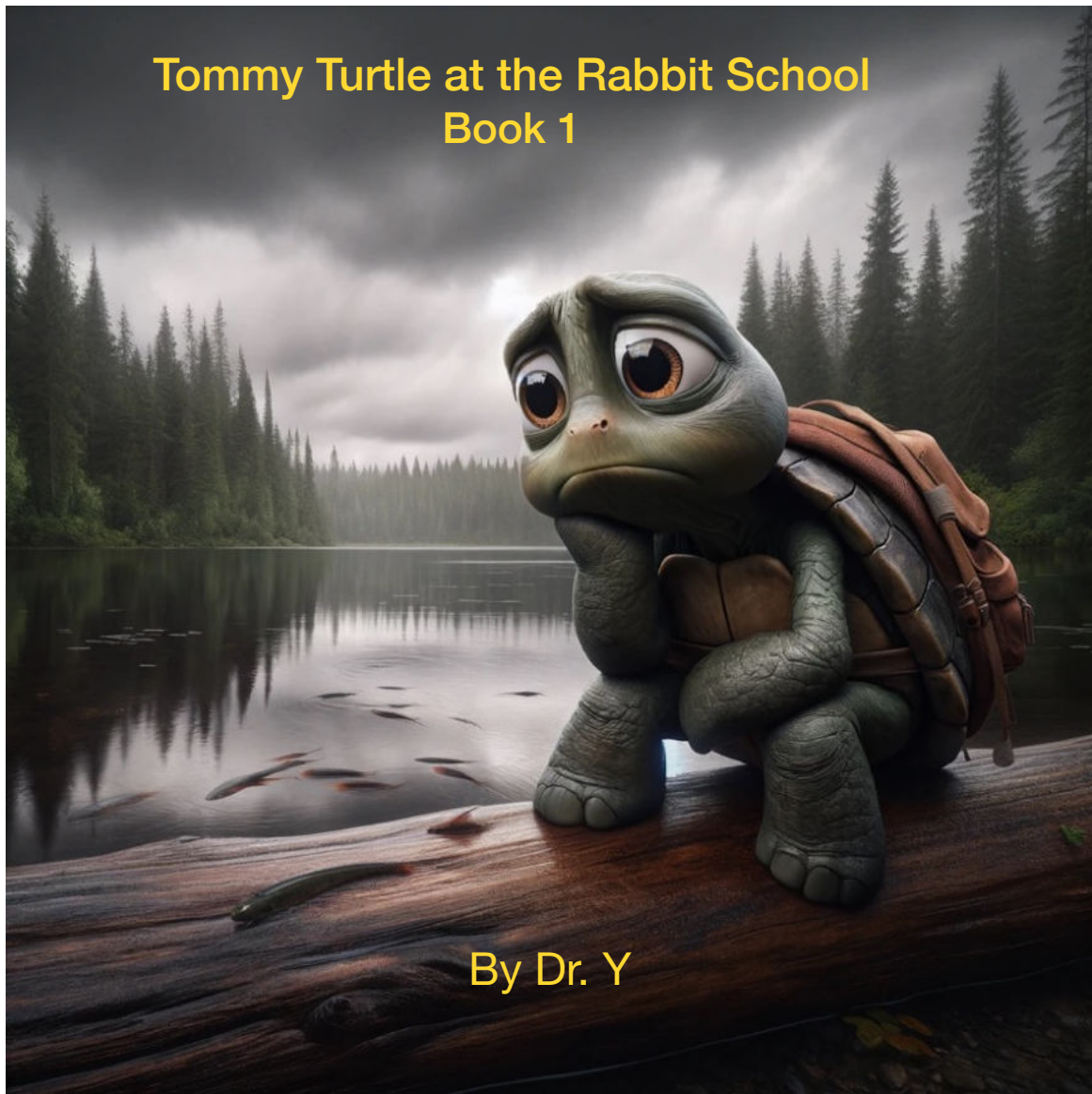Unpublished Draft for comments

Tommy Turtle at the Rabbit School
Book 1

By Dr. Y

Chapter 1: A Sad Turtle

Tommy Turtle had never missed a day of school. But this morning, as he left the Principal's Office, 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.

Today the lake's surface was mostly dark gray. It reflected the blanket of clouds. A slight breeze from the west sent small ripples across the surface. Surrounding the lake was a forest. Its naked branches reached toward the sky.

"Rain is coming," Tommy thought.

Tommy plopped into the water, swam under the surface, and felt 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, 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 the highest 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.

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, he felt a sense of relief. His mind drifted back to an earlier time:

Near the Turtle Village where he lived, life had been easy. He chased small fish. He ate earthworms, caterpillars, snails, beetles, and grasshoppers. Sometimes, while swimming, he poked his head out of the water to look around. When he was tired, he sat on a log in the sun with the other turtles. The turtles felt safe from most predators because their hard shells protected them.

In the spring, he watched the forest dress itself in green. In the summer, he watched the grass along the shore grow tall. During the autumn, the leaves from the trees would float gently to the ground, swinging back-and-forth on the air. Geese filled the sky in a giant V shape as they flew south for the winter. He sometimes tried to count the geese, but there were too many. At night, he watched the moon and the stars as they silently crossed 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.

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 on their AI computer 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: IIIIIIIIIIIIIIII. 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, and the patterns of birds flying north and south, the patterns of the movements of the sun, moon and stars.

In a clearing, not far from Turtle Village, his father had put a large stick 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."

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, and later he described it to his parents.

"That's an opossum," his father had said. "We've had reports of several of them moving into this area."
"Why are they moving here?" Tommy asked.
"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 stick marks for animals, and his parents showed him how to bunch them together. After he made 4 stick marks, he could make a mark sideways through all four of them. This showed 5 total marks in a

group. Making groups of 5, 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 stick 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, and Tommy was waddling on the muddy ground of the forest next to the lake, heading home. He came to a clearing and startled a small opossum eating something.

It showed its sharp teeth and hissed at him. Tommy got scared, and he pulled his head and feet into his shell.

"Sorry to scare you, turtle," the opossum said. "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.

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 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 said, "Can I learn to count the animals like you and Dad?" She had smiled and said, "Yes."

So he had left the Turtle Village, swam to the opposite side of the 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.

Also, each grade had its own small building. The buildings were arranged in a circle, and the school office was in the center of the circle. The new library, with an AI computer, was located just outside the circle. All the buildings were located about halfway between the shore of Blue Lake and the forest.

The teachers were all large rabbits, while the students were medium-sized rabbits in the 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 east side of the lake.

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 on 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.

The students and teachers had not seen the eagle in the sky, but they had seen its shadow as it swept across the playground, its wingspan causing a slight chill as it suddenly blotted 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 them easy prey for the eagle.

So once a month, when the students are 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." And if anyone ever saw 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: How Much and How Many

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."

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." For the three marks 111, Tommy drew a picture of 111 turtle eggs.

