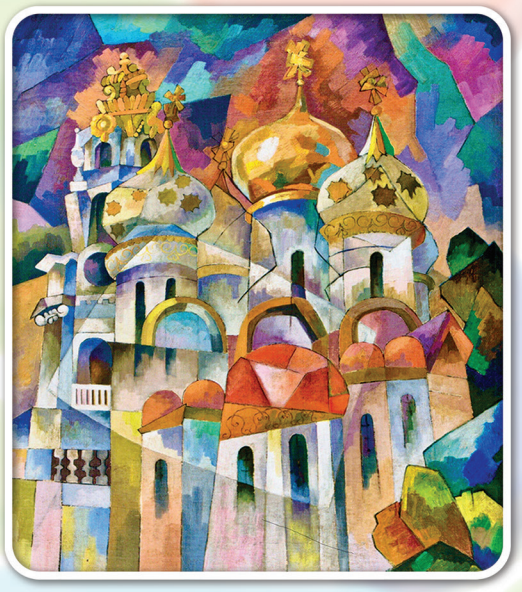
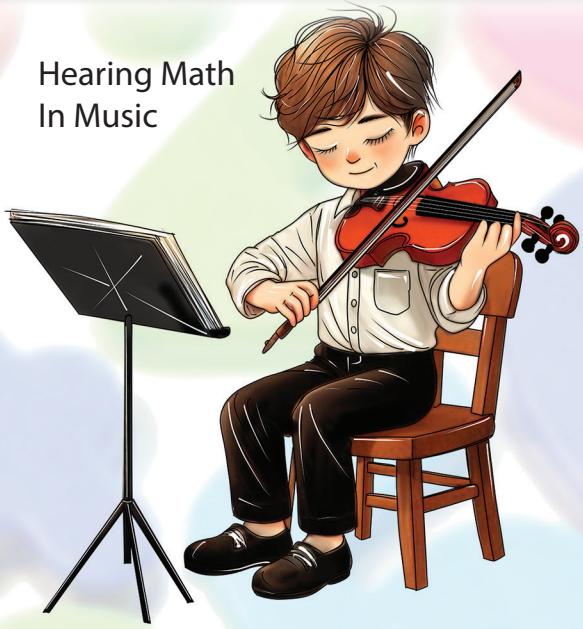
Core Knowledge® MATHEMATICS

Connecting Math to Our World:
Math All Around Us

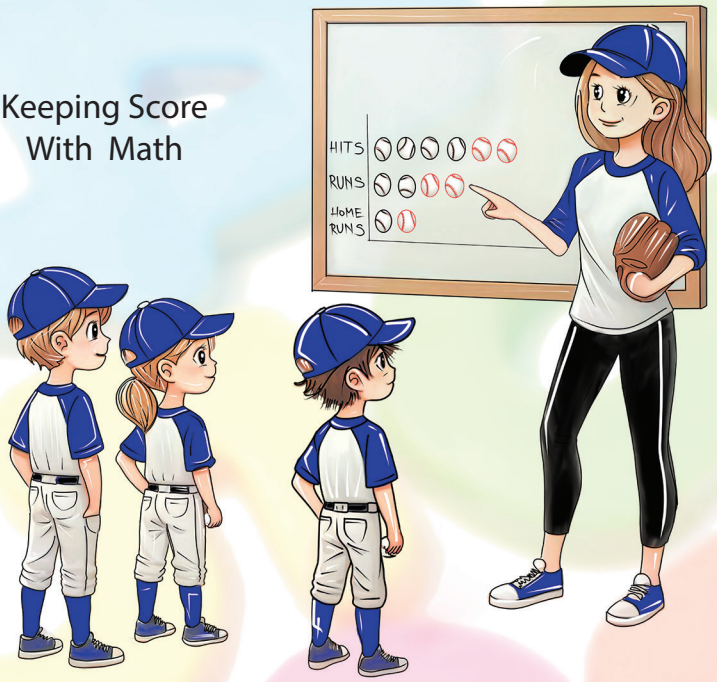
Seeing Math In Art



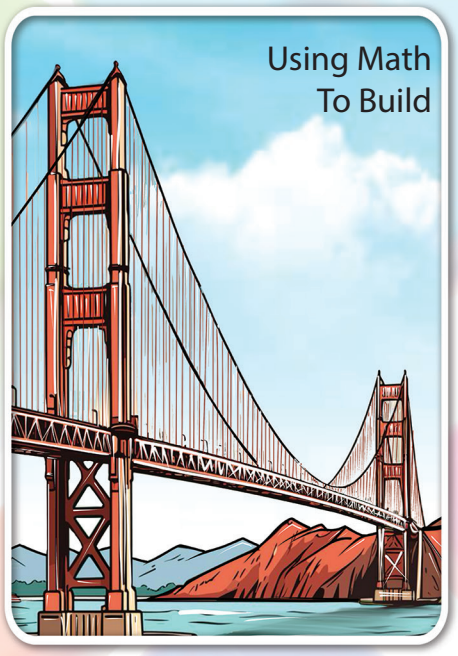
Hearing Math
In Music



Keeping Score
With Math



Using Math
To Build



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Math All Around Us

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Math All Around Us

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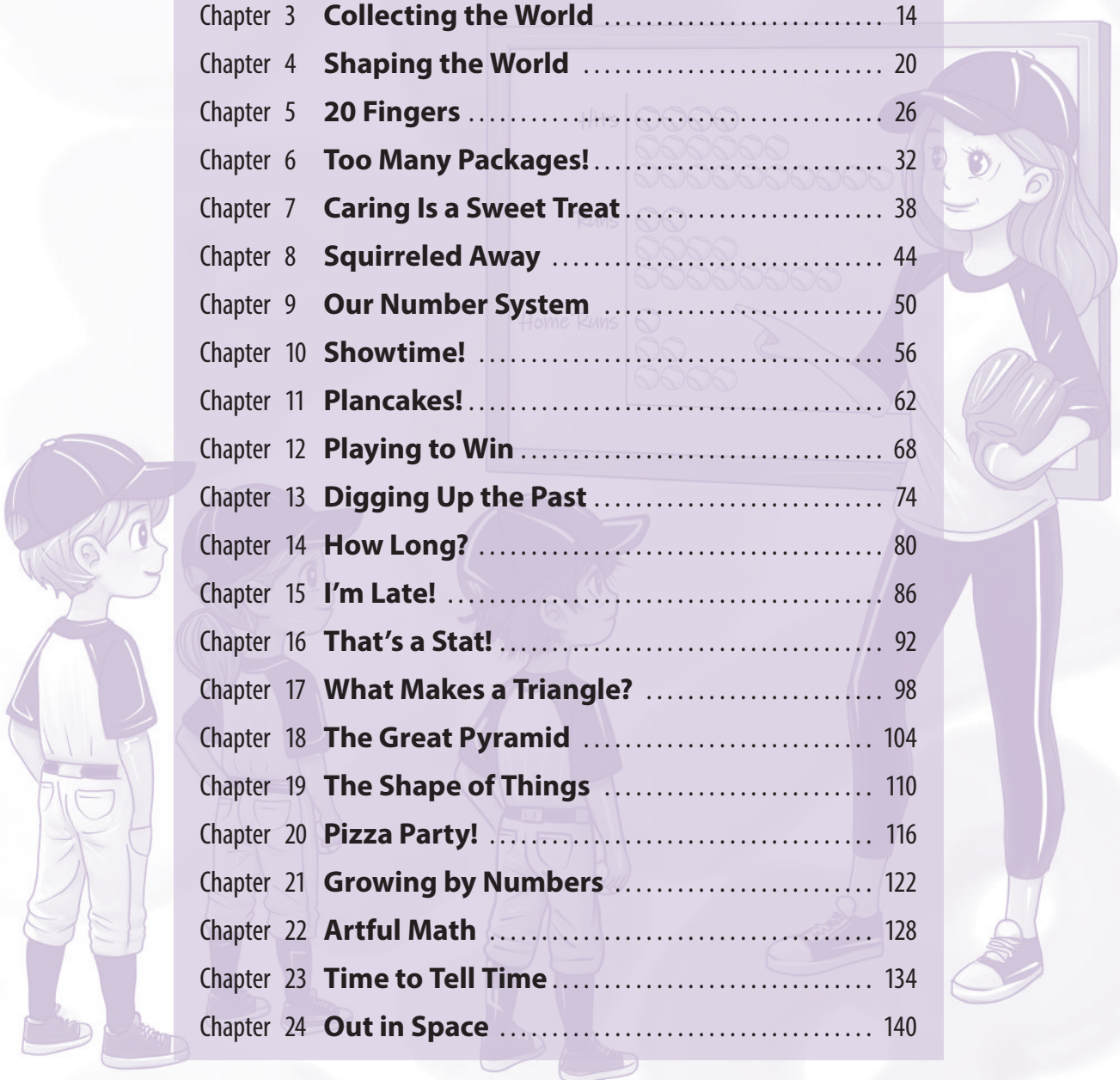


Let’s explore math in our world!

Math is everywhere, even in music.

Math helps us plan . . .
how to grow plants in a garden.

Math helps us have fun . . .
moving pieces on a game board.

Math helps us answer questions like . . .
how many nuts can a squirrel carry?

What else can math do?

Let’s find out!

CHAPTER
1

Math in the World

Art is full of shapes, lines, and colors.

Look at this painting.

What do you see?

See how the artist used colors and shapes.

How does this painting make you feel?

Sometimes a painting has a message.

Sometimes a painting is teaching a lesson.

Sometimes a painting is just a fun thing for the artist to make.

We see shapes in nature.

Bees make honeycomb in their hives.

They make the honeycomb out of beeswax.

The holes are called cells. Look at the shapes they make—these are hexagons.

The hexagons are strong, and they don't take much beeswax to make.

That means the bees can make a lot of cells!

There is no wasted space.

How are buildings made?

We don't just grab some bricks and start building!

First, an architect designs the building.

They want it to look interesting as well as be useful.

Architects must answer questions.

What will the building be used for?

How tall should it be?

How will light get in?

What shapes work best? What is the best material to build with?

