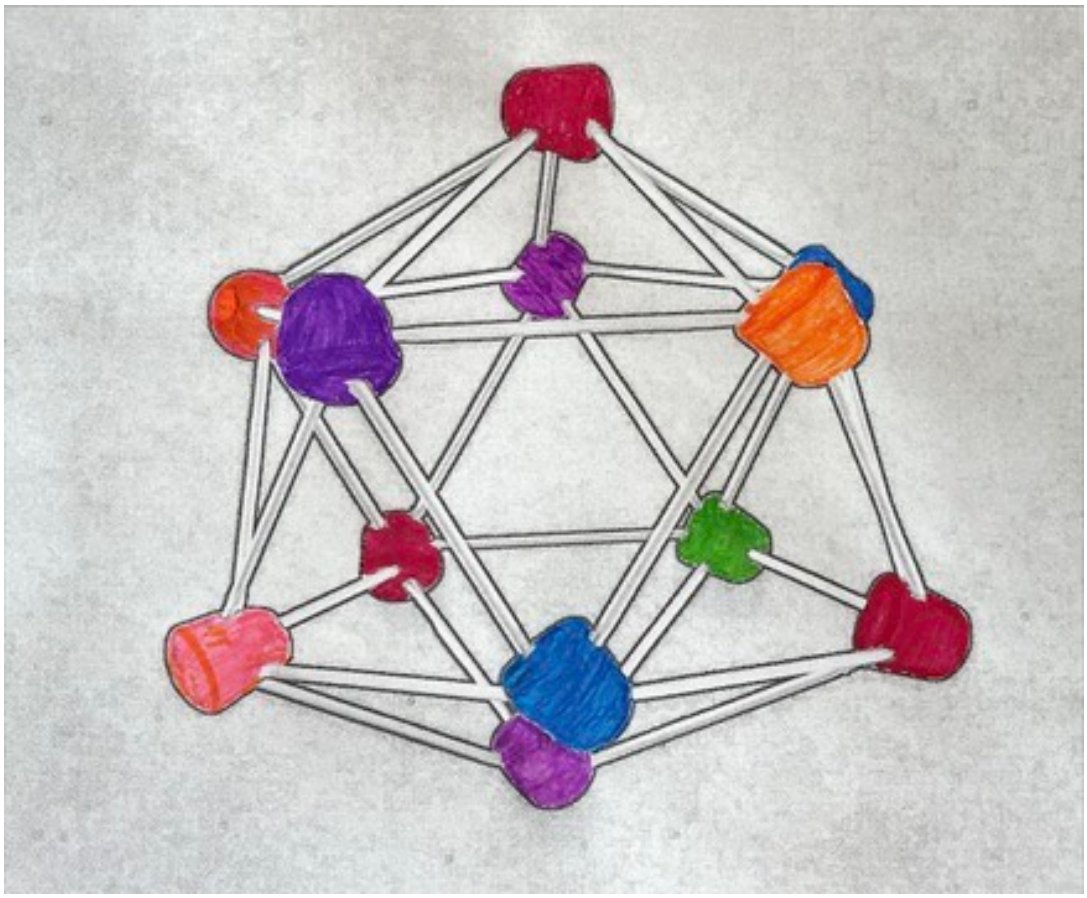
As he waddled down the path, Rebecca Rabbit hopped alongside him. "Those shapes are really interesting, Tommy," she said. They passed Peter Opossum, he was already sleeping in his usual spot under a bush, one eye briefly opening to watch them pass.

"Mr. Smart," he said, placing his shapes on the desk, "I made these shapes and I was wondering if you could give me some information about them ..."

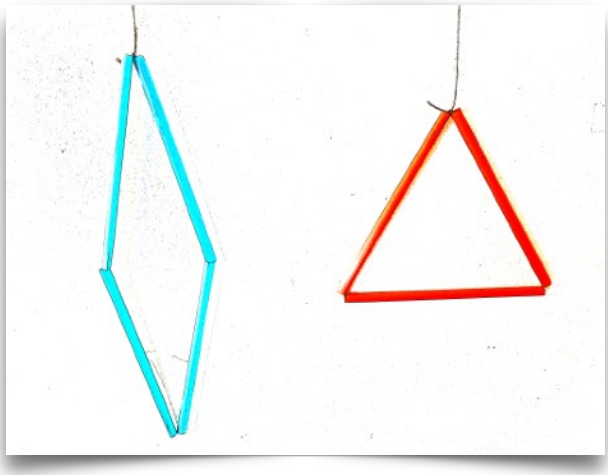
Mr. Smart gave Tommy a book with shapes like Tommy's. The shapes had some big names: tetrahedron, octahedron, hexahedron, icosahedron, dodecahedron. The book said they were the names that the ancient Greeks had given the shapes. Tommy studied the book and then left. Mr. Smart had let him put his shapes in the library on a bookshelf.

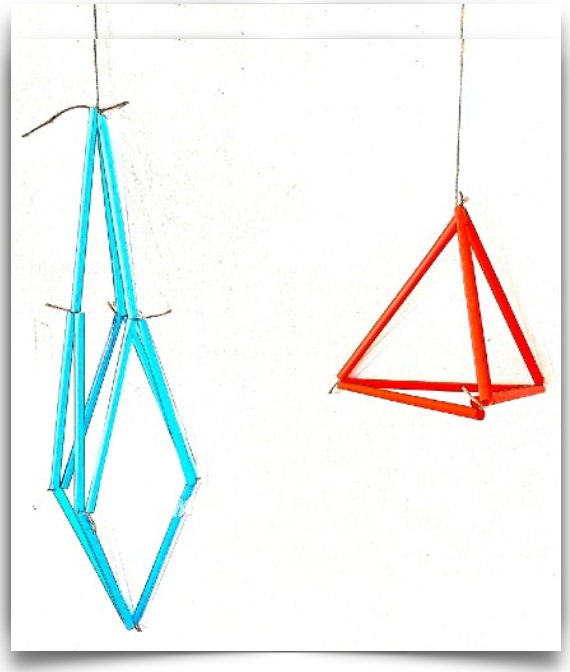
The next morning, just before he was fully awake, an idea came to Tommy of how to make the names easier to remember and use. He had realized that each shape had a different number of corners. So Tommy decided to call each corner a "nook," since a nook is a corner. He called them a 4-nook, 6-nook, 8-nook, 12-nook, and 20-nook.