He thought, "It is quicker to write '111 turtle eggs' than to draw all those eggs or all those stick 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.
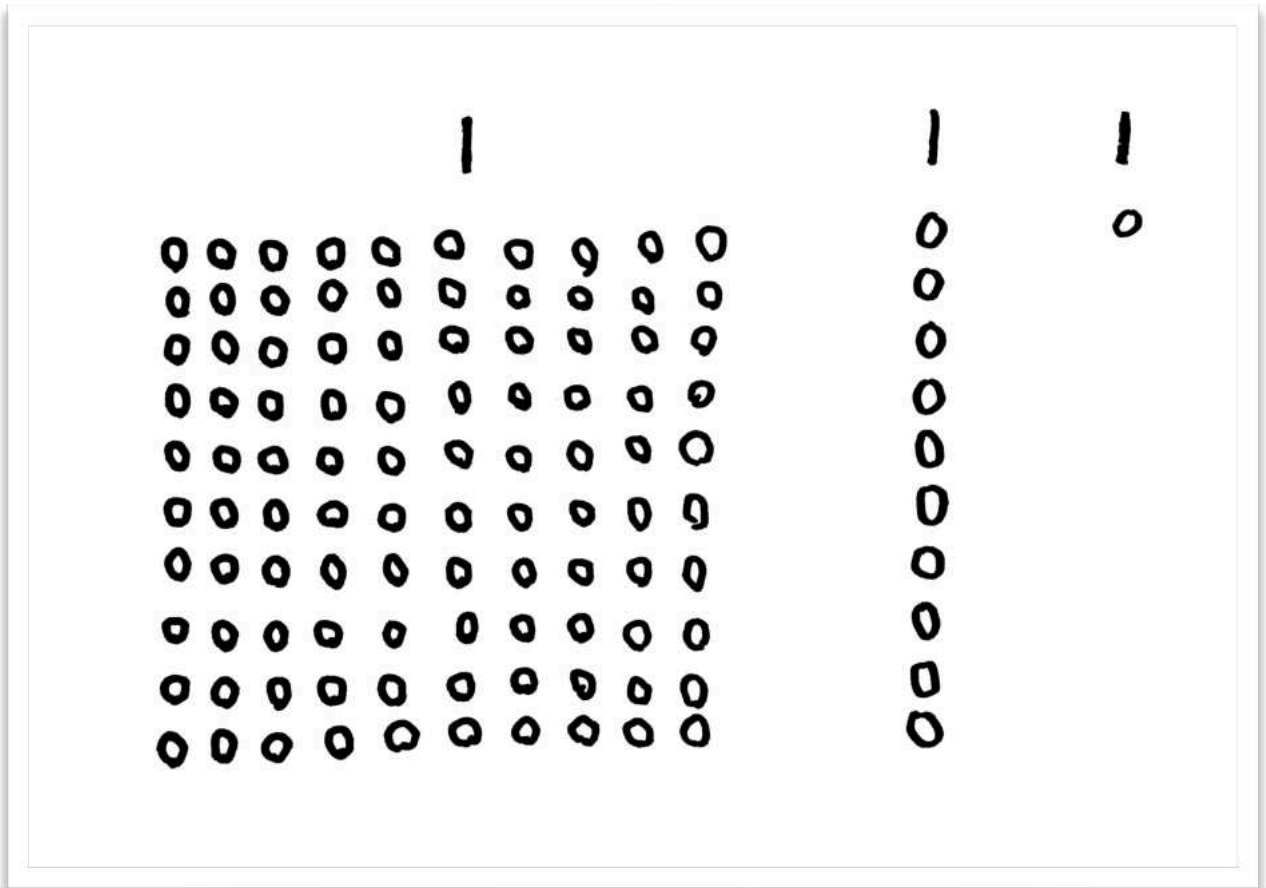
Tommy Turtle's 111 turtle eggs.

Tommy thought for a minute, "If I saw a 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:

OOOOOOOOOOOOOOOOOOOOOOOOOOOOO
OOOOOOOO

"I could write it using stick marks."

He wrote 37 stick marks.

卌 卌 卌 卌 卌 卌 卌 卌 卌 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 stick marks." So when the teacher asked him if 5 + 2 equaled 2 + 5, Tommy wrote IIIII + II = II + IIIII or IIIIIII = IIIIIII and he saw that it was true. So, sometimes he used his stick marks, and sometimes he used the new, shorter way.

He also noticed that with the plus sign, +, the two line came together, but with the equal sign, =, the two lines stayed apart, and had the same length.
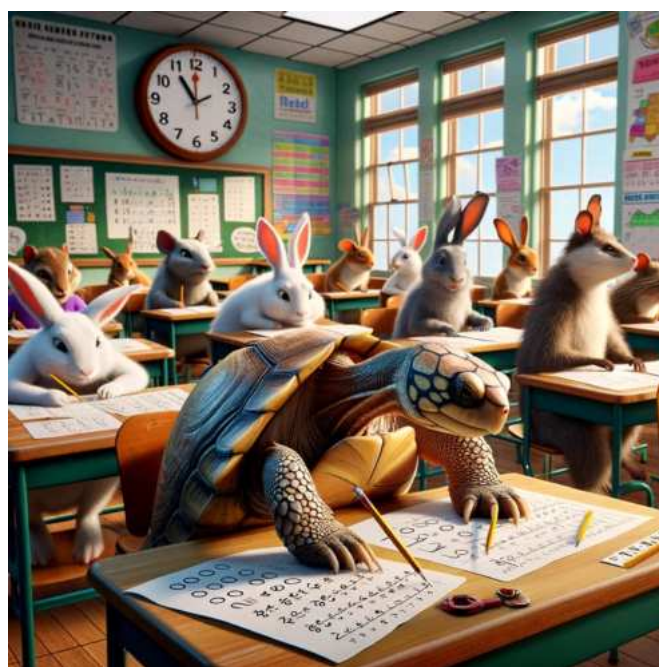
1. What does the "1" mean in this number: 125?
2. What are four different ways to write the number 28?

Chapter 6: A Number Circle

One April day in the second grade, there was a chill in the air and some leaves had begun to reappear on 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.
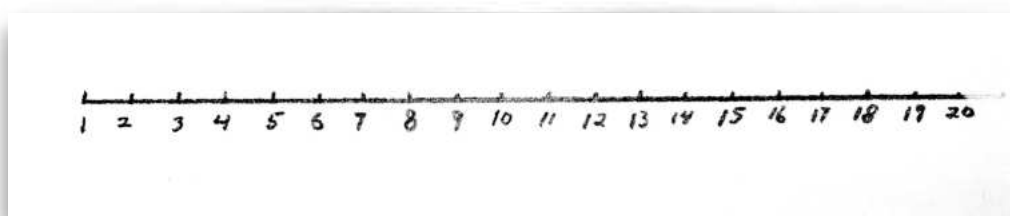
Miss Duller's number line.

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, 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. Using a circular lid from a large jar, he drew a circle, and then he numbered it.

Tommy thought, "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."