How will it stand out from other buildings?

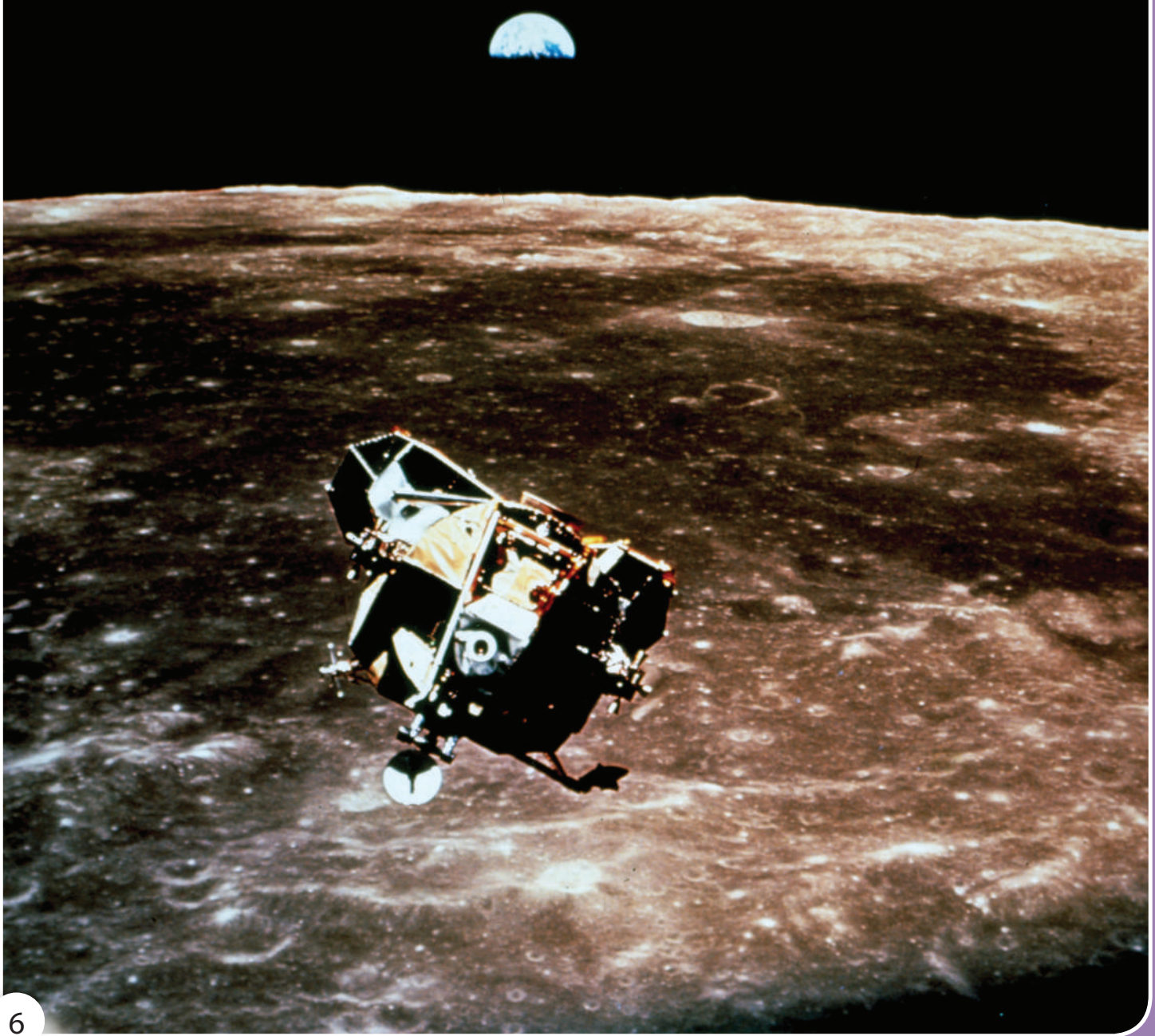
Smart phones can do all sorts of things!
We can make calls, browse the internet, and watch videos.
Smart phones are small computers.
How does the phone do what we want it to?
The phone works by using a special language, or code.
Computer code uses numbers.
The code tells the phone what to do.

The farthest people have ever traveled is to the moon and back.

That is a very long trip!

It took a lot of planning.

It took a lot of studying to understand how to build machines to go to space.



Designs in art and in buildings use shapes.

Smart phones use codes made up of numbers.

Numbers and shapes are used in math.

Math helps us explore, learn, create, and play.

It helps us ask questions.

It helps us find the answers!

If we look closely, we can find a little math in just about everything.

And each new thing you learn about numbers and shapes leads to some new thing that you can do.

Main Idea

Math is a part of our everyday lives.

CHAPTER
2

Fun and Games

Talia, Maya, David, and Diego are going to play a board game!

"How does this game work?" asks David.

"We each have a piece to mark our place on the game board. We want to move our piece to the end of the board. The person whose last roll lands them on the end square wins. If you pass the end square, you lose!" says Talia.

"But how do we know how far to move our piece?" asks David.

Talia and Maya show him a die and a coin.

"We use these!" they say.

Die or Dice?

One of a set of dice is called a die. *Dice* is the plural. If you roll one, it's a die. If you roll more than one at a time, it's dice!

David looks at the die. It has 12 sides!

"I don't think I've seen a die like this before," he says.

Diego points out all the numbers on the die.

"You can get all sorts of dice these days. I've seen one with 20 sides," he says.

"Think about the game," says Talia. "If you get the best roll on this die, how far can you move?"

David thinks then answers. "12 spaces."

"And how about if you get the worst roll?" says Talia with a smile.

"Only 1 space. Huh!" says David.

Keep On Rolling

Dice roll even though they are not round. Dice have flat surfaces and edges for a reason. It means they will show a number when they stop rolling.

Maya grins at David.
"But that's not all!" she says.
"The die tells you how far you move. But the coin tells you if you go forward or backward!"

She tosses the coin and catches it. "Heads!"
"Heads means you move your piece forward. Tails, backward," Maya continues.
Diego holds up his finger. "But you can always choose not to move, too."
David thinks about it.
"Let's play a few rounds," he says. "I think I get it!"

The friends start to play.

David thinks about his moves. He wants to win!

He rolls a 7, and the coin shows heads, so he moves forward 7 spaces.

That's pretty good!

Then he rolls a 5, but the coin shows tails.

Does he move 5 back?

He can also not move at all.

David looks at his friends and notices something.

Maya is thinking hard about her moves.

Talia wonders why Maya decides to move back again.

Diego keeps rolling high numbers and moving forward.

The friends are all making choices!

They all want to win.

The die and the coin make the game exciting.

They do not know what will happen next!

Take a Chance

Games with dice and coin tosses are called games of chance. We try to guess and make good decisions. We can work out how likely something is to happen.

David figures out how the game really works.
To beat his friends, he needs to make his own choices.
He also needs to see where everyone's pieces are.
He thinks about where they could go if they roll well!
He realizes that this is why the game is fun:
Everyone is having a good time making choices.
And they need to use math to win!

Main Idea

The result of rolling a die or tossing a coin is random.

CHAPTER 3

Collecting the World

This is the National Museum of Natural History in Washington, DC.

It has items from all around the world.

People come from all over to visit the museum and learn.

But the items are not just thrown together in any order.

They are shown in collections, or groups.

Each collection contains things that are similar in some way.

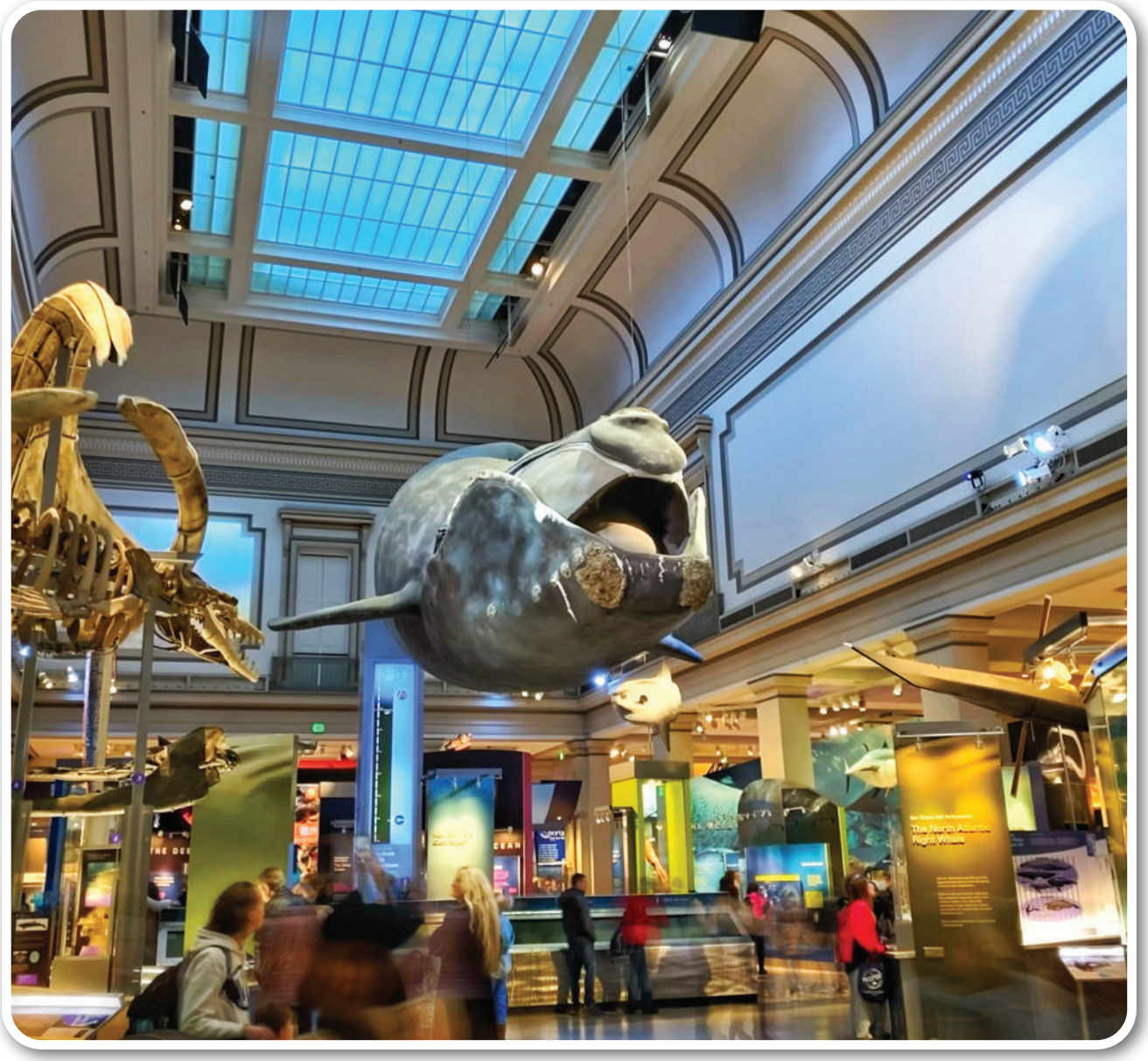
The Ocean Hall is filled with sea creatures.