After school he hurried to the library. The 12-nook was made of 3-niks, or triangles, on the outside, so Tommy thought that it might hold its shape. He took apart his old shapes and tried to make the 12-nook to be sure. But he needed five more toothpicks! So he went back to the classroom and Mrs. Block gave him the toothpicks.



The 12-nook was firm! Then he made a 20-nook. It fell down. He knew from the classroom that the cube, with squares, or 4-niks, on the outside, was not firm, and now he knew that the 20 nook, or dodecahedron, with 5-niks, or pentagons, on the outside, was also not firm.





He had told Mr. Smart his new names, and Mr. Smart had been watching him build the icosahedron. So Mr. Smart printed out the five shapes with both the Greek names and Tommy's new names. Mr. Smart told Tommy that Tommy's names were better for primary school students.

Mr. Smart also did some research on the library's AI Helper, and he found that you could also make shapes out of string and ordinary drinking straws. He showed Tommy some shapes a scientist had made: 1. Triangles that held their shape and 2. Squares that had folded. Tommy was happy to see them.

The next day, when Tommy explained his "nook" system to Rebecca, she smiled. "That makes so much more sense than those long Greek words!" she said. “But my mom says I need to learn them to understand English better.”
“Yes, my mom says I’ll have to learn them someday,” said Tommy.

1. What kind of shapes did Tommy make with toothpicks and gumdrops in class?
2. Why did the other students scratch their heads when they saw them?
3. What happened when Rex Rabbit tried to crush Tommy's shapes, and how did Miss Duller react?
4. What word did Tommy use for a 3D shape called a tetrahedron?

Chapter 16: The Shadow of the Home Star

Tommy had passed Mrs. Block's third grade class. It was June 21st, the longest day of the year, at noon.

On this date last year his father had placed the shadow pole, and Tommy had been placing small pebbles to mark the length of the shadow at noon each day for a year. Tommy had just placed a pebble next to the one he had placed last year. Now he was looking at the shadow—made by the Home Star and the pole—and the the two parallel rows of pebbles. On June 21 of last year, the shadow had been the shortest, but it had gotten longer each day until December 21. Then, it had gotten shorter each day until today.

Tommy studied the pattern of pebbles on the ground. He remembered trudging through snow in winter to place his markers, and splashing through spring puddles to continue his measurements. Some days it seemed like the shadow had barely changed from the day before, but over time, the pattern had become clear.

Rebecca hopped up as Tommy was studying the pebbles. "What are you looking at?" she asked.

Tommy explained about his year of shadow measurements. Peter Opossum peered out sleepily from under a nearby bush. “A whole year of getting up at noon just to put down pebbles? That's very... turtle-like,” he yawned with a slight smile.

Drawing in the dirt with his front foot, Tommy drew a line showing how the shadow changed through the seasons. The line went slowly up, then slowly down, like a hill. He noticed it took exactly half a year to go from shortest to longest, and another half year to return.

”The shadow changes with the seasons because the Earth is tilted as it goes around the Home Star,” Tommy said. “And it changes throughout the day, because the Earth is spinning.”

Tommy's father had waddled up as Tommy was talking, “Yes, when Green Forest is tilted toward the Home Star at noon, the light is coming almost straight down on us like today.” He showed the motion of the light with his front foot. "So the shadow is very short.” In winter, Blue Lake is tilted away from the Home Star at noon, so the shadow is long, because the light is coming like this.” He once again demonstrated the motion of the light from the Home Star to the Earth. “And the shadow moves around the pole like this as the Earth spins.”

His father asked, “So what do you predict will happen next at noon each day to the shadow?” "I think will get longer again like it did last year. I think it will follow the same pattern," said Tommy. “I agree,” said Rebecca.

His father nodded thoughtfully. “This is what scientists often do—look for patterns and then make predictions. But how can we be sure your prediction is right?” Tommy thought for a moment. "We could measure it again?"

His father said, "Yes, but this time you can check it at noon just once a week. That should give us enough data to see if you are right.”

They all watched as the shadow slightly changed its position. Tommy thought for a few seconds and then said, “Since the Earth is spinning as it goes round the Home Star, why do animals say that it ‘rises’ and ‘sets’ if it is we who are spinning.”

“You are exactly right,” answered his father, “In the morning, when the ‘sun rises’, it is actually Green Forest that is spinning toward the Home Star. We are the ones moving, not the Home Star.”

“But it looks like the Home Star is moving!” protested Tommy. "There are some historical reasons for that," replied his father. ”In ancient times, we didn't know that the Earth went around the Home Star.” He continued his explanation, “The shadows you see everywhere are just blocking the light of the Home Star as it tries to leave our Solar System. Trees make shadows, rocks make shadows, birds make shadows, clouds make shadows, even the Earth makes a shadow.” “Is that the shadow we saw that covered the moon?” asked Tommy. “Exactly!” said his father.

“Since you like to think of new ways to say things, maybe you can think of another way to say ‘sunrise’ and ‘sunset’.”

Tommy thought for a moment. “Well, since we're spinning toward the Home Star in the morning, maybe we could call it 'spin in.' And when we're spinning away in the evening, that would be 'spin out.’”

His father smiled and nodded. Rebecca said, "You always take something complicated and make it simple.”

A few weeks later, Tommy decided to write “Homestar” as one word. The next day Tommy noticed all the shadows of the forest pointing out of the solar system.

When he looked back at the Homestar, his eyes got wide. It seemed to be much much much much much much much much much much bigger now.

He told his parents about this, and they nodded and his mother said, “When you think that the sun goes around the Earth, the sun seems very small, like the moon. But when you understand that the Earth goes around the Homestar, you can better see its true size.”

1. What pattern did Tommy discover about the shadow's length throughout the year, and how did he record this pattern?
2. How did Tommy's father explain why shadows change with the seasons?
3. How did Tommy change the phrases “sunrise" and “sunset.”