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.
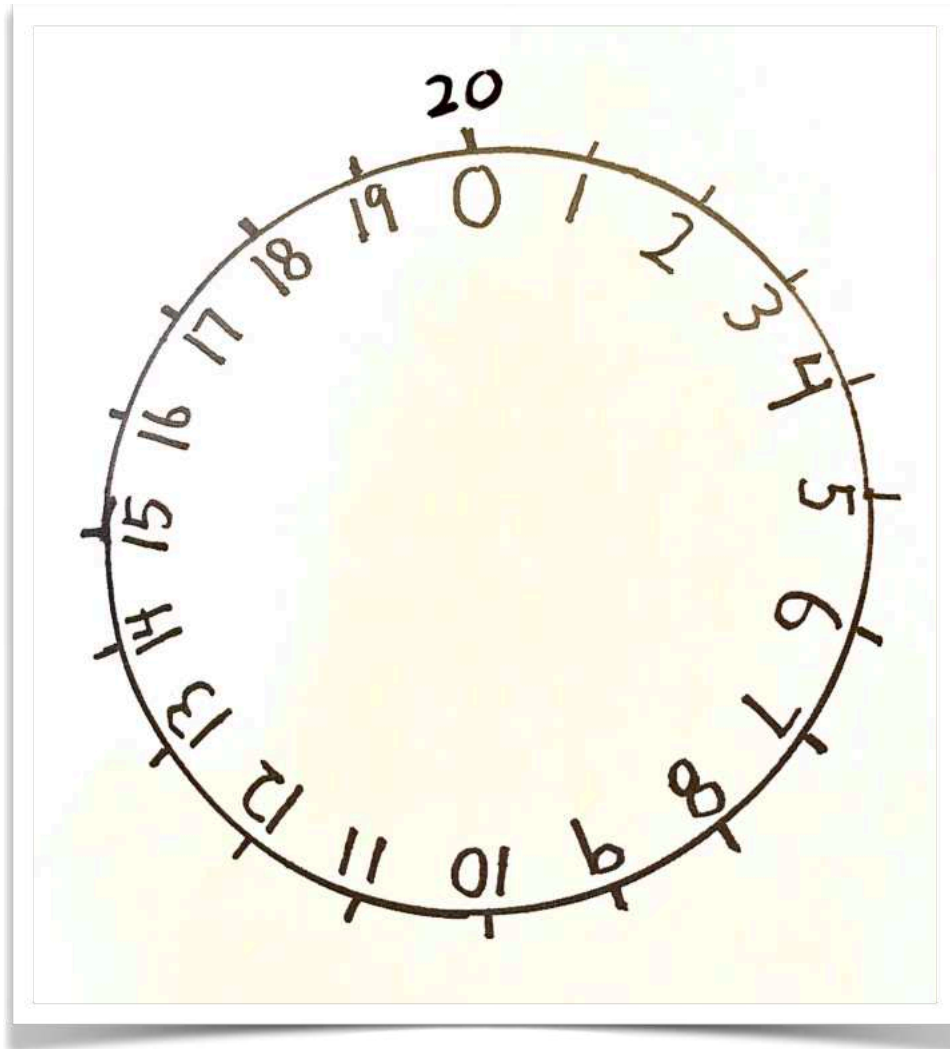
Tommy Turtle's number circle.

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 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.

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: 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."
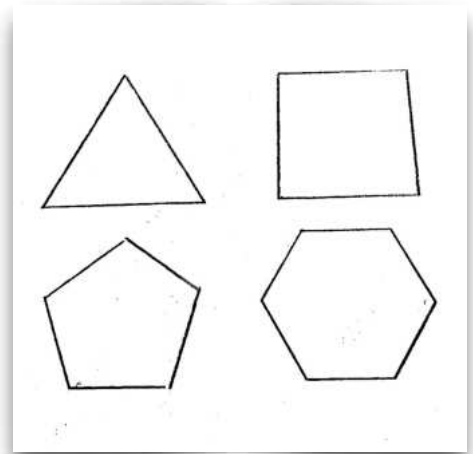
Then, all the students started drawing them.

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.

Mr. Smart liked his new names and Rebecca Rabbit did too. Mr. Smart printed out a chart with the old names and the new names. "I wonder what a 100-nik looks like …" thought Tommy.

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 8: 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 stick marks and then he moved all the marks to the left, above the 2.
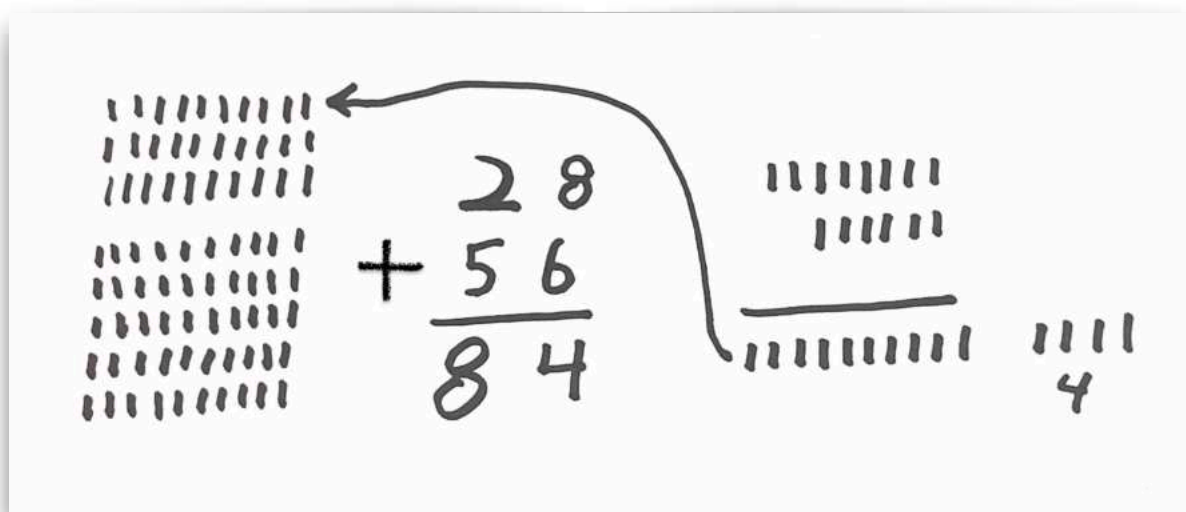
Sometimes Miss Duller gave them a sheet of paper with many addition problems on it. Tommy did them his way.

He thought, "There's a lot of motion in 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 stick 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."

He said to himself, "That's how I like to do it. The others sometimes make mistakes, but I don't."

And he kept doing it his way for some time, and even though he was slower, he rarely made mistakes. 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 in 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 9: Bullying

During the morning break and lunchtime all the students would go outside and play. Tommy 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 also listened 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. He began to mark down their 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

Meanwhile, the boy rabbits would have fun playing the game "tag," and the girl rabbits would skip rope.

Tommy felt a bit hungry, so he put away his notes and 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.

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.

Very high in the sky, a small dot moved in a circle. It was an eagle, and it was gliding on the air. It was morning, so the echo shadow fell to the west, over the forest. So no one at the school could see the eagle, but it could see all the animals walking into their classes. Of all animals, eagles have the very best eyes.

1. What did Tommy think about the birds he saw and heard?
2. What did Rex Rabbit and some other boy students say to Tommy during the morning break, and how did Tommy react to their teasing?