It is a very large collection.

It has over 600 items.

There is a long list of what is in the collection.

Counting the items helps the collectors keep track of what they have.



The Hall of Mammals is another special collection.
It displays mammals from around the world.
Some exhibits group mammals by where they live.
Other exhibits compare mammals that have the same features.
Another exhibit displays animals that are extinct, or no longer alive on Earth.
The different groups show how scientists think about nature.

Great Groupings

Scientists group animals by how they are alike. Mammals have fur or hair. What feature do you think is common to all birds?

If you like rocks, you might like the Hall of Geology, Gems, and Minerals!

People come here to learn about different kinds of rocks.

One part of the collection shows rocks that glow in the dark.

Another part has special stones called gems.

These stones can be bright colors.

Some are cut and polished and used in jewelry.

Rocky Math?

Scientists who study rocks use math in their work. They measure and weigh different rocks. This helps them compare different types. They also study the shapes that make up special rocks called crystals.

The Hall of Fossils tells about plants and animals of the past.
This hall has many groupings for people to learn about.
Fossils can be grouped together by their age.
Dinosaur fossils are in one group.
Plant fossils are in another.

These are dinosaur fossils from the Hall of Fossils.

Question the Past

Paleontologists are scientists. They study the history of life on Earth. They use math to measure the size of the animals. They figure out how old each fossil is. This helps them understand how animals have changed over time!

This is the kind of plant fossil you might see at a museum.

Another exhibit tells about life in ancient Egypt.
Items in this collection are very old.
They show how people lived long ago.
Visitors can see the mummies of 3 people.
There are also 16 mummies of animals!
What other collections do you think the museum has?

Main Idea

We organize objects so that we can understand how they are alike and different.

CHAPTER
4

Shaping the World

This is the Golden Gate Bridge.

What do you see when you look at it?

There are lots of different shapes.

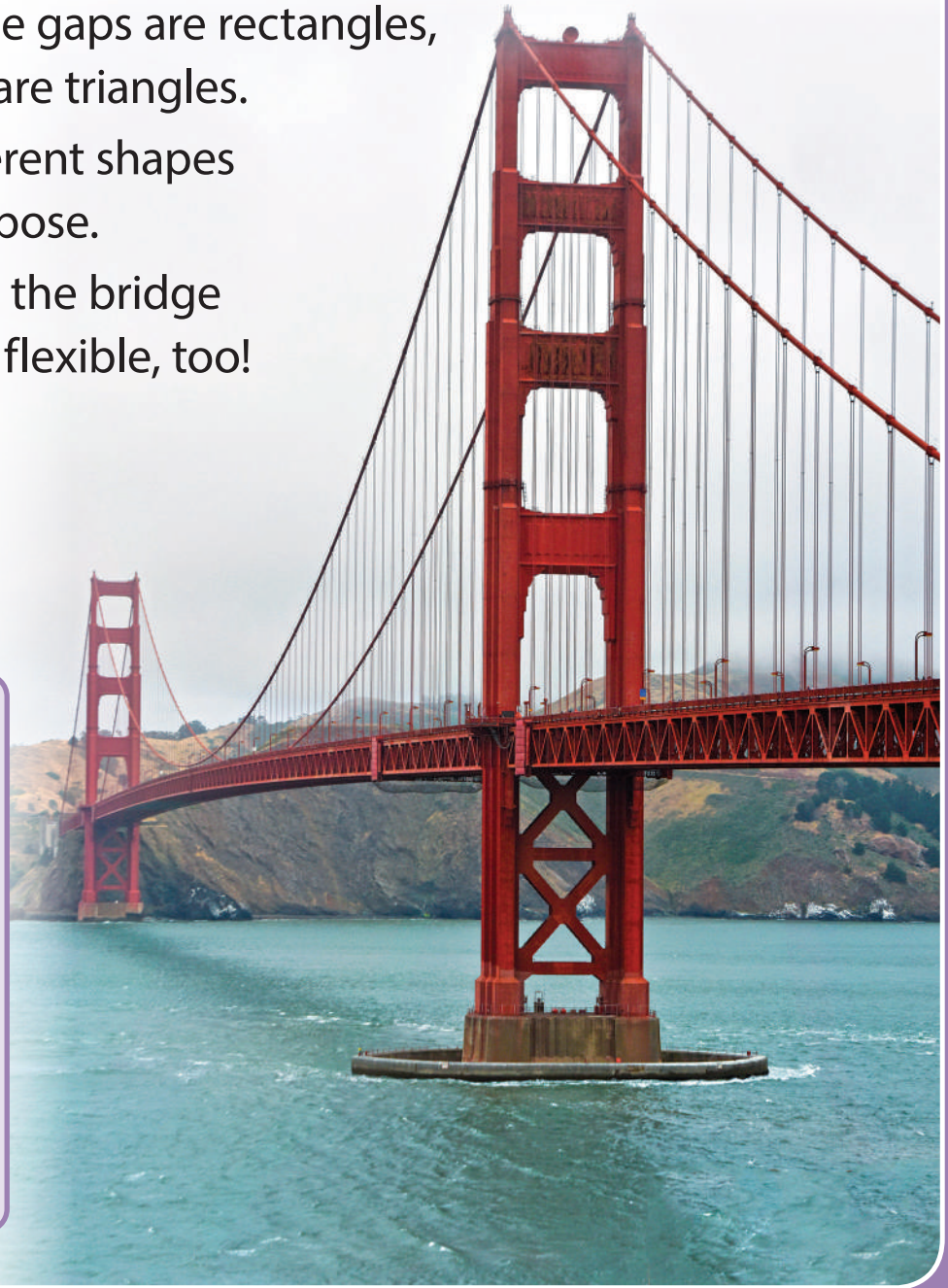
The bridge is held up by the 2 towers.

But the towers aren't solid. They have gaps.

Some of the gaps are rectangles, and some are triangles.

These different shapes have a purpose.

They make the bridge strong but flexible, too!



Strong Shapes

Triangles are common in buildings. They are a very strong shape. See the triangles under the bridge?

Once you see triangles in buildings, it's hard to miss them!

This is the Eiffel Tower in Paris, France.

It is made up of many triangles.

These shapes help the building to stand tall.

This is the Great Pyramid in Egypt.

It was built thousands of years ago.

But it is still standing today!

The ancient Egyptians used lots of blocks to build it.

The Great Pyramid and the Eiffel Tower are quite different.

But they were both built using knowledge of shapes.

Shapes aren't just used for strength.
They make buildings look interesting, too!
The Seattle Central Library is in Seattle, Washington.
The windows have the shape of a rhombus.
Rhombuses have four sides, like diamonds.
Look how they fit together!

You can see shapes used for decoration all around the world and across time.

This is a temple in Indonesia.

Do you see the rhombuses on this building?

This building is called Fallingwater.

It is in the state of Pennsylvania.

Fallingwater gets its name from the waterfall underneath it.

It was designed by the architect Frank Lloyd Wright.

He used many rectangles in his design.

The building looks wide and flat.

Other buildings are very tall.

They are so tall that they are nicknamed skyscrapers!

This skyscraper is the Empire State Building.

It is in New York City.

The building looks like many rectangular blocks.

The windows are rectangular, too.

Some buildings use curved shapes.

This is the Gateway Arch in St. Louis, Missouri.

This is also a very strong shape.

Lots of buildings use arches.

How did people get the idea to build arches?

Maybe they looked at nature and worked out how to copy it.

Arches National Park is in Utah.

It is filled with arches made by nature!

This one is called Delicate Arch.

Arches and Arches

Wind, rain, ice, and snow helped form the arches at Arches National Park over thousands of years. The park has more than 2,000 arches! Over time, they do crumble and fall.

People build bridges, too.

This is a bridge in Lujiazui, China.

It was built so people could walk above the busy roads.

It is wide enough for many people to stand side by side.

It is tall enough for traffic to pass underneath.

What shape is this bridge? Why do you think the builders chose that shape?

Main Idea

Architects use the qualities of shapes for strength and beauty and to make buildings useful.

CHAPTER
5

20 Fingers

Hi! I'm Echo.

I come from the planet Eco-C.

As you can see, I have quite a few fingers.

I've learned different ways to use these fingers.

They help me think and figure out the world around me.

The first thing I learned to do with these fingers is count. I love to count how many ships come through the space port. When I count, I can tell if more or fewer ships are coming through each day. When something fun is happening, we have more visitors! Sometimes I need all my fingers to count the ships.

Are You Like Echo?

What things do you count on your fingers like Echo does? Why do you count those things?

Then I learned to add things up.

Fingers are handy for that!

I look at space geese through my galaxy glasses.

I can add how many red geese and how many blue geese are swimming in the crater.

Next time I visit, I'll know how much food to bring them!

These fingers help me subtract, too.