Chapter 17: Grade 4 Mrs. Wise

In the fourth grade, an unusual thing happened. As Tommy walked from the lake to his classroom, he noticed the crickets humming and buzzing, their chorus rising and falling. A woodpecker went: knock-knock-knock … knock-knock-knock. Tommy smiled as he recognized the pattern, three quick knocks, pause, three quick knocks, 3,3,3. The forest seemed more energetic than usual.

He waddled into the class and saw his 4th grade teacher. Surprised, he stuck his head out of his shell all the way, lifted it high up, and opened his eyes wide to get a better look. She wasn't a rabbit, she was an owl!

Illustration by Waldon Gonso

Although many owls will hunt rabbits, this owl had gone to one of the best universities in the land and was now a vegetarian. She had moved here from a lake in the West. Her name was Mrs. Wise.

When she later saw one of Tommy Turtle's math drawings, she said, "That's a very interesting way to solve that problem." Tommy didn't say anything. He just

smiled and later, when he was alone, he cried because he was so happy.

During a lunch break, Rebecca hopped over to Tommy. "What do you think about Mrs. Wise?" she whispered.
"She's different," Tommy replied. "She actually tries to understand our answers."
"And do you notice?" Rebecca added excitedly. "She doesn't just tell us what to think like our other teachers did—she keeps asking questions until we figure it out ourselves!"

From his usual spot under a shady bush, Peter Opossum opened one eye. "Maybe now I won't have to sleep

through every lesson," he yawned. "Though I might still need my morning nap."

And when Rebecca Rabbit asked Mrs. Wise if she could play the boys' game, Mrs. Wise answered, "Of course. It's not a boys' game, it's just a game!"

1. What patterns did Tommy notice on his way to meet her for the first time?
2. How does Mrs. Wise teach differently from Tommy's previous teachers, and how do Tommy and his friends feel about her teaching style?
3. What made Tommy cry happy tears for the first time at school?

Chapter 18: Grade 4 Mrs. Wise, Rebecca Rabbit Plays ESCAPE!

The first time that Rebecca put on the computer goggles and logged in to the game called ESCAPE!, she was amazed at how realistic the world was compared to the game she had been playing with the other girls.

For the Hunter, she chose Coyote. And for location, she chose Any. She knew that if she could survive for two minutes she would win the game, but if the Coyote captured her she would lose.

She found herself in a desert at the foot of some hills. It was not the forest that she was used to. There were bushes, rocks, and desert trees called Joshua trees. She noticed her fur color was the same color as the sand of the desert. She had seen some of the boys in this location. Rather than running toward the hills, as the boys usually did, she decided to wait, and to look for the movement of the coyote.

She stayed perfectly still, barely breathing, her ears pressed flat against her back. The wind whistled through the desert bushes, carrying the scent of sage. Suddenly, she caught a flash of movement on her left—the coyote was circling around, sniffing the air.

She slowly inched backward toward some rocks, keeping her body low to the ground, matching her movements to the motion of the coyotes said.

The coyote paused, its nose twitching in the air. Rebecca's heart pounded, but she remained motionless. The hunter turned away, scanning another area. One minute had passed.

If she could reach the rocks without being seen, she might have a better chance of surviving the full two minutes. Taking advantage some gusts of wind that made all the vegetation sway, she moved in short, careful bursts, freezing whenever the wind died down.

The coyote suddenly turned and looked directly at her! But in her sandy-colored fur, pressed against the ground, she was just another rock in the desert landscape. The hunter's gaze passed over her and moved on.

Just as the timer reached one minute and forty-five seconds, the coyote caught her scent. It charged toward her hiding spot, but Rebecca was ready.

She sprinted out, leading the hunter toward a dense patch of sagebrush, then suddenly doubled back,

passing directly underneath the coyote! While the hunter was still turning around, looking confused, Rebecca had already changed direction again, and hid behind a desert tree, a Joshua tree.

When the timer hit two minutes, the desert scene disappeared, and "VICTORY!" flashed across her goggles. Rebecca had won her first game of ESCAPE!

She removed the goggles to find several of her classmates staring at her computer screen in amazement. Even Rex Rabbit looked impressed, though he quickly tried to hide it.

"That was amazing!" Tommy Turtle said.
Rebecca smiled, "Thank you."

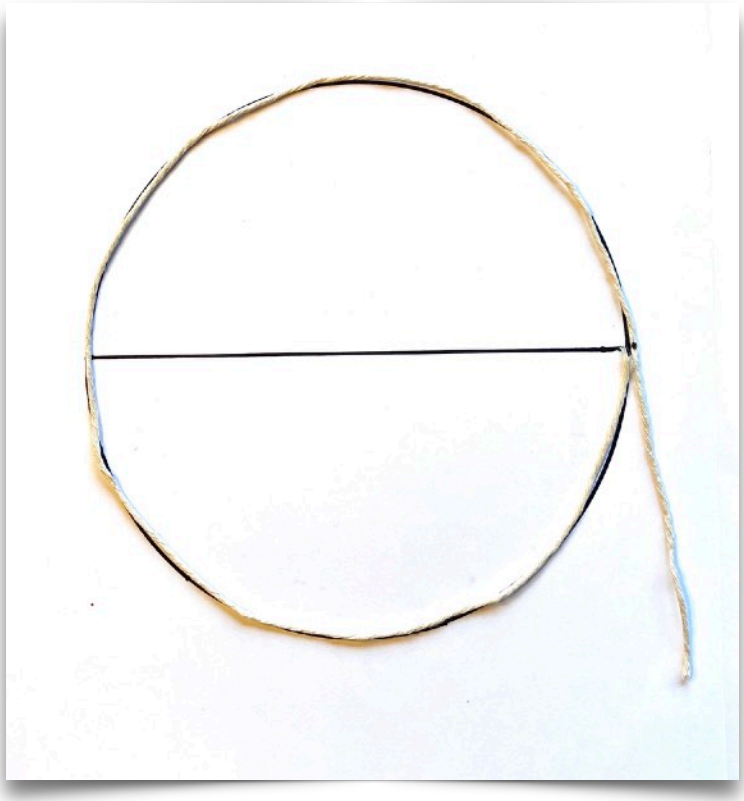
Mrs. Wise, who had been watching from her desk, nodded approvingly. "Excellent strategy, Rebecca." The next day, three more girl rabbits asked to play ESCAPE!.