Chapter 10: 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, Miss Duller 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.
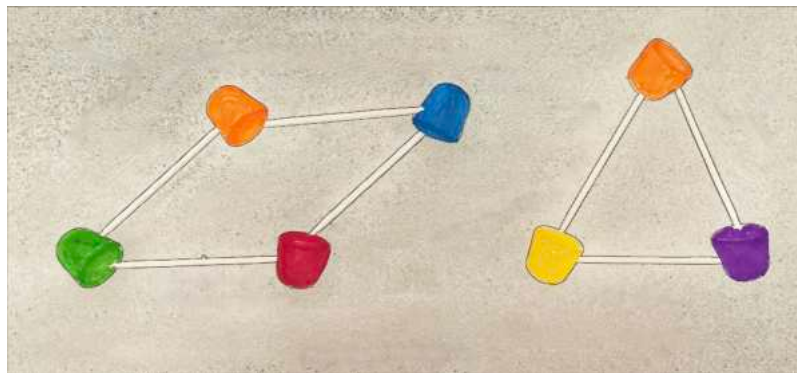
Tommy made a 4-nik and 3-nik. He discovered that the 4-nik could bend out of shape easily but not the 3-nik. The 3-nik was stronger. So he made some larger, 3D shapes using 3-niks on the outside.
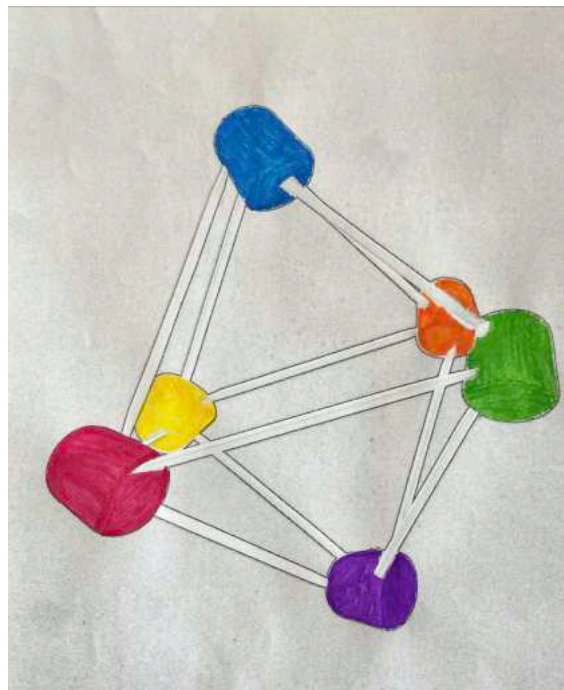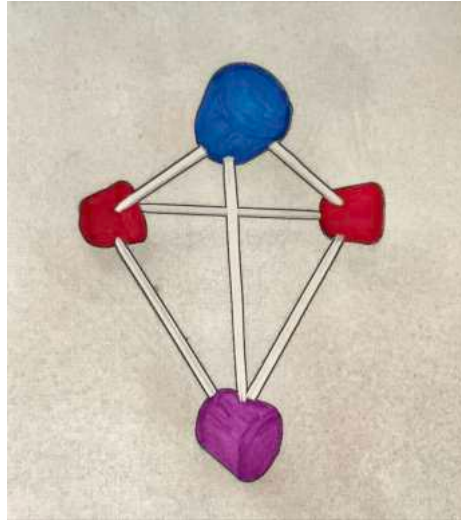
Miss Duller and the other students didn't know what to think about these unusual shapes. They scratched their heads with their paws. Tommy wondered why the others didn't make strong shapes—strong like his turtle shell.

While Miss Duller 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 Miss Duller suddenly turned around and said, "Rex Rabbit! Get back to your seat!"

It was the first time Tommy had seen Miss Duller 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, Miss Duller let the students take apart the shapes and eat all the gumdrops. Tommy did not take apart his shapes. He put them in a bag and later took them to the library.

In the library, Mr. Smart showed Tommy a book with shapes like Tommy's. The shapes had some big names: tetrahedron, octahedron, hexahedron, icosahedron, dodecahedron. Mr. Smart said they were the names that

the ancient Greeks had given the shapes. Tommy decided to make the names easier to remember and use. So he studied them carefully. He noticed that they all 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.

The 12-nook was made of 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
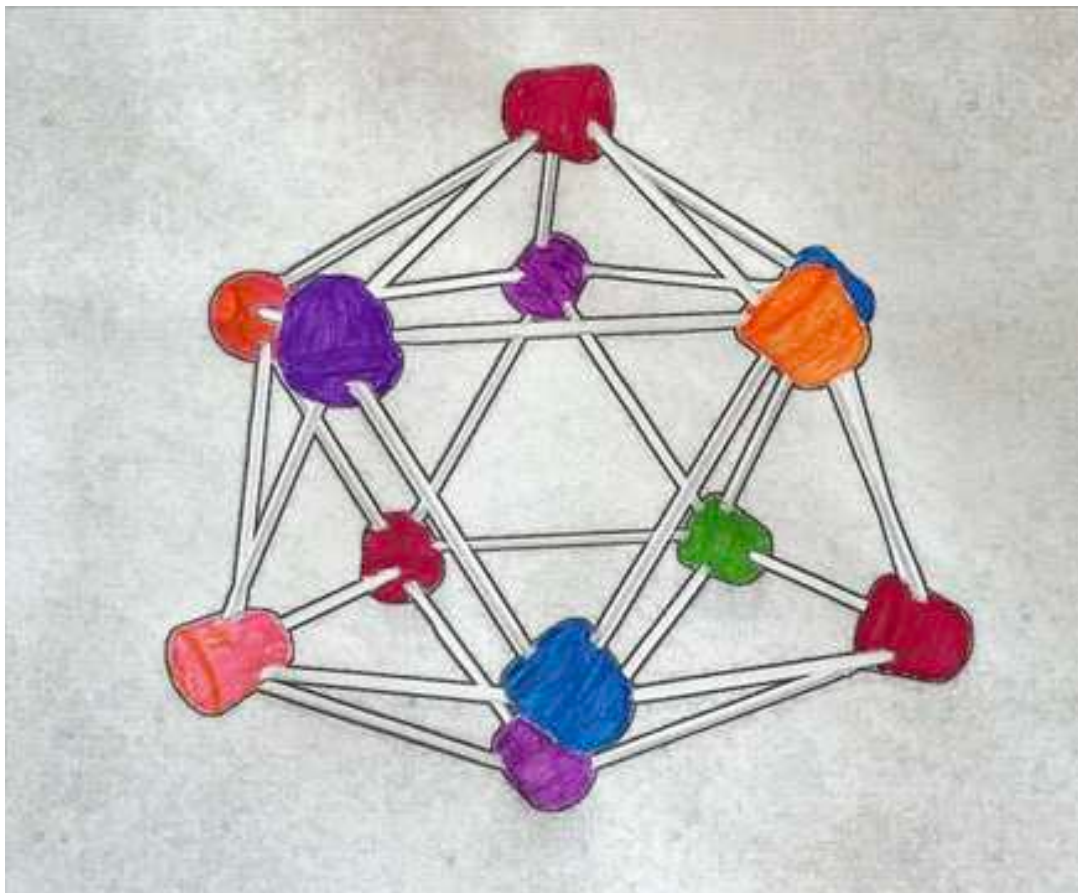
back to the classroom and Miss Duller gave him the toothpicks.