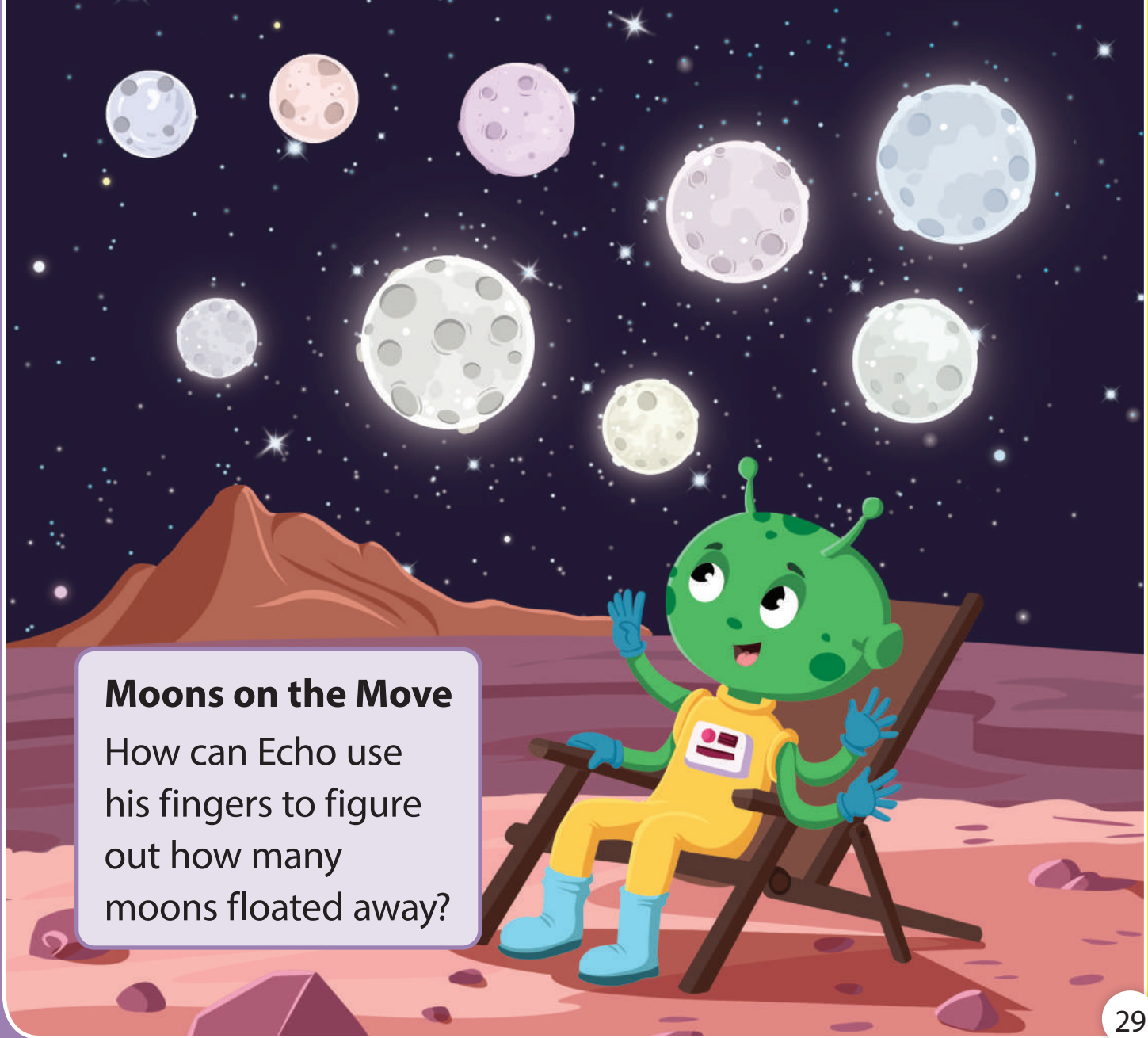
Last week, there were 14 moons around my planet.

Not anymore!

My fingers helped me figure out how many went away.

I wonder where they could have gone.

Even though it's a space mystery, I can use my fingers to keep track of it.



Moons on the Move

How can Echo use his fingers to figure out how many moons floated away?

I can solve all sorts of problems with my hands.

There are so many questions to answer.

One question I have is, "How many donuts do I get to eat?"

I grab one with each hand.

There are enough left for my brother to grab one with each of his hands, too!

Out of Fingers?

Fingers are great for keeping track of lower numbers of items. When the numbers are too high for our number of fingers, we can use paper to keep track.

You can use your fingers to answer questions, too.

You might not count space rocks like I do, but you can count anything you want.

Being able to use your fingers to take away and add is very helpful!

Main Idea

We can use our fingers to add and subtract.

CHAPTER 6

Too Many Packages!

Hello, friend! Today is a very busy day for me!
I have lots of packages to deliver and pick up.
I go through the streets in the same order each day.
Things move fast that way.
It helps me get home in time for supper.
My route around the city is almost a complete loop.
That way, I finish near where I started!

Each package I deliver has an address.

The address is a building number and street name.

Lower numbers are on one end of the street.

Higher numbers are on the other end of the street.

This helps me plan my route.

Help on the Path

Postal workers and delivery people follow special routes to make their deliveries. The routes are more than just streets and paths. They are a way to plan deliveries to save time.

I start on this street with 12 packages.
Some of them are quite big!
3 of these packages are for Elephant.
They are very heavy!
Elephant loves reading.
I wonder if they're books!
I'm glad Elephant is at the beginning of my route.
Now my load will get a little lighter.

Next on my route is Crocodile.
4 packages are for him.
The rest are for Crocodile's neighbor, Horse.
Now my basket is empty.
I think I'll make it home in time for dinner tonight.
I just need to pick up my packages for tomorrow's deliveries!

I turn onto the next road on my route.
I have to stop at 3 houses.
I pick up 5 packages at the first house.
I pick up 3 packages at the next house.
And 3 more packages at the last house.
That's less than I started with today.

I give all the packages I collected to Panda.
She is the last stop on my route.
Panda helps me carry the packages.
She will get them ready for the next delivery.
What a busy day!

Main Idea

We can use math to keep track of when items are collected or taken away.

CHAPTER 7

Caring Is a Sweet Treat

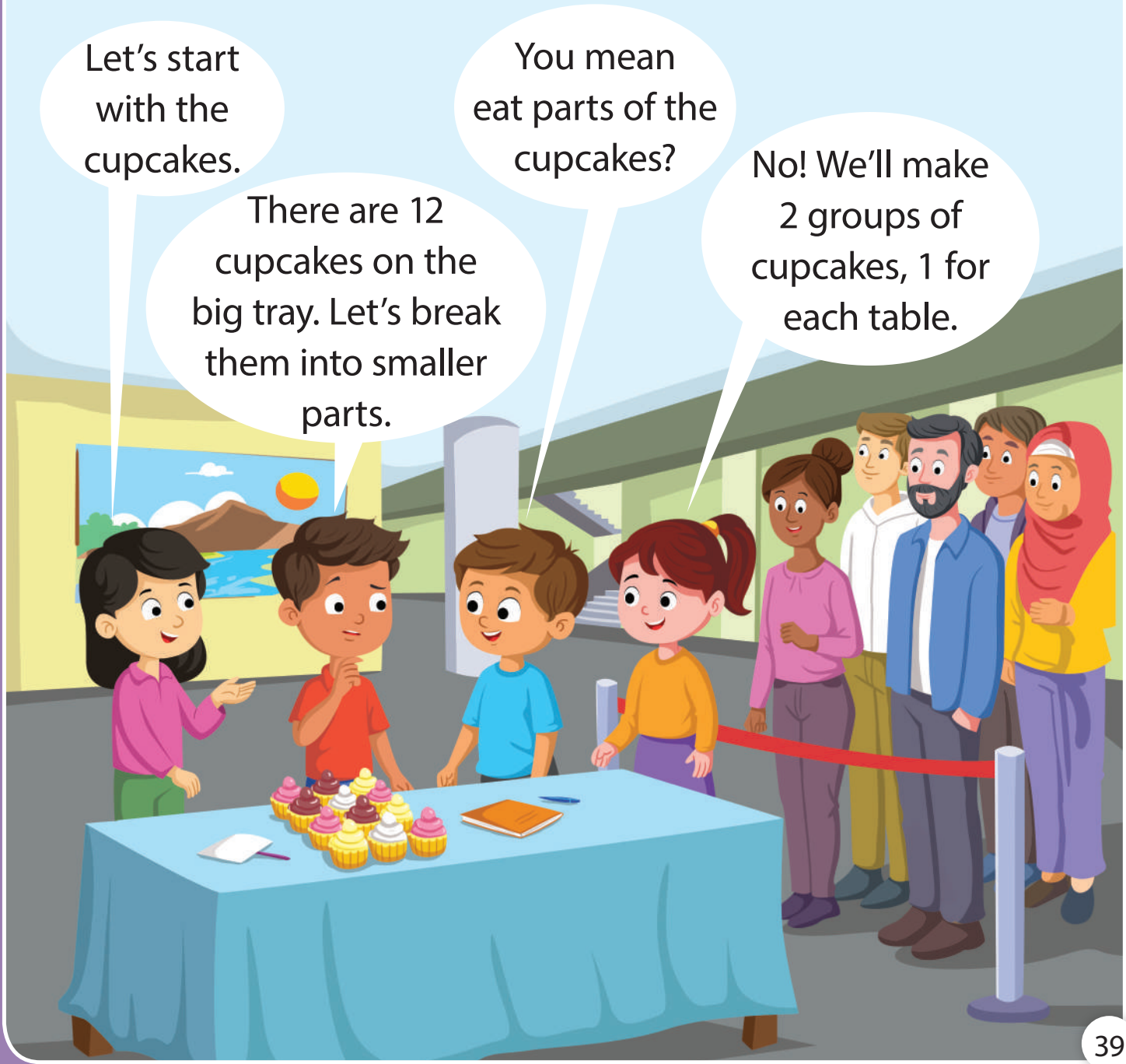
A bake sale is a great way to raise money in your community!

These 4 friends are volunteering at the bake sale.

They will use the money they make to start a community garden.

To have a successful bake sale, they use math.