1. How did Rebecca's approach to playing ESCAPE! differ from how the boy rabbits usually played the game?
2. What strategies did Rebecca use to survive her first game, and how did these help her win?

3. How did the other students and Mrs. Wise react to Rebecca's victory, and what changed the next day?

Chapter 19: Grade 4 Mrs. Wise, Measuring Shapes

One day, for homework, Mrs. Wise told them to draw their favorite 2D, or flat shape, and measure its sides. Then they should add up the sides to get the perimeter. At home, Tommy looked at the homework assignment.



Most students would probably draw a square, pentagon, or hexagon, he thought, remembering the shapes they usually chose in class. But his favorite flat shape was a circle.

But Tommy's favorite flat shape was a circle. So he drew a circle. Then he looked at it and tried to figure out how

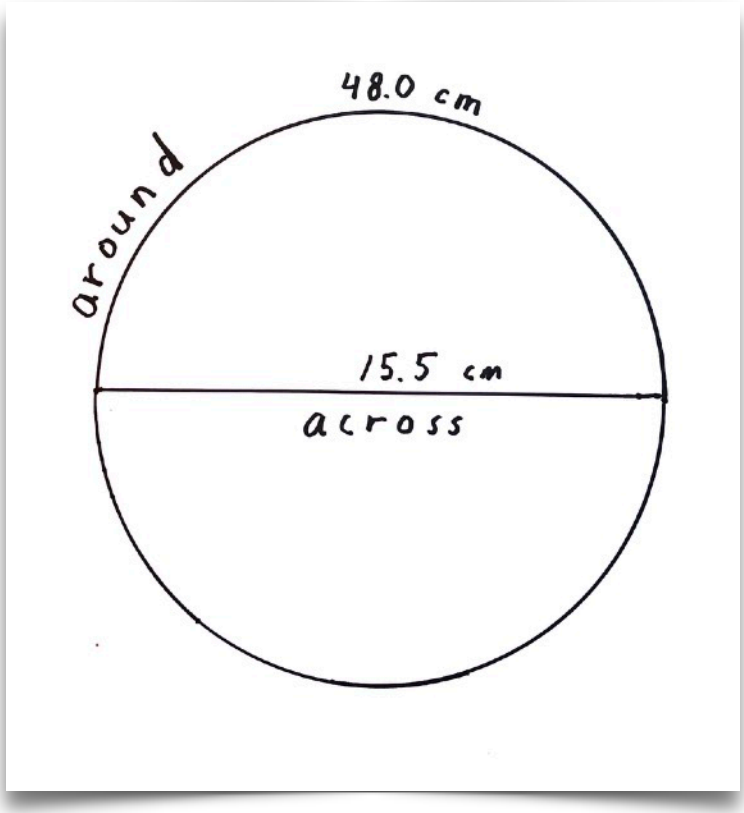
to measure its sides. It seemed impossible, because it had no sides. Or maybe it had only one side—the around. He stared, trying to figure it out. He was about to ask his parents, when the answer came to him.

He went and bought a roll of string, laid it carefully on top of the circle and cut it off. Then he straightened out the string and carefully measured it. Then he also carefully measured the across. He labeled them with his easy names and with the measurements.

The next morning, Rebecca hopped over as Tommy was taking his drawing out of his backpack. “Is that a circle?” she asked, peering at his paper. “You always think of different ways to do things.”

The next day, after Mrs. Wise had a chance to look at all the drawings, she held up Tommy's drawing for all the students to see. She said, “In my many years of teaching, this is the first drawing I've ever received of a circle.” Some students snickered. She ignored them and continued, “Notice that this person has used the words “around” and “across” for “circumference" and "diameter" which is quite clever. And they have the measurement of the circumference written here. Can any of you tell me how this person measured the

circumference?" Everyone was silent for several seconds.



"Tommy, can you tell us how you did it?"

Tommy was a little embarrassed, but he said, "I used a string."

"That's what I thought," said Mrs. Wise.

Then, Mrs. Wise passed out paper and had everyone make a circle of a different size and measure the diameter. She also passed out some string to each person and had them measure the circumference.

Afterwards, using Tommy's names, she made a table on the board of all the arounds and acrosses. Then she divided all of the arounds by the acrosses. She got numbers like this: 3.1, 3.0, 3.3, 3.2. She asked the students what they noticed about the numbers. Rebecca

Rabbit raised her hand and said, “They are all a little bit larger than three.”

“That's right,” said Mrs. Wise. "That's a special number which is true for all circles. We call it pi.”

Mrs. Wise asked Tommy if she could keep his drawing and he said, “Yes.” Later she posted it on the bulletin board. He began to show more of his head as he walked around the school. Later, someone wrote on corner of the drawing, "Turtle Math,” but Mrs. Wise said, “Perhaps more of us should do Turtle Math!”

From his usual spot in the classroom, Peter opened one eye. “Looks like ‘turtle math’ isn't so funny anymore,” he thought, and then yawned.

1. What was the homework assignment given by Mrs. Wise and what did Tommy draw?
2. How did Tommy measure the sides of the circle for his homework assignment?
3. What did Mrs. Wise do with Tommy's drawing and how did it make Tommy feel?
4. Why do you think she says, “Perhaps more students should do Turtle Math!”

Chapter 20: Grade 4 Mrs. Wise, The Competition

The state was having a math competition for all elementary students in fourth grade. Mrs. Wise asked the school principal, Mr. Stern, to let her fourth grade students enter the competition. He agreed, but told her he would personally supervise the test to make sure no one cheated.

Rex Rabbit did not prepare for the competition. He had usually gotten the highest math scores in his previous grades, so why should he worry? He was sure he would score highest again.

Tommy Turtle was afraid that this would be like all the tests he had taken in the third grade—not enough time. Mrs. Block would say something like, "You have 10 minutes to finish this quiz." Then she would set the timer and say, "Begin ... NOW!" And most of the rabbits would start to write furiously.

However, he found out that although the competition was timed for 60 minutes, there were only three problems. Also, the problems would not be usual problems. Tommy liked unusual problems, and if there were only three of them, maybe he could finish all three. He went to the library and asked for a book of unusual

math problems. Mr. Smart found a book of math puzzles, with solutions in the back.