The 12-nook was firm. Then he made a 20-nook. It fell down.
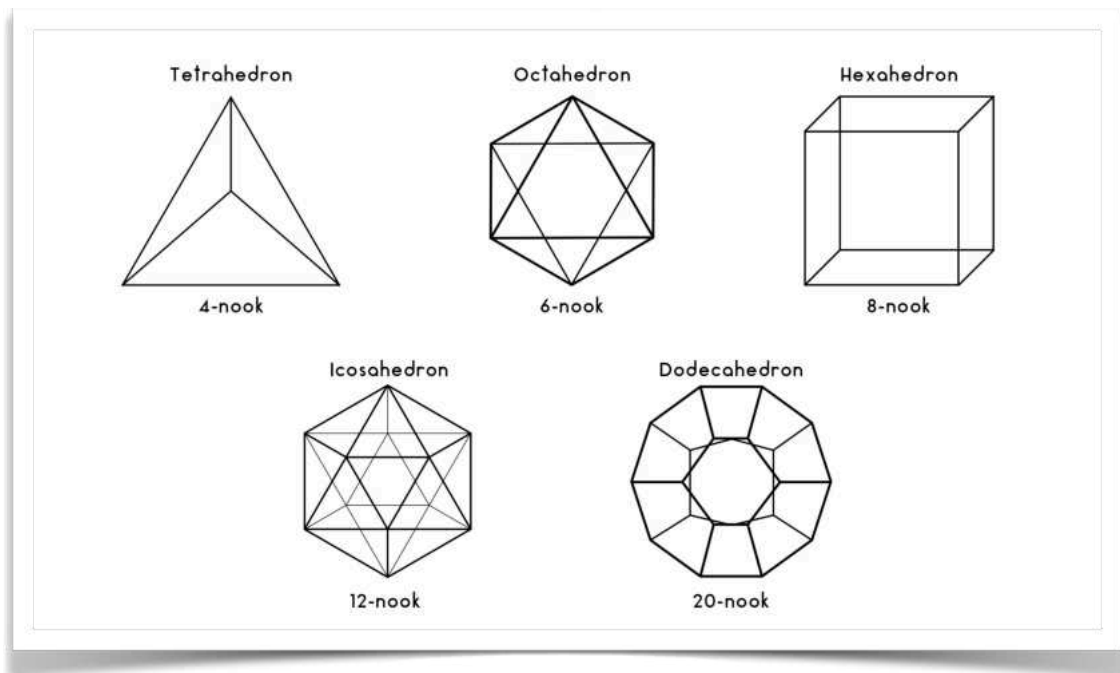
Computer printout of the Greek names and Tommy Turtle's easy names.

Then, with help from Mr. Smart, he printed out the shapes with both the Greek names and Tommy's new names. Mr. Smart thought that Tommy's names were better.

Mr. Smart also did some research on the library's AI and found that you could also make shapes out of string and 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. He thought he might make some of these.
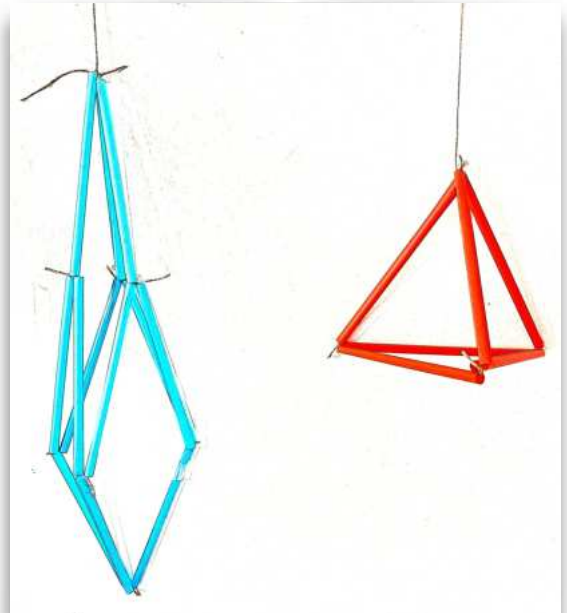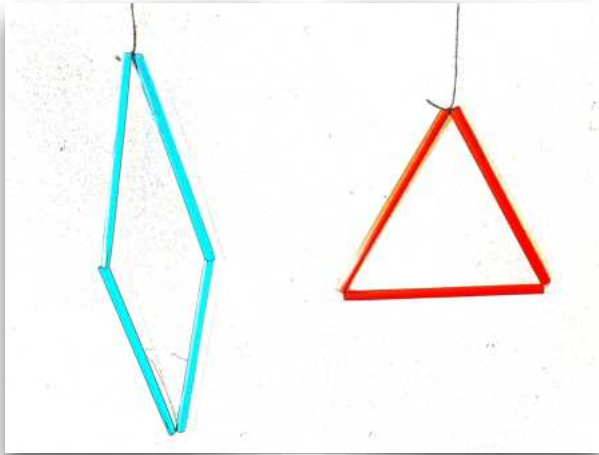
1. What kind of shapes did Tommy make with toothpicks and gumdrops in class?
2. Why did the other students scratch their heads when they saw them?
3. What happened when Rex Rabbit tried to crush Tommy's shapes, and how did Miss Duller react?
4. What word did Tommy use for the flat, 2D shape called a triangle?
5. What word did Tommy use for a 3D shape called a tetrahedron?

Chapter 12: 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.
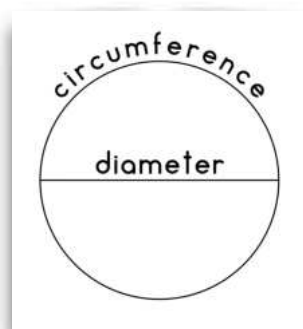

She passed out twelve round lids of different sizes and told the students to use them to make circles. Then, they

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

Tommy didn't like those big words, so he made some simpler words that he could remember easily around and across.

He was still the last one done. When he finished, everyone was already playing computer games.
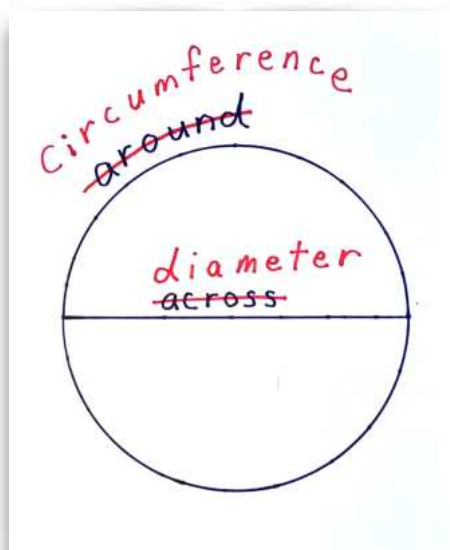
The next day Mrs. Block passed back all the papers. Tommy's paper had his easy words crossed out, and the big words written in.