The friends set up their table.
They have baked lots of treats to sell!
They get 1 table.
But is 1 table enough?
Maybe 2 tables would be better.
2 tables would give them more room!



The friends split into 2 groups.
Each group starts with 6 cupcakes.
The cupcakes are selling fast!

Soon, the friends have only 3 cupcakes left.
But more people want treats!
They must get more items to sell.

It is a good thing that the friends have lots of treats to sell!
Look at how many people want treats.
They are making lots of money for the community garden.
The garden will be enjoyed by so many people.

The friends had a lot of fun and sold so many treats.
They have some treats left over too!
They are excited to plan the community garden.
They will use math again when they do that!

Main Idea

We can use math to help our community.

CHAPTER
8

Squirreled Away

Have you ever saved food to eat it later?
Some animals have to do this every fall.
The food they eat cannot be found in the winter.
So they are food collectors!
Squirrels are one of these animals.
They look for acorns throughout the fall.
They bury the nuts in the ground to eat later.

Squirrels don't take every acorn they find.
They first shake the nut to see if it's worth keeping.
They can tell if the nut will last until winter.
And they put as many acorns in their cheeks as they can fit.
That can mean up to 4 or 5 at a time.

All Puffed Up

Some types of squirrels have a special pouch in their cheeks. This allows them to carry lots of acorns at once.

Squirrels can bury up to 25 acorns an hour.
And they just keep doing that for months!
The acorns add up fast!
A single squirrel can bury 3,000 acorns.
That's quite a feast!
They collect more than they'll need for a long, cold winter.

Other Collectors

Blue jays and chipmunks also collect and store food. They store seeds and put them in special hiding spots—just like squirrels.

Squirrels remember where they bury most of their acorns.

They remember where they put as many as 95 out of every 100 acorns they bury!

What happens to the acorns that get lost or forgotten?

Many grow into oak trees!

Scientists learn about animal collectors by watching nature.

They count how many acorns squirrels collect.

They compare the numbers collected by different types of squirrels.

They compare the numbers collected year after year.

The more squirrels they watch, the more they find out!

What can you learn about animals by watching nature?
What animal would you like to learn about?
You can use math to find out more about animals, too.

Main Idea

In their own way, animals pay attention to how much when collecting and storing food.

CHAPTER
9

Our Number System

How did people from the past keep track of numbers?
One way was by using tally marks.
They wrote one mark for each thing they counted.
Then they made groups of 5.
Make 4 lines down and one across.
That makes groups of 5 easier to count!
Tally marks are good for counting small numbers.
But they're not very good for big ones!

People also used their 10 fingers to count.
Fingers can be used to add.
They can also be used to subtract.
We also have 10 toes.
We can use them to count, too!
But 10 fingers and 10 toes are only 20.
Sometimes we need to keep track of numbers bigger than 20!

Scholars in India had an answer!
They came up with 10 symbols.
Each represented a different number from 0 to 9.
Later, Arab scholars wrote about these numbers.
Soon, people brought these numbers to Europe.
The numbers carved in the photo are in England.
They show some of the early symbols used.
This new system became the base-10 number system—10 numbers, like our 10 fingers!

Zero has a special place in the base-10 number system.
There was no zero in early number systems.
One of the symbols that the scholars in India created was for zero.
Using a symbol for zero changed things!
It let people solve new kinds of math problems.
It also helped people tell the difference between numbers.
Zero shows the difference between 18 and 108 or between 12 and 120.

Hold My Place!

You might think of zero as meaning *nothing*. But it's quite something! Zero is a placeholder. We can use it to make numbers greater . . . and greater!

The base-10 number system is very helpful.

It uses the same symbols again and again.

We use the same symbols in the same order when we count . . .
1, 2, 3, 4, 5, 6, 7, 8, 9.

This helps people know which number is greater.

Greater numbers have more digits.

The base-10 number system is all around us.

We use it when we look at prices in stores.

We use it to add and subtract.

It's used to solve all kinds of problems in science and math.

Because of the base-10 number system, people solving the same problem will get the same answer.

This is one reason why we still use this system today!

Main Idea

We use a number system called base-10.

CHAPTER
10

Showtime!

It's Mom's birthday today.

We're taking her to see her favorite thing in the world—the orchestra!

This is the first time I get to come along.

I can already hear the sounds of instruments practicing.

I hear high notes racing down to low notes.

I'm excited for the performance!

There are so many chairs up on stage!

Dad says there are about 40 players performing today.

Before we came, he taught me about some of the instruments I would hear.

Each one has its own sound.

Here comes the music!

A violin can sound as sweet and clear as a spring afternoon.

Or it can sound as harsh as a frog stuck in mud!

Even though the violin has only 4 strings, it can play 51 different notes!

A trumpet makes a rich, strong sound. A trumpeter makes music by blowing into the mouthpiece. A trumpet can play up to 39 notes.

And a drum can sound like a thunderstorm! It makes a beat for the other instruments to follow. Drums can be loud, quiet, or somewhere in between.

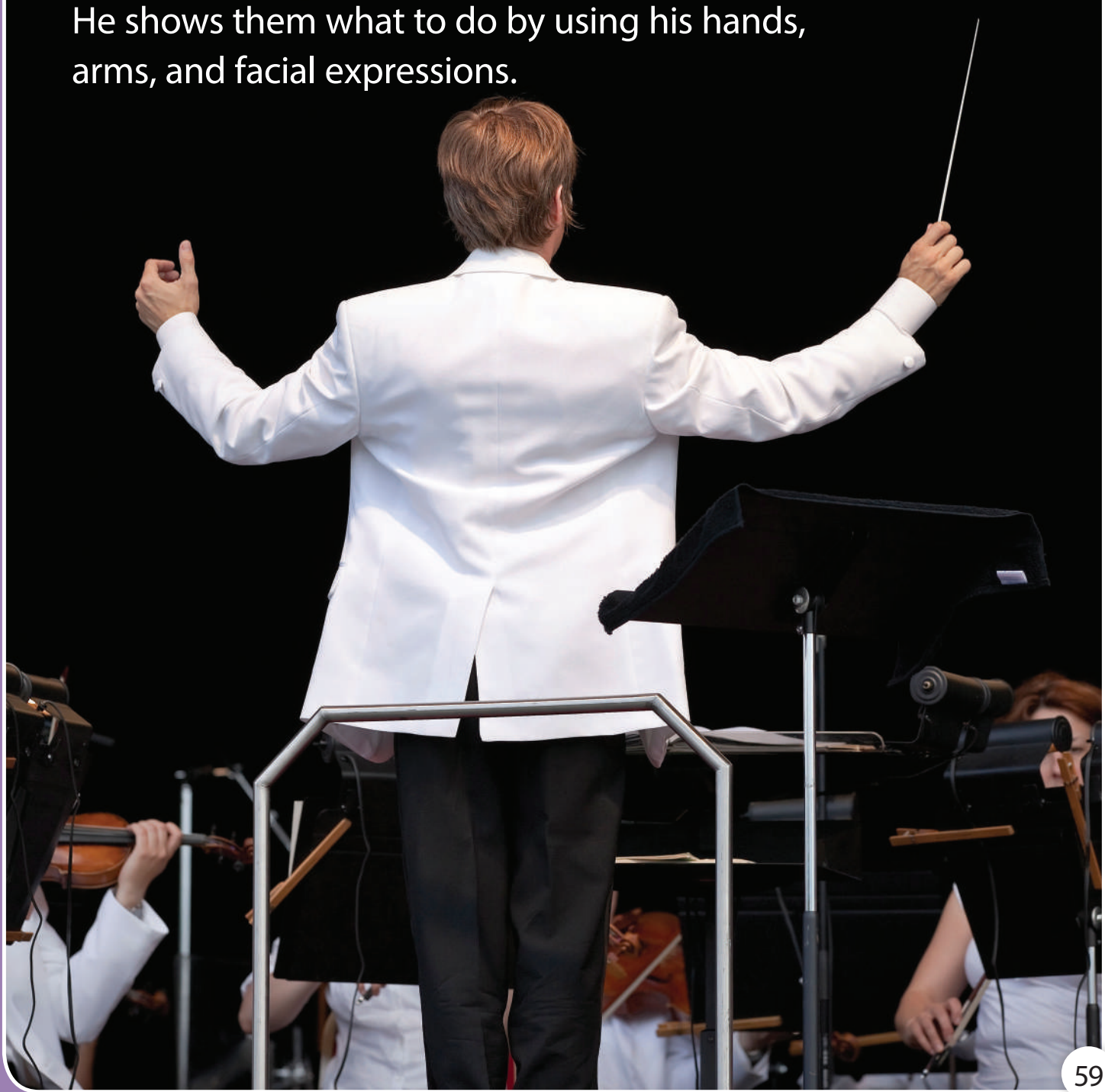
All the individual instruments' sounds could just make up a lot of noise.

But instead, they combine to make beautiful music!