Rebecca's ears perked up with interest when she saw Tommy studying in the library. “Only three long problems?” she whispered. “That means we'll have time to think them through carefully.” Peter Opossum was in the library for a change. “Twenty minutes for each problem instead of rushing through twenty problems,” he mused. “That's more my speed too.”

As Tommy studied the puzzles, he noticed they were like the patterns he saw in nature—you had to look carefully and think about how things connected. Mr. Smart helped him find more puzzle books, and Rebecca and even Peter often joined him in the library to work on them together.

Rex Rabbit passed by and saw them studying. “Puzzles are for babies,” he told the other rabbits who were with him. “I always get the highest scores without studying.”

1. What kind of math competition did the state organize for elementary students in fourth grade?
2. How did Tommy prepare for the math competition?
3. How did Rex Rabbit and Tommy approach the competition differently?

Chapter 21: Fourth Grade Mrs. Wise, The First Problem

On the day of the competition it was cold. Gusts of wind blew from the northwest, forming waves on the lake. Golden brown leaves floated down slowly from the trees. They twirled and then landed on the lake and floated there.

However, Tommy noticed none of this. He was only thinking about the test. He had decided to walk to school this day and as he walked in his mind he was reviewing some math problems and solutions. He was on the path going around the lake, when suddenly Rex Rabbit and two other rabbits hopped out of the forest and blocked his path.

Tommy tried to pass by them, but they didn't move. Rex said, “Are you going to use 'turtle math’ on the exam today?” The other two rabbits laughed. Suddenly, they grabbed the side of Tommy’s shell and flipped him over onto his back! Just then, the five minute warning bell rang, and the three rabbits hopped quickly towards the classroom.

Tommy was scared. Turtles are helpless in this position. Tommy swung his webbed feet around in the air, frantically trying to return to his stomach.

In the 4th Grade classroom, Mrs. Wise and Mr. Stern were at the front of the classroom preparing the exams. All of the rabbits were hopping into the classroom and settling into their seats. Then, the bell rang for the start of the class.

Mrs. Wise noticed Tommy's empty desk. He had never been late for her class before, and she couldn't believe he would be late on the day of the competition! She knew he had studied hard for it. Rebecca was worried too.

Mr. Stern began passing out the test, face down. He told all the students, "Do not turn over the test until I say begin!" Mrs. Wise looked at the clock. She wondered what had happened to Tommy! Rex and two other rabbits were secretly smiling at each other.

Mrs. Wise got an idea. She interrupted Mr. Stern. "Class, before we begin the test, I'd like you to do some warm-up problems." She began writing a problem on the board.

Mr. Stern was very annoyed. "Mrs. Wise, I thought we agreed to start the test at 8 AM sharp?"
"Yes, Mr. Stern. But one of our students is not here yet."

Mr. Stern looked around and noticed Tommy Turtle's desk was empty. "I'm sorry, Mrs. Wise. But we can't wait for the turtle. All the students know what time class begins."

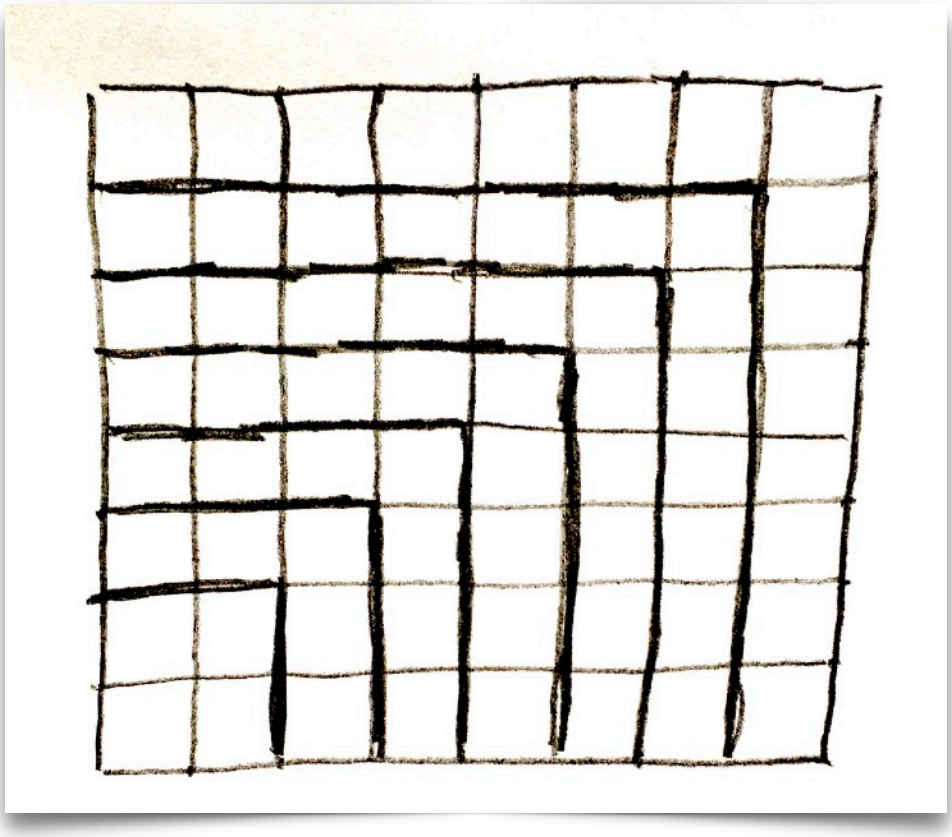
So Mr. Stern passed out the tests and told them they had 60 minutes to finish. "Remember to show all your work clearly," he said. "Begin!"

All the rabbits begin to read the first question, "How many squares are there, of any size, on a 8 by 8 chessboard." Rex Rabbit thought that was easy. He just multiplied 8 times 8 and got 64. Then he went on to the next question. After five minutes, Tommy had still not arrived and Mrs. Wise was very nervous.

Tommy was still struggling when Peter Opossum shuffled up. "Those rabbits need to learn some manners," he said sleepily. "Good thing I was running late as usual. Come on, let's get you to class."