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 11: The Eagle

During the morning break, one hot summer day, 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 some 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 lunch of worms was going to come out of his mouth. It did. Some of the rabbits said, "Yuck!"

Then someone yelled loudly, "Eeeeagle! Eeeeagle!!" All the rabbits and animals from every direction froze and then began sprinting toward the school building. Tommy began following them as fast as he could, but he was soon far behind the others. As he ran, he imagined that the eagle was diving down toward him at that very moment. Tommy wished he had stayed closer to the school.

Suddenly, Peter Opossum was beside him. Peter said, "Don't worry, Tommy, that was me who yelled 'Eagle.' There is no eagle."

Tommy smiled, and then Peter Opossum and Tommy Turtle walked calmly together to the classroom where they found all the rabbits shivering fearfully under their desks. Rex Rabbit's eyes were very wide. Later, the teachers somehow discovered what Peter Opossum had done, and they told him to sit in the corner all the next day—where he had a nice sleep.

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"? What happened afterwards to Peter Opossum?
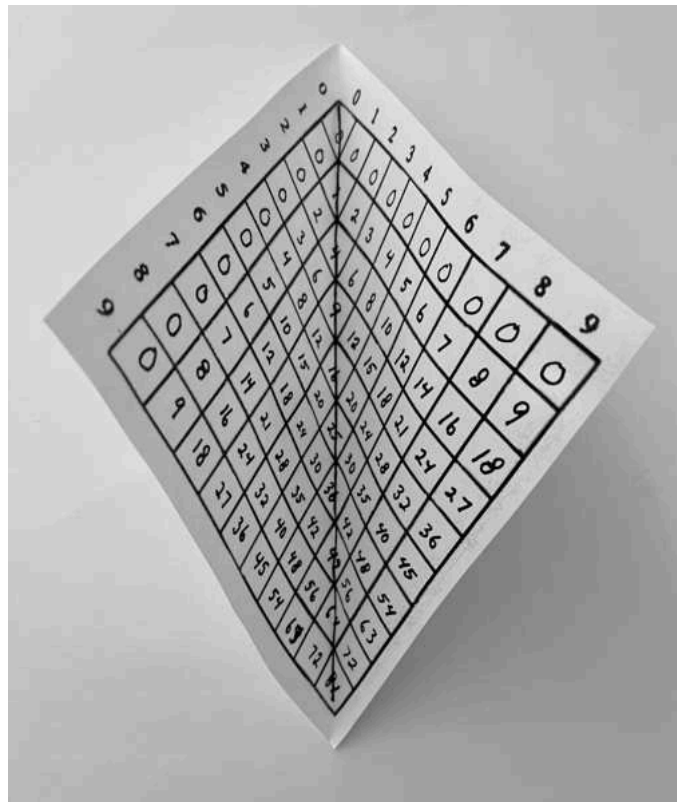
Chapter 14: A Multiplication Triangle?!

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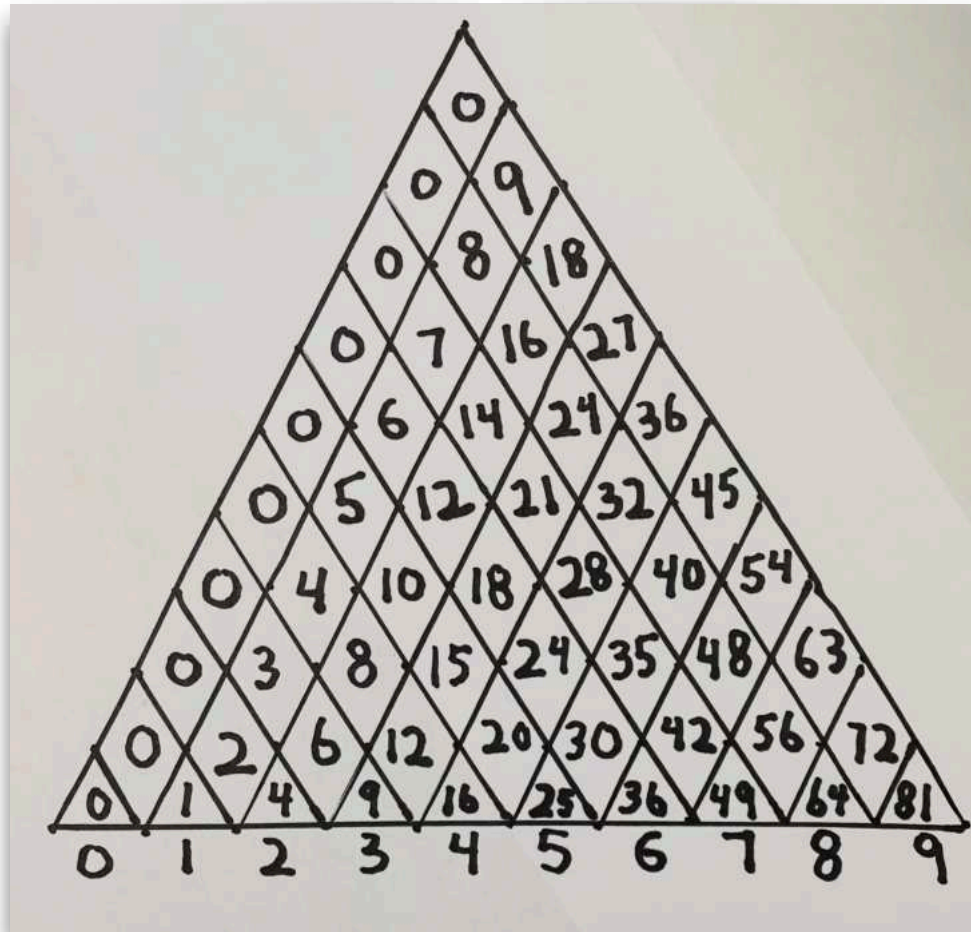
Tommy and the students stayed busy for some time. When Mrs. Block had finished the report cards, she walked around the room and began collecting all the papers. When she got to Tommy's desk, she froze and said, "What's this?!"

"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 15: 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 Sun and planets. 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." 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 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 was 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 16: 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. 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.

When Mrs. Wise called on him to read, he read slowly. However, she told the class, "Tommy Turtle reads with a lot of feeling. That shows understanding."

Mrs. Wise didn't talk a lot. She would usually ask a question and when someone answered, she would ask another question, and when that was answered she would ask another question. Tommy enjoyed her way of teaching and tried to answer all her questions.

1. Who is Tommy's new teacher in fourth grade and where did she move from?
2. How did Tommy feel when his new teacher, Mrs. Wise, complimented his math drawing?
3. How does Mrs. Wise teach in the classroom, and how does Tommy feel about her teaching style?

Chapter 17: 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. Most of the students drew a square, a pentagon, or a hexagon.