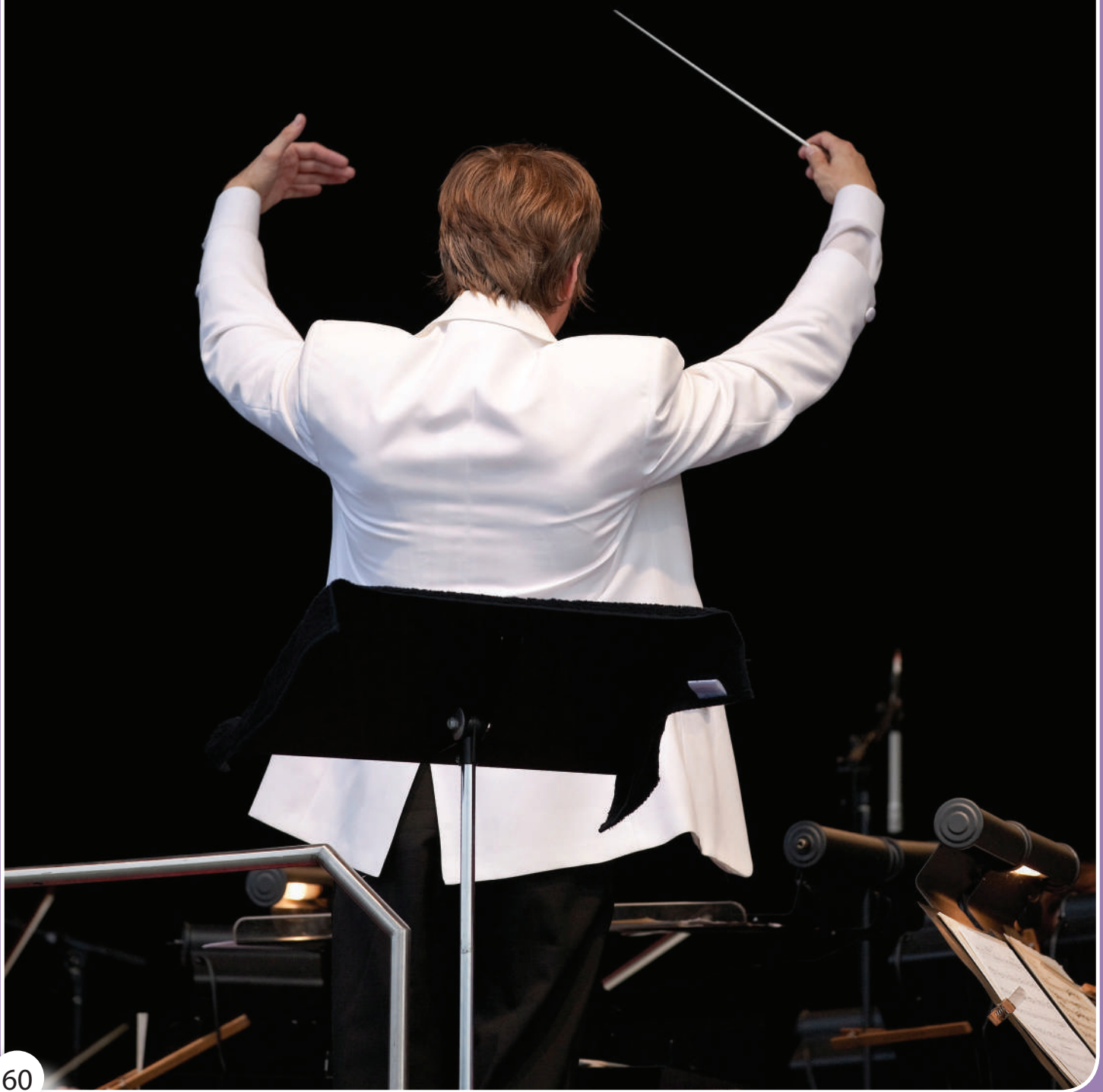
The conductor guides all the parts of the orchestra.

He uses a small stick called a baton to direct the musicians.

He shows them what to do by using his hands, arms, and facial expressions.



The conductor controls everything about the music.
He guides the musicians to play faster or slower.
They get louder when he spreads out his arms.
They play softly when he brings his hands back together.
The sounds flow through the room like magic.



The sounds make patterns.

They follow the beat of the drums.

Sometimes the patterns repeat.

As I listen to each song for a few seconds, I start to feel like I know what notes will come next.

I think I will try to learn to play an instrument myself!

Main Idea

Different instruments in an orchestra play different numbers of notes, but they all come together to make beautiful music.

CHAPTER
11

Plancakes!

Idris and his dad love pancakes!
Every Saturday they get up and make them together.
And then they eat them together, too.
Dad knows what to do. Idris helps!
But this Saturday is different.
Dad tells Idris that it is his turn to be in charge.
He needed to plan!

Idris knows where to start.
He looks for the recipe.
He sees all the different ingredients.
The recipe tells him how much of each ingredient he needs.
Idris checks the amounts and writes them down.
That will help him know if he has everything he needs.

Time to see what Idris and Dad already have in the kitchen.
If they have the ingredients, they don't need to buy more!
Idris checks his list as he looks in the pantry.
It looks like he has enough flour and salt!
He checks them on his list.
He looks in the fridge.
The milk is half full—that will be enough.
Idris puts a check next to milk on his list.
He looks in the egg carton . . . oh no!
Only 1 egg left!

Time for a trip to the store!

Idris and his dad find the eggs in the aisle.

Idris wants to get 1 carton of eggs. Each carton has 12 eggs.

He needs 3 eggs to make pancakes.

Dad points out that they use a lot of eggs in the week!

They decide to get another carton as well.

That way they won't run out!

Plan-O-Rama

Idris and Dad make a good plan. They know how much they have. They know how much they will use. That helps them know how much more they need to get!

Time to make pancakes!
They measure the ingredients and mix them up.
They use 3 nice fresh eggs.
Idris makes a note—plenty of eggs left for the week.
When the batter is made, Dad heats up a pan.
Idris carefully pours the pancake batter into the pan.
The batter sizzles.
Dad flips the pancakes when he sees bubbles in the batter.
Soon they have yummy pancakes!

Dad and Idris sit down with their pancakes.

Dad has 3. Idris has 3. They made 9 altogether.

Idris reaches for the syrup, but . . .

Oh no!

It's just 1 single-serving bottle. Not enough!

Idris grins. Time to make another plan!

Main Idea

We use math when we make plans.

CHAPTER
12

Playing to Win

What's your favorite game?

Games are as old as human communities.

They are a way to have fun with friends and family. Did you know they are also a way to practice and enjoy math?

Let's learn about some games people played in the past!

The Royal Game of Ur is an ancient game.

It was played long ago in a place called Mesopotamia.

To start, each player rolls a die.

The player with the greater number goes first.

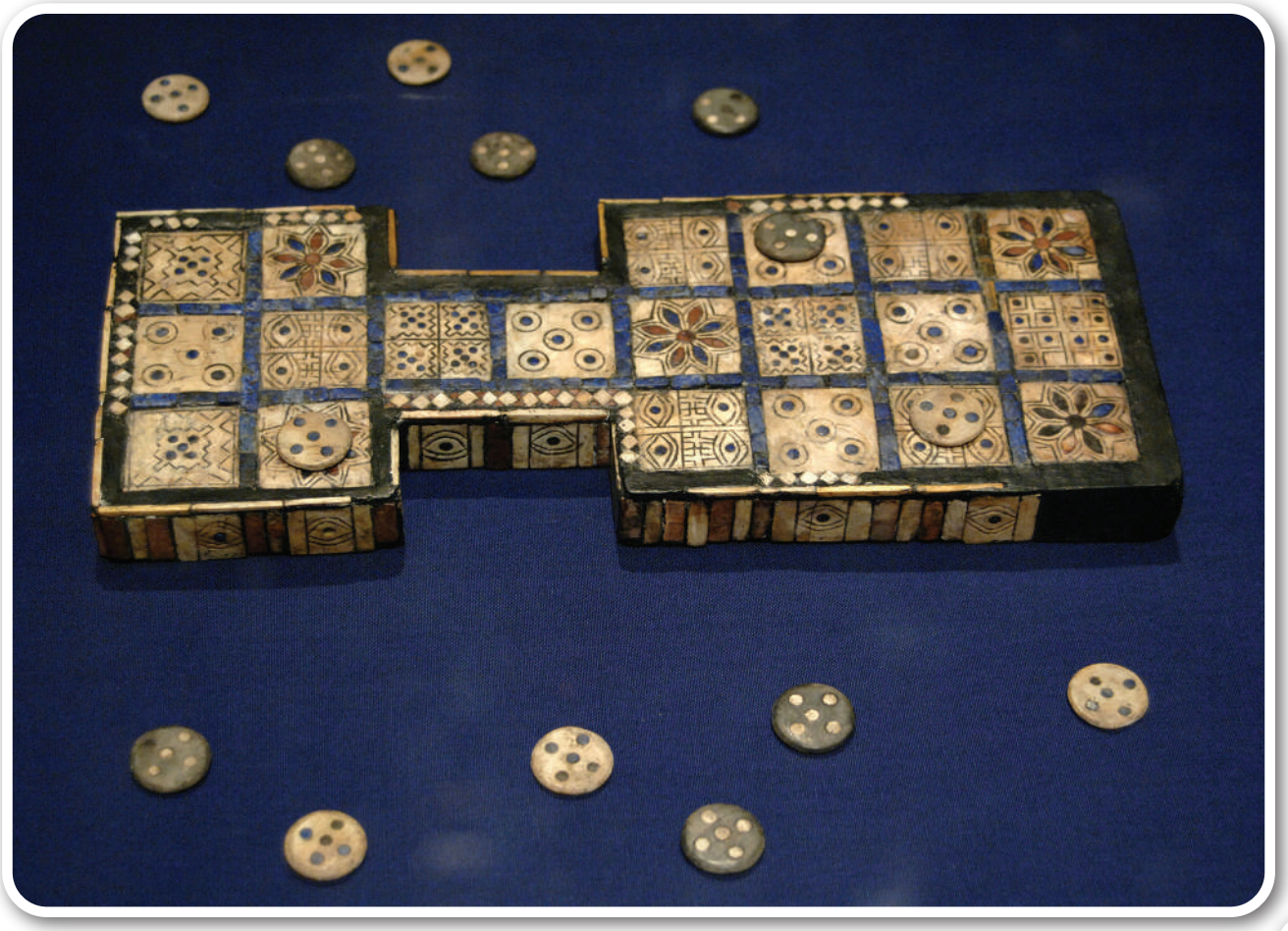
Each player moves 3 pieces around the board.

They roll the die to see how far they can move.

Be careful. Some rolls make you miss a turn!

How Many Sides?

Many people play games with dice that have 6 sides. But dice can have 4 or even 20 sides or more!



The ancient Egyptians played a game called Senet.

It is a lot like the Royal Game of Ur.

And it is just as old!

Players have 5 pieces.

They roll dice to see how to move around the board.

They add the numbers on the dice to know how far to move their pieces forward.

They subtract to move their pieces backward.

Just Like Today

Many games today use dice to move a playing piece. You add the numbers on 2 dice after you roll them. That's the total number of spaces you can move your playing piece.

The ancient Romans also liked to play games with dice.

To play Tali, players throw 4 dice into the air.