Just as Mrs. Wise and Rebecca had given up all hope that he might come, suddenly both Tommy and Peter Opossum came through the entry door! They had hurried, as fast a turtle could hurry, to the school. Mrs. Wise gave Tommy and Peter Opossum a test.

Rebecca's worried expression changed to relief. She had been watching Rex's smug smile. She gave Tommy a quick nod of encouragement before turning back to her test.

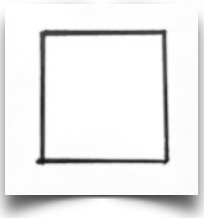


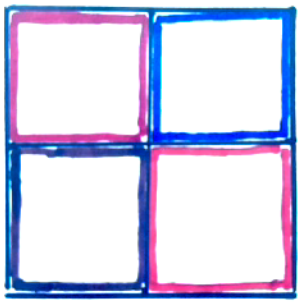
Tommy Turtle read the problem carefully and drew a picture of a chessboard. He saw the 64 small squares, but he also saw many other squares of different sizes which he also drew.

But when he began to try to count up all these different squares he got confused.

He checked the clock and found that 10 minutes of the test had already passed! "There must be a simpler way," he decided. He remembered reading that when problems were too complicated, you should try to solve an easier problem first.

So he decided to start with a simple square, 1 inch on each side. The answer would be one square.



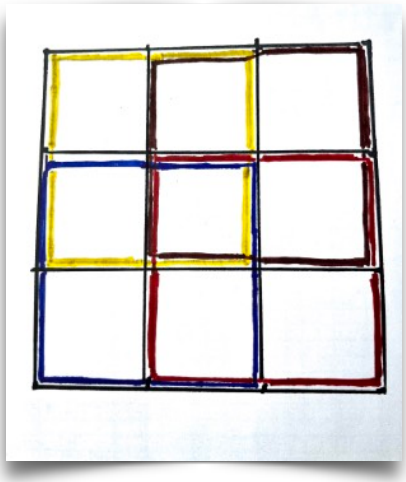


Then he drew the next biggest chessboard which was made of four small squares. Each side was 2 inches long, and he knew that it was called a 2 by 2 square. And he could also write it, 2 x 2. Now he had a total of four little squares and one larger square, five total squares.

Meanwhile, Rex Rabbit had glanced over at Tommy Turtle's desk and noticed his drawings. He wondered if he might be doing something wrong. What if he had not understood the question? He also drew a chessboard and suddenly saw the other squares.

Meanwhile, Tommy was drawing a 3 by 3 chessboard. He had nine little squares, four 2 by 2 squares, and one

larger square. A total of 14 squares. He looked at the clock and saw that he had used 15 minutes! He thought he would not finish all three problems. But he would still try. Turtles were not quitters.

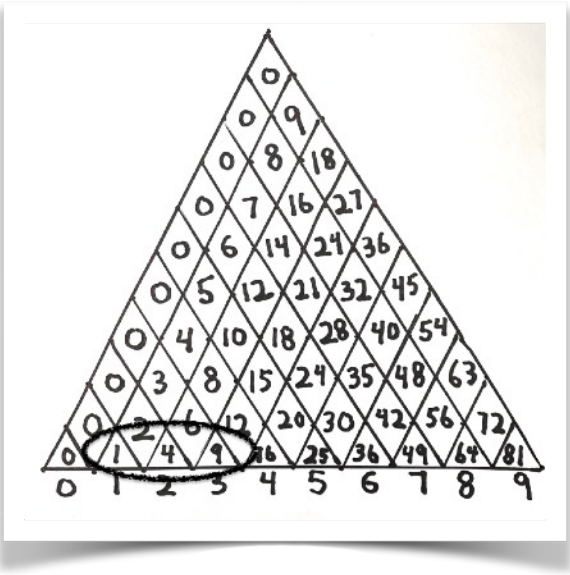


He remembered what his father had said about turtles sometimes understanding things better than rabbits. Tommy looked at the clock again—even with only 45 minutes left, he would solve this problem his own way.

Checkerboard size	number of squares	total
1 x 1	1	1
2 x 2	4 + 1	5
3 x 3	9 + 4 + 1	14

He made a chart. In the 1 by 1 square there was only one square. In the 2 by 2 square there were four little squares and one large square. 4 + 1 = 5 total. In the 3 by 3 square there were nine little squares, four 2 by 2 squares, and one large square. 9 + 4 + 1 = 14.

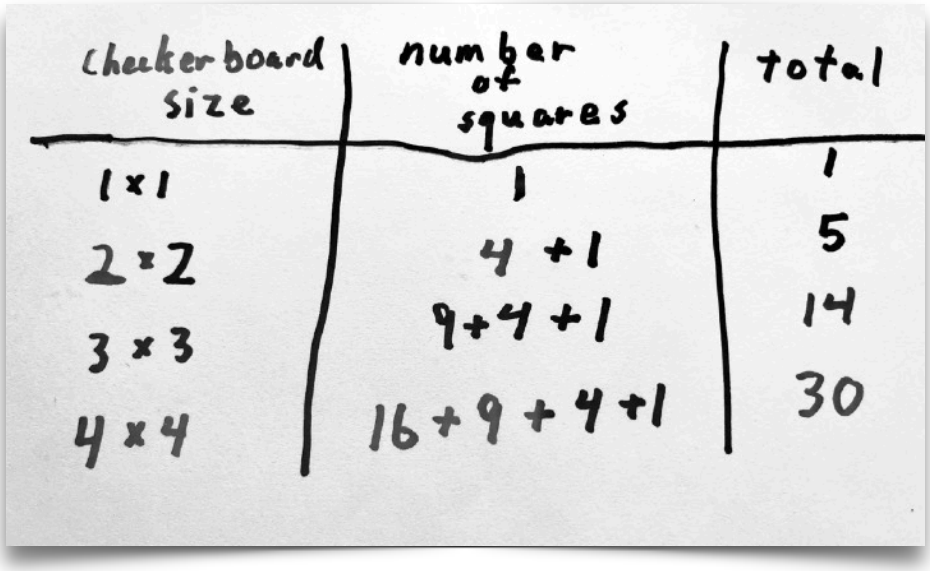
1 x 1, 1, 1
2 x 2, 4 + 1, 5
3 x 3, 9 + 4 + 1, 14



"Wait!" He thought. "9, 4, and 1 are the same numbers at the bottom of my triangle multiplication table! The number times itself! The square of the number!"