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, cut some off, and laid it carefully on top of the circle. 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 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 it has 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.
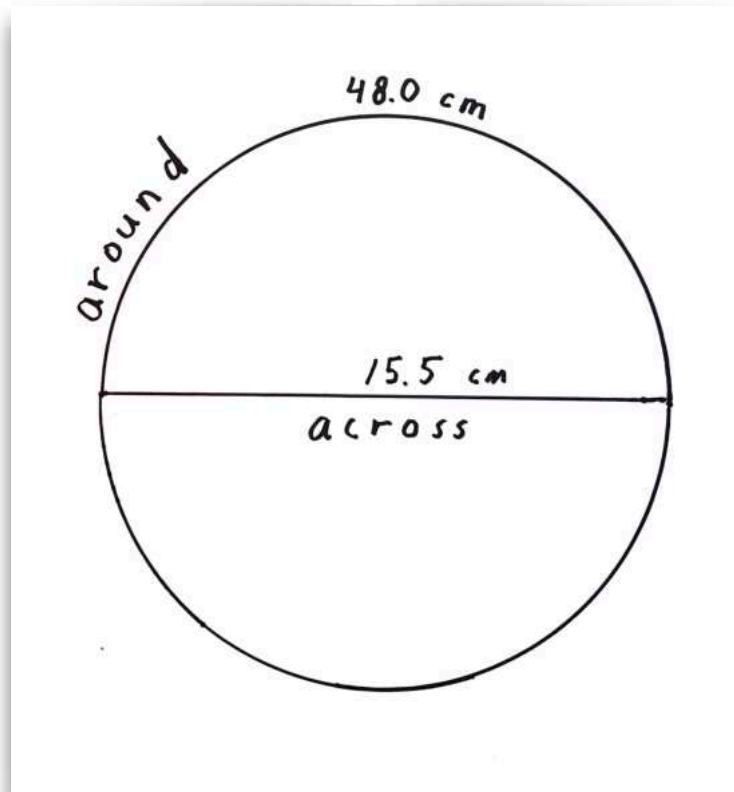
Afterwards, using Tommy's names, she made a table on the board of all the arounds and acrosses. Then she divided all of the arounds by the acrosses. She got numbers like this: 3.1, 3.0, 3.3, 3.2. She asked the students what they noticed about the numbers. Rebecca Rabbit raised her hand and said, "They 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!"

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 18: 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. Tommy studied the book and the solutions, and he learned a lot.

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?

Chapter 19: 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.

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.

Just has she had given up all hope that he might come, suddenly both Tommy and Peter Opossum came through the entry door! Lucky for Tommy, Peter Opossum was late as usual, and he had found Tommy and flipped him onto his feet. They had hurried, as fast a turtle could hurry, to the school. Mrs. Wise gave Tommy and Peter Opossum a test.

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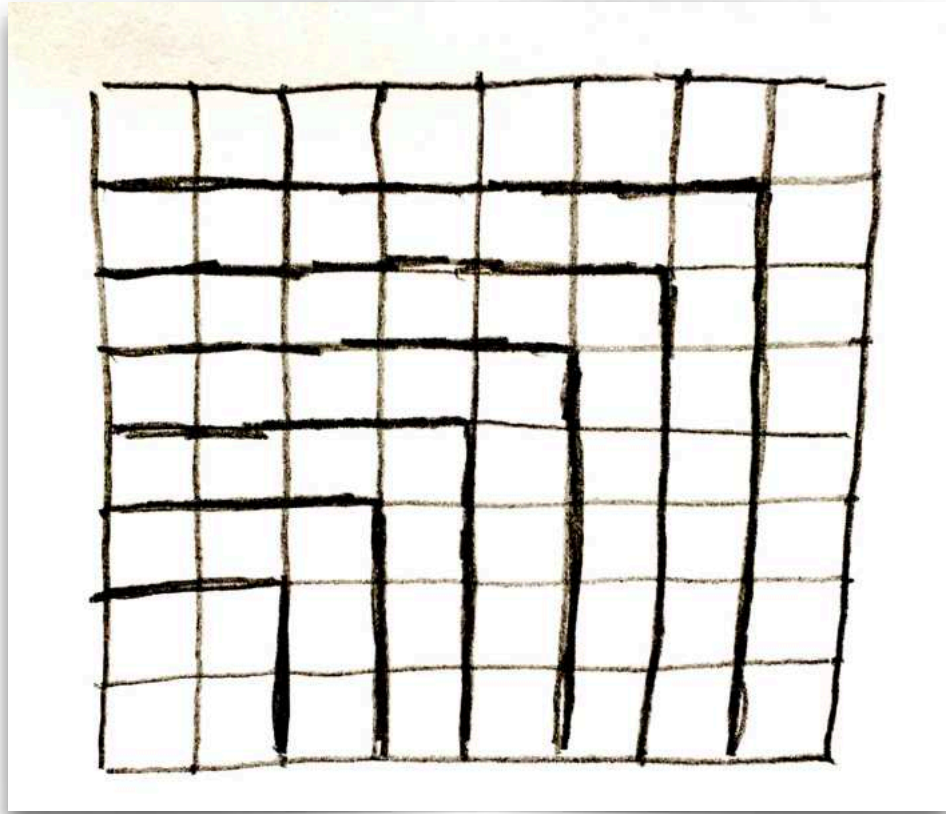
but he also saw many other squares of different sizes which he also drew.

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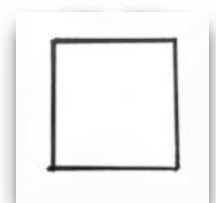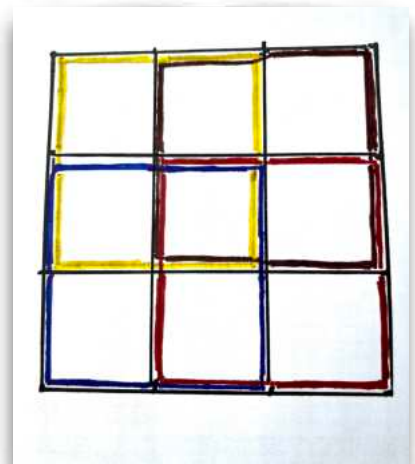
square.
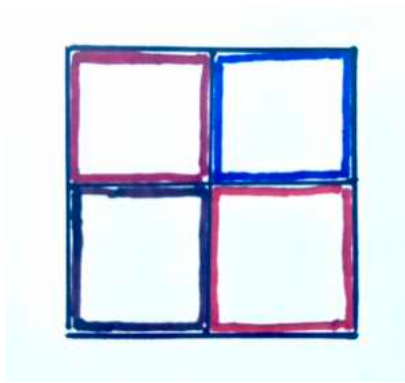
Then he drew the next biggest chessboard which was made of four small squares. Each side was 2 inches long, and he knew that it was called a 2 by 2 square. And he could also write it, 2 x 2. Now he had a total of four little squares and one larger square, five total squares.