How will the dice land? If each die lands on a different number, you win!

The Romans thought the gods controlled their games.

But really, it was chance!

People all over the world play chess today.
Did you know this game is very old?
Chess has many different pieces.
Each piece follows different rules.
Some pieces can only move 1 space at a time.
Other pieces can move any number of spaces.
The goal of the game is to catch the other player's king.
Chess players use a lot of math to protect their king!

Shovelboard was a game played by kings and queens.
Each player pushed weights down a long table.
The table was marked with numbers and lines.
If their weight landed next to a 3, they earned 3 points.
The players added up their points.
The first person to get to 11 points won.
Today, people play a similar game called shuffleboard.
What other fun games do you play?

Main Idea

We use math skills to play games, to keep score, and to decide who wins.

CHAPTER
13

Digging Up the Past

How do we know about people who lived in the past?

We can learn about them by looking at what they left behind.

We look at their homes, their tools, and sometimes even their toys!

Archaeologists investigate the past.

They dig into the ground to find ancient things.

They use math to do this.

They measure out areas and carefully sift through sections of dirt to find items.

Look at this picture of Stonehenge in England.

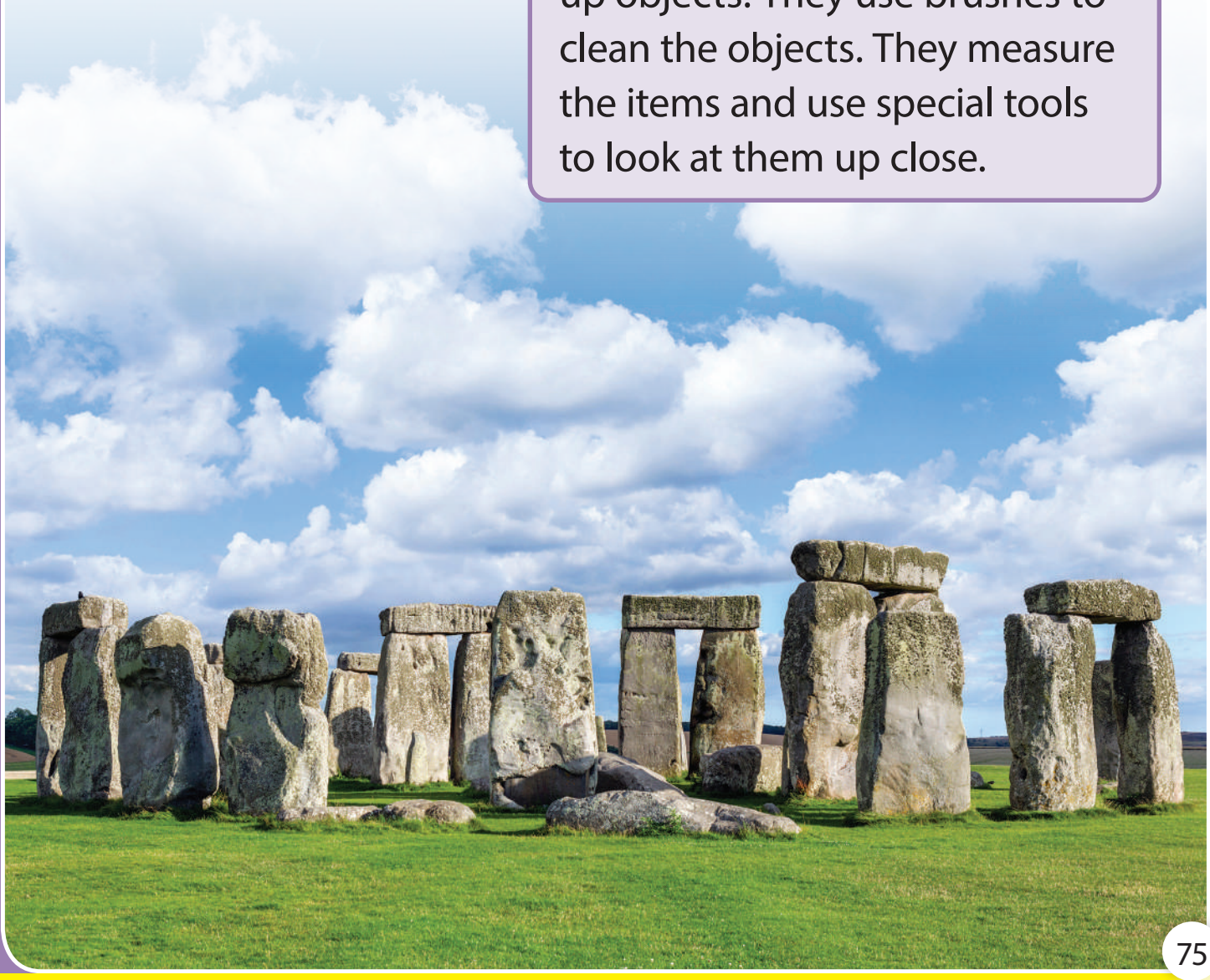
Scientists guess the weight of these stones.

They are very heavy!

We know these stones were moved here, but we don't know how.

Amazing Archaeologists

Archaeologists have many tools. They use special shovels to dig up objects. They use brushes to clean the objects. They measure the items and use special tools to look at them up close.



The people who made Stonehenge placed the rocks in the shape of a circle. Twice a year, the sun shines through the openings in the rock.

This lights up the center of Stonehenge.

Maybe Stonehenge was used as a calendar.

Maybe it was a place for ceremonies.

We do know it is a special place.

Archaeologists don't just look at big sites.
Things from the past are all around us.
They can even learn from studying clay pots.
People have used clay pots for a very long time.
They held food and water and other goods.
Archaeologists measure the pots (and pieces of pots).
The measurements give us clues about how much food people stored.
They also help us see how many people lived together.

Looking Back in Time

These pots are old and were dug up out of the ground! The different shapes and sizes mean they had different uses. The black-and-white strip is a measuring tool for archaeologists.

Archaeologists can find out what people ate a long time ago by examining their teeth!

They look for traces of food on the teeth.

What if a person ate fish but archaeologists find their teeth far away from a lake or ocean?

What could this tell us?

Teeth and bones tell us a lot about animals that lived way in the past, too—like the dinosaurs!

Measurements can tell us about the past.

Archaeologists may measure out areas in a grid.

Each part of the grid is the same size.

They can search each area for items to show where they were found.

Measurements can also help us know how old something is.

Archaeologists are finding new ways to learn about the past all the time.

Math and measurements can help us answer questions!

Main Idea

Archaeologists use measurements to discover facts about the past and understand how people lived.

CHAPTER
14

How Long?

How long is your foot?

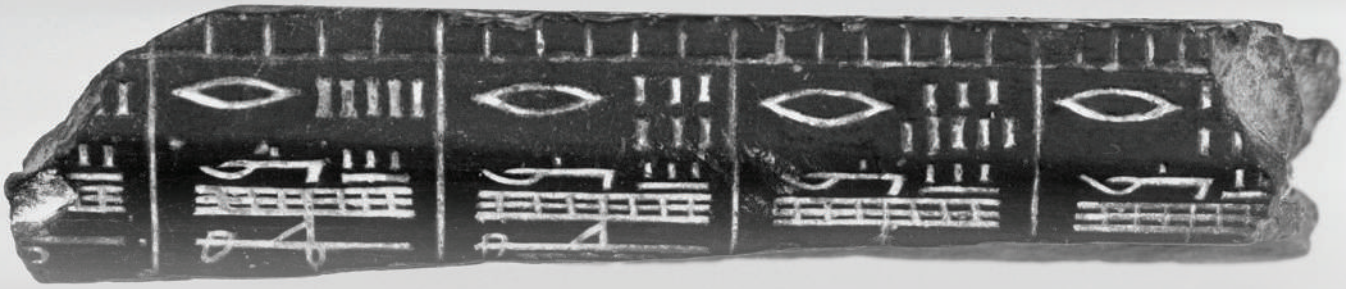
Is it longer or shorter than your friend's foot?

Is it longer or shorter than your teacher's foot?

What if your foot were a tool you could use to measure things?

Surprise! This is one way people measured things in the past.

In the past, people didn't have rulers like we have today.
However, they still had to find ways to measure!
Ancient Romans measured using their feet!
They placed one foot in front of the other.
They counted each step they took.
This was an easy way to measure.
There was one problem, though.
Not all feet are the same size!
One person's measurements are different from another's.
How might this cause problems?



The ancient Egyptians had their own way of measuring.

They used the distance from their elbow to their fingertips.

What could be a problem with this system?

Not all arms are the same length!

To fix this problem, they were said to have measured the arm of the king.

In all of Egypt, people measured using the length of the king's arm.

The Egyptians even used this measurement to build the pyramids.

There are other ways to measure things.
We often need to know how heavy something is.
Long ago, in England, one unit of weight was 7,000 grains.
Not everyone used the same system, though.
In France, one unit of weight was far fewer grains.
This picture shows someone weighing goods using scales at a market.
This image is from the 1300s CE.
Lots of things are still sold by weight.
Can you think of any?

It is easy to see why one system of measurement is important for everyone.

A standard system was finally developed.

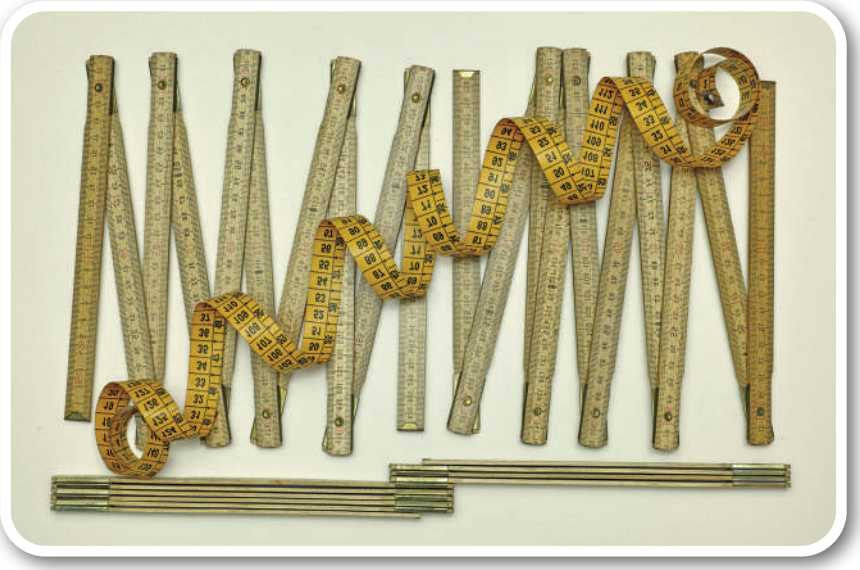
Standard means it is the same for everyone.