Rex Rabbit did not make any charts. He quickly tried to count all the squares and got confused. He quickly tried again and got confused. The third time he also got confused. He glanced over at Tommy Turtle's desk, but Mr. Stern was watching him carefully, so he just took a guess that the answer was 100, and he wrote that down.

Meanwhile, Tommy had seen a pattern!



Checkerboard Size	number of squares	total
1x1	1	1
2x2	4 +1	5
3x3	9+4+1	14
4x4	16+9+4+1	30

He decided to continue his chart to 4 by 4 by using the pattern. The 1, 4, 9, and 16 he remembered from his multiplication triangle. The next numbers, 9, 4, and 1, were repeats of the earlier row. So now the rows looked like this:

1 x 1, 1, 1
2 x 2, 4 + 1, 5
3 x 3, 9 + 4 + 1, 14
4 x 4, 16 + 9 + 4 + 1, 30

It looked like a good pattern. So then he continued his table to 8 by 8.

1x1, 1, 1
2x2, 4+1, 5
3x3, 9+4+1, 14

4x4, 16+9+4+1, 30
5x5, 25+16+9+4+1, 55
6x6, 36+25+16+9+4+1, 91
7 x 7, 49+36+25+16+9+4+1, 140
8 x 8, 64+49+36+25+16+9+4+1, 204.

According to his table, the final answer was 204 squares. Tommy looked at the clock. He had used 40 minutes of the 60 minutes! He had only 20 minutes to solve the next two problems. How could he finish in time?!

1. How did Rex Rabbit approach the first problem and what did Tommy Turtle do differently?
2. How did Tommy Turtle solve the problem of counting the number of squares on an 8 by 8 chessboard?
3. How much time did Tommy Turtle have left to finish the problems?

Chapter 22: Grade 4 Mrs. Wise, The Second Problem

Problem 2 read, "If the chessboard were now 16 by 16, how many total squares, of any size, would there be?"

Rex Rabbit had drawn a large 16 x 16 chessboard and had begun to try to count all the squares. Now he was erasing and counting, and then erasing and counting again, and writing down a lot of numbers and adding them up. His paper was getting smudged from all the erasing. Sweat was pouring down his furry face. From his desk nearby, Peter glanced over and noticed Rex's frustration. For his final answer, Rex just guessed that it was 500.

But for Problem 2, Tommy Turtle looked at his chart and thought about the pattern. Just like the shadows he had measured all year, this pattern would keep growing in a predictable way. Each larger square would contain all the squares from the smaller ones, just like the ripples in the lake when a leaf fell contained all the smaller ripples inside them.

Rebecca caught his eye and gave him a small smile—she could tell he had figured something out. She wanted to whisper to him, but Mr. Stern was watching everyone carefully.

Tommy slowly and carefully wrote the numbers down and got his final answer of 1,496.

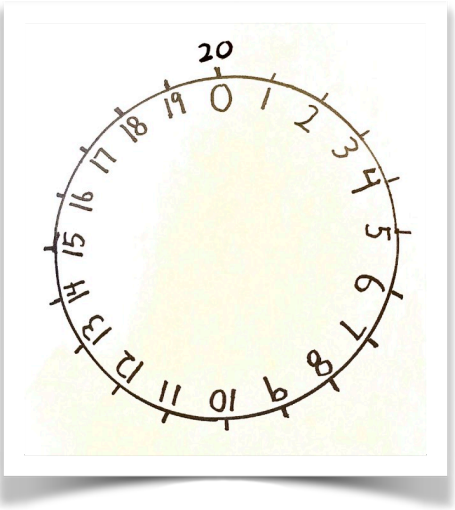
He took a moment to look through the classroom window, and saw a few clouds drifting by. He thought about how patterns were everywhere—in the squares he had just counted, in the shadows he measured, in the ripples on the lake. Even the Earth, moon, and sun followed patterns as they moved through space. The Earth spinning to make day and night, the moon circling the Earth to make months, and the Earth circling the Home Star to make years. Always following the same patterns, just getting bigger and bigger, like his number chart.

Then he remembered that there was no time for daydreaming. He had only five minutes left!!

1. How did Tommy and Rex approach the second problem differently?
2. What patterns in nature did Tommy think about while looking out the window?
3. Continue the pattern for the second problem. Get some help if you need it.

Chapter 23: Grade 4 Mrs. Wise, The Last Problem

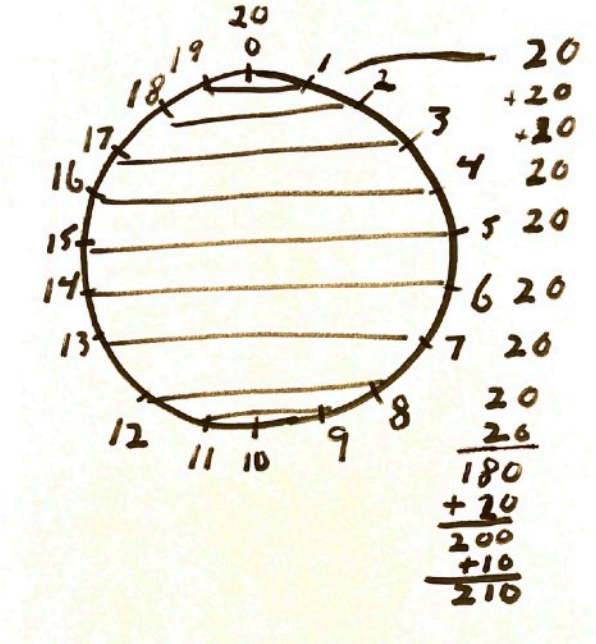
Problem 3 read, "What is the sum of all the numbers from 1 to 100. Be sure to include 1 and 100."



Tommy Turtle's number circle.

Tommy's first thought was, "I'll never finish that in five minutes." But for some reason, the image of his Number Circle came to his mind.

He realized that adding the numbers from 1 to 20 would be a simpler problem. Then he realized that he could draw a straight line from the 19 to the 1, another straight line from the 18 to the 2, from the 17 to the 3, and all the way down to the 11 to the 9. He made a sketch.