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 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.
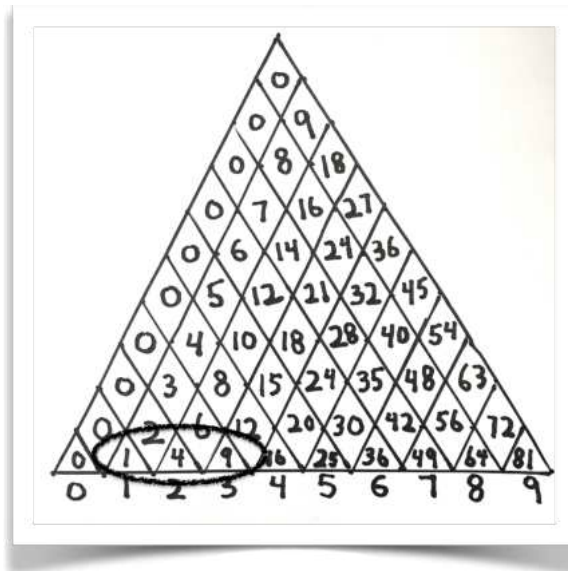

1 x 1, 1, 1
2 x 2, 4 + 1, 5
3 x 3, 9 + 4 + 1, 14

"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
1×1	1	1
2×2	4 +1	5
3×3	9+4+1	14
4×4	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. What was the first problem in the math competition?
2. How did Rex Rabbit approach the first problem and what did Tommy Turtle do differently?
3. How did Tommy Turtle solve the problem of counting the number of squares on an 8 by 8 chessboard?
4. How much time did Tommy Turtle have left to finish the problems?

Chapter 20: 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. Sweat was pouring down his furry face. For his final answer he just guessed that it was 500.

But for Problem 2, Tommy Turtle looked at his chart and thought, "This pattern probably continues all the way to 16 x 16. I don't need to draw anything!" He slowly and carefully wrote the numbers down and he got his final answer of 1,496. He looked at the clock. There were only five minutes left!

1. Continue the pattern for the second problem. Get some help if you need it.

Chapter 21: 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'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.
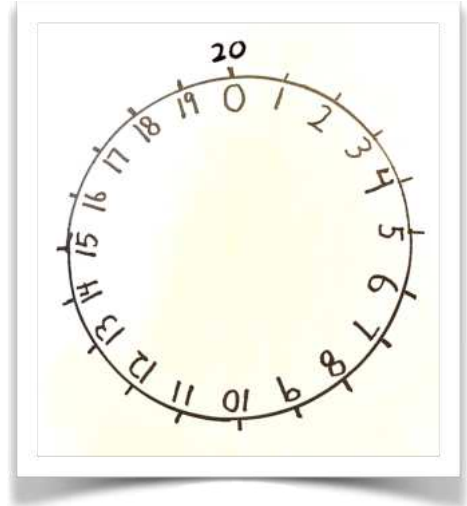

Tommy Turtle's number circle.

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.
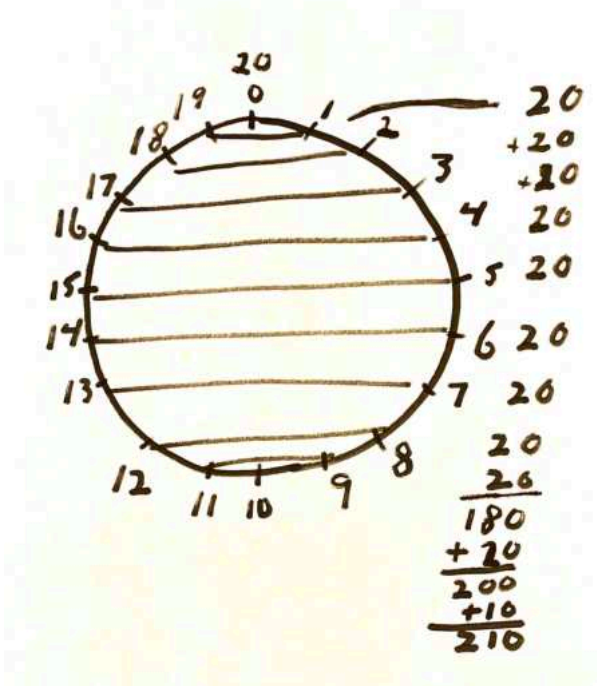
Each of these lines added to 20. Then he added the nine lines to get 180. Then he added the 10 at the bottom and the 20 at the top, to get a total of 210.

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 lines 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. He finished just before Mr. Stern said, "Put down your pencils."   He hoped he had shown enough of his work so that someone could understand what he had done:
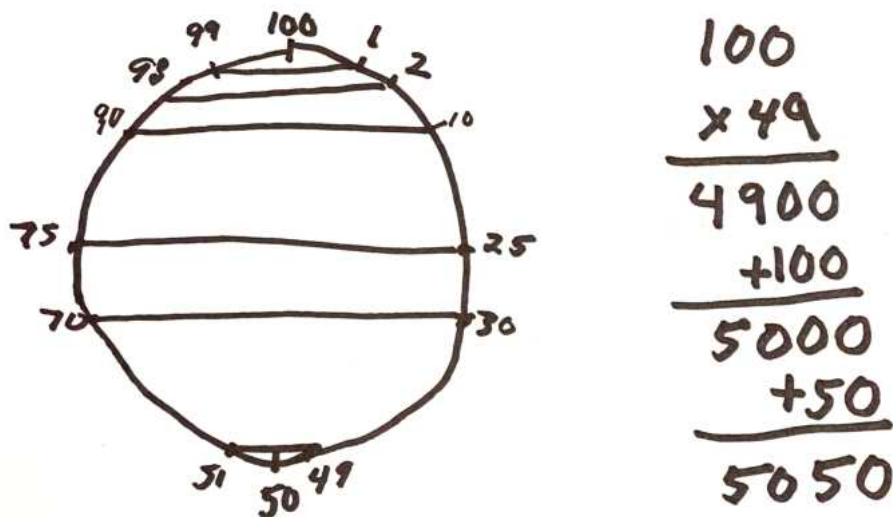
1. What's the sum of all the numbers from 1 to 1000. Get some help with this problem if you need it.

Chapter 20: 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 12th at Green Forest and 255th 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 was another surprise. 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.

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 257th. When Mrs. Wise found out why Tommy was late to class she suspended Rex from school for a day and his parents 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.

Meanwhile, Edric and Edda Eagle now had two large eggs in its nest, and, while Edda kept the eggs warm, Edric launched gracefully into the sky with a screech, flying north towards the Rabbit School.

1. Who scored second highest in the math competition in Tommy's school and how did he achieve it?
2. What was Rex Rabbit's reaction to his place in the math competition, and what happened after he asked the university to recheck his paper?

Chapter 22: Rebecca Rabbit

Tommy passed the second grade. 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. The boy rabbits really liked to play ESCAPE! In this game a hungry animal would chase after the rabbits and try to catch them. The boys could choose a fox, coyote, bobcat, hawk, or eagle to be the chaser, and then they would have to run and hide from it to earn points in the game.

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.

One day, Rebecca Rabbit hops to the front of the class and says to Mrs. Block, "I want to play ESCAPE!" Several of the students chuckle, but not Tommy.

Mrs. Block smiles nicely, "That's a boys' game, Rebecca."

Rebecca is firm, "I don't care. It looks like fun. The other game is boring."

Mrs. Block says, "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!"

As Rebecca is leaving the room, Rex Rabbit whispers to her, "You'll get caught every time." She ignores him.

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

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. Do some research on how real animals are different, or the same, as those in the book.

2. When Mars is closest to Earth, about how long it would take light to travel to Mars from Earth? How about with Jupiter? Look up the correct answers to see how close you were.

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.*