Each of these lines added to 20. Then he added the nine lines to get 180. Then he added the 10 at the bottom

and the 20 at the top, to get a total of 210.

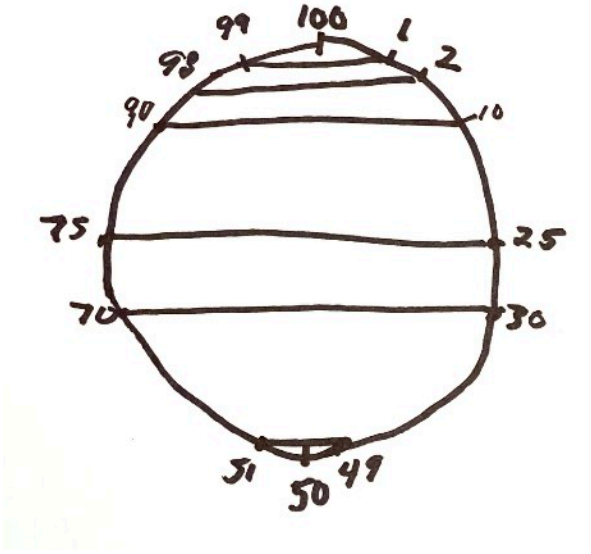
Now, all he had to do was to apply this to a number circle from 0 to 100. He made another sketch, and then, by connecting the 99 and the 1 with a line, the 98 and the 2, the 97 and the 3, all the way down to the 51 and 49, all of these pairs would add to 100. So he multiplied 100 times 49 and got 4900. Then he added the 100 at the top and the 50 at the bottom to get 5050.

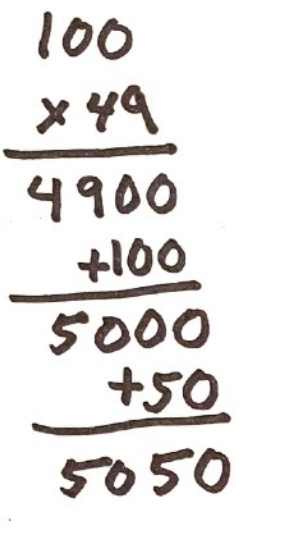
Peter was in that dreamy state between sleep and waking where his mind often worked best. For some reason the image of a snake came to his mind with the tale of the snake near its head. He realized he could make pairs that added to 100. Like 1 and 99, 2 and 98, 3 and 97 ... to 49 and 51. His eyes opened slightly. There would be 49 pairs that each totaled 100 with the numbers 50 and 100 left over. So 49 times 100 would be 4900, then add the 50 and 100 to get 5050!

Meanwhile, Rebecca had diligently written all the numbers from one to 100 in a column and had started to add them together. Then she thought that there must be an easier way. She suddenly realize she could write another column with 99 next to 1, 98 next to 2, and so on to 49 and 51. Each row added to 100, and, like

Tommy and Peter, she multiplied 100 times 49 to get 4900 and then added 150 to get 5050!

All three of them finished just before Mr. Stern said, "Put down your pencils." Tommy hoped he had shown enough of his work so that someone could understand what he had done:





1. How did Tommy use his number circle to solve the problem of adding numbers from 1 to 100?
2. How did Peter and Rebecca solve the same problem differently?
3. What's the sum of all the numbers from 1 to 1000? Get some help with this problem if you need it.

Chapter 24: The Results

One week later the results were announced at the school. The highest score at Green Forest Elementary School had been Tommy Turtle's! In fact, of all the fourth graders of the State, Tommy Turtle was second place! Rex Rabbit placed 10th at Green Forest and 66th in the State.

There was a story in the local paper about the competition. "Turtle Gets Second Place in State Math Competition!" When his parents found out they were very pleased. "You see," said his father smiling, "We turtles understand things better!"

There were some surprises. Peter Opossum had scored second highest in the school and fifth in the State. Apparently, he couldn't sleep at night, and had spent the nights studying math. And Rebecca Rabbit had placed third at the school and twelfth in the state. Mrs. Wise said she was proud of everyone for the effort they had put in to the competition and that other teachers throughout the state were wondering what was happening at Green Forest Elementary school! How had their fourth graders scored so high?

Rex Rabbit was not pleased with the competition results. He asked the university to grade his paper again. The university rechecked it and then moved Rex down two places to 68th. When Mrs. Wise found out

why Tommy was late to class she suspended Rex from school for a day and his mother had to come meet with her.

All of the teachers in the school now treated Tommy Turtle with more respect, and Mrs. Wise gave him, Peter Opossum, and Rebecca Rabbit some extra hard math problems to work on after class. Peter Opossum began arriving to school on time because he wanted to walk with Tommy to school. The three friends began meeting in the library regularly.

Meanwhile, high in tree east of Blue Lake, Edric and Edda Eagle were building their nest. While Edda carefully positioned two large eggs in the nest, Edric launched gracefully into the sky with a screech, flying north towards the Rabbit School.

1.How did the three friends place in the math competition, and what helped them succeed?
2. How did the school change after the competition results were announced?
3. What danger might be coming to the Rabbit School?

Questions for the whole book:

1. What are some of the challenges Tommy Turtle faces throughout the book?
2. How does Tommy Turtle grow and change during the book?
3. What lessons can be learned from Tommy Turtle's experiences?
4. How does the book compare to the story of the Tortoise and the Hare?
5. Is it better to memorize math or explore math?

Science Projects:

1. Research and compare the real behaviors and characteristics of turtles, rabbits, owls, and opossums with how they're portrayed in the book. What's accurate? What's different?
2. Using the speed of light (186,282 miles per second):

a. Calculate how long light takes to travel from Earth to Mars at its closest approach (34.8 million miles).
b. Calculate the same for Jupiter at its closest approach (365 million miles).
c. Look up the actual values astronomers use. How close were your calculations?

Author's notes:

- *The mathematics in this book is consistent with the California Common Core State Standards.*
- *All charts and photos are by the author, and the images were generated by the author using DALL-E.*
- *All the animals in this story are fictional. Any similarity to actual animals, living or dead, is accidental.*

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