Rulers measure standard lengths.

Scales measure standard weights.

The same systems are used around the world.

It's a way for people to talk about math.



Today, most people use standard measurements.

Everyone using a standard measurement can find the same answer.

Main Idea

Today, people measure length and weight using standard systems.

CHAPTER 15

I'm Late!

Hi. I'm Rabbit!
I have many friends to see today.
That makes me a busy bunny, indeed.
Would you like to come along?

First is Panda.
We're meeting
in the park
at 8:00.
Uh oh. We're
running late.

Right on Time

Rabbit has a lot of things he wants to do. If he wants to do them all, he must keep track of time!

Panda and I have a lovely time in the park.

We always go to the pond.

That's where we see the ducks!

Next is book club with Elephant.

That's at 10:30. What time is it now?

We'd better hurry.

Time in Two Ways

This picture shows two different types of clocks. Can you see them? What's the difference?

Elephant and I read lots of books.
We drink tea. We talk about what we've read.
Speedy Elephant is 2 chapters ahead of me!

Time to see Horse at noon for lunch.
Better take the hot-air balloon!

Horse and I love tacos.
We eat slowly. No need to hurry!
I don't see my next friend until 1:30.

The amusement park is far away.
"Don't worry," says Horse.
"Just borrow my bike!"

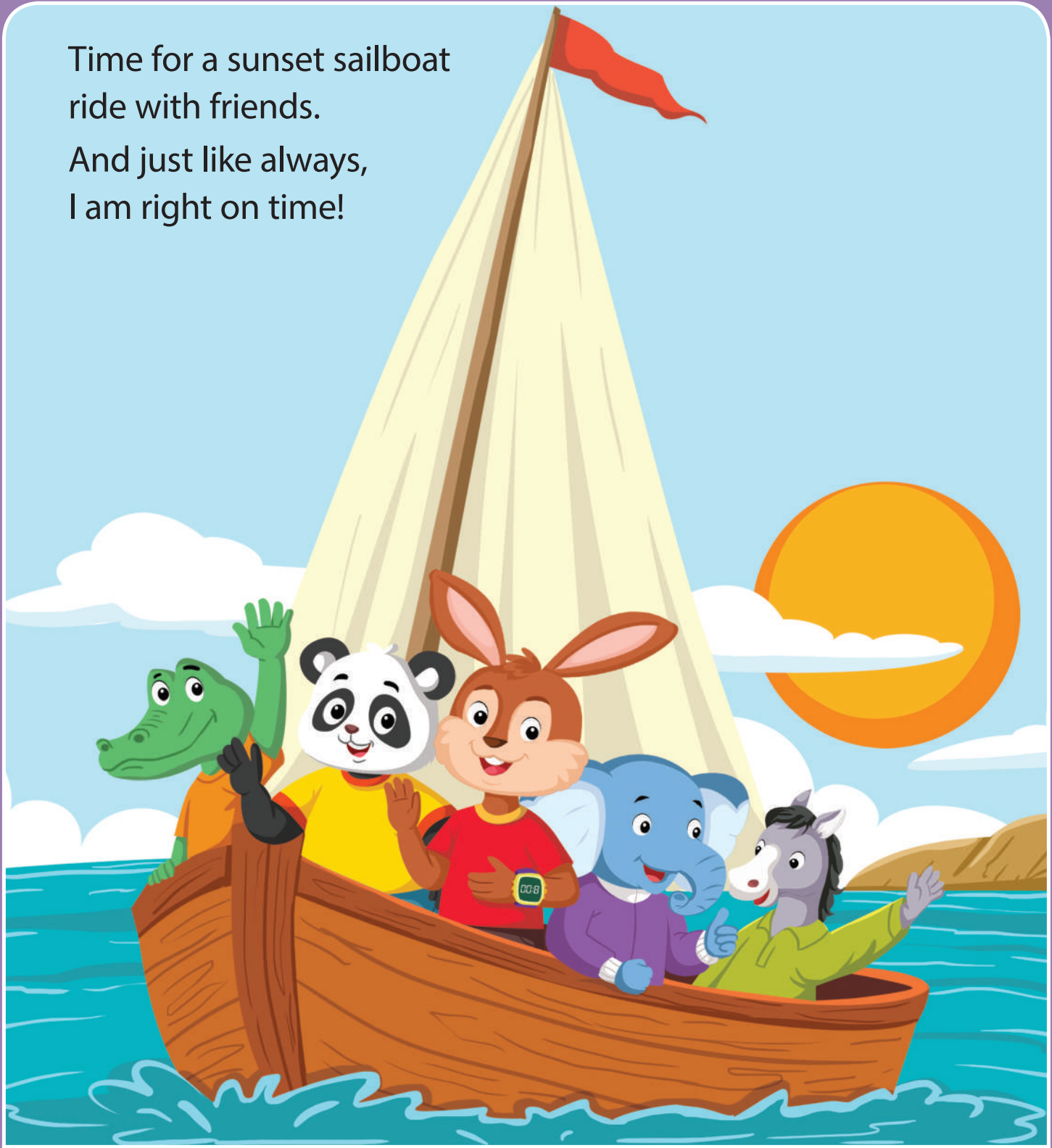
Take Your Time

Rabbit knows he has plenty of time to eat lunch with Horse. He knows the time, and this helps him stay on track.

Crocodile and I ride the roller coaster.
He really loves a thrill!
We laugh, loop, drop, and climb.
And that's when I notice the time . . .
But there's no rush right now.
We can just use our feet.

Time for a sunset sailboat ride with friends.

And just like always, I am right on time!



Main Idea

Telling the time helps us plan our day.

CHAPTER
16

That's a Stat!

Rebekah, Roberto, and Davide are getting ready to play baseball.

They are worried about the game today.

The team they are playing today is really good.

They notice that Coach doesn't look worried, though.

In fact, she looks confident!

Coach has a graph to show the team.

A graph tells information with a picture.

“Listen up!” says Coach.

“I know you’ve been worried about this game. But you shouldn’t be!”

Coach points to the chart.

“You are getting better every game, and I can prove it!”

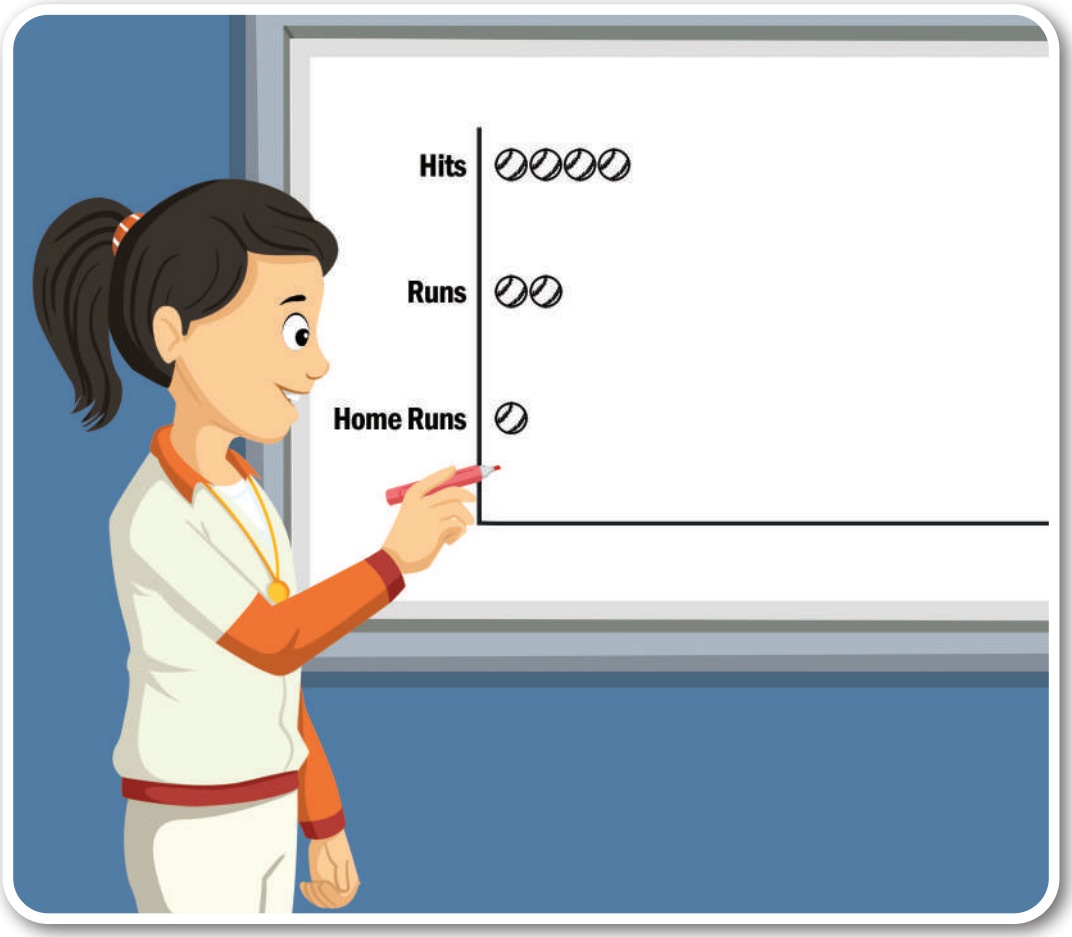
Coach gets a marker and begins to make a picture graph.

“Let’s look at how many hits, runs, and home runs we scored in our first game.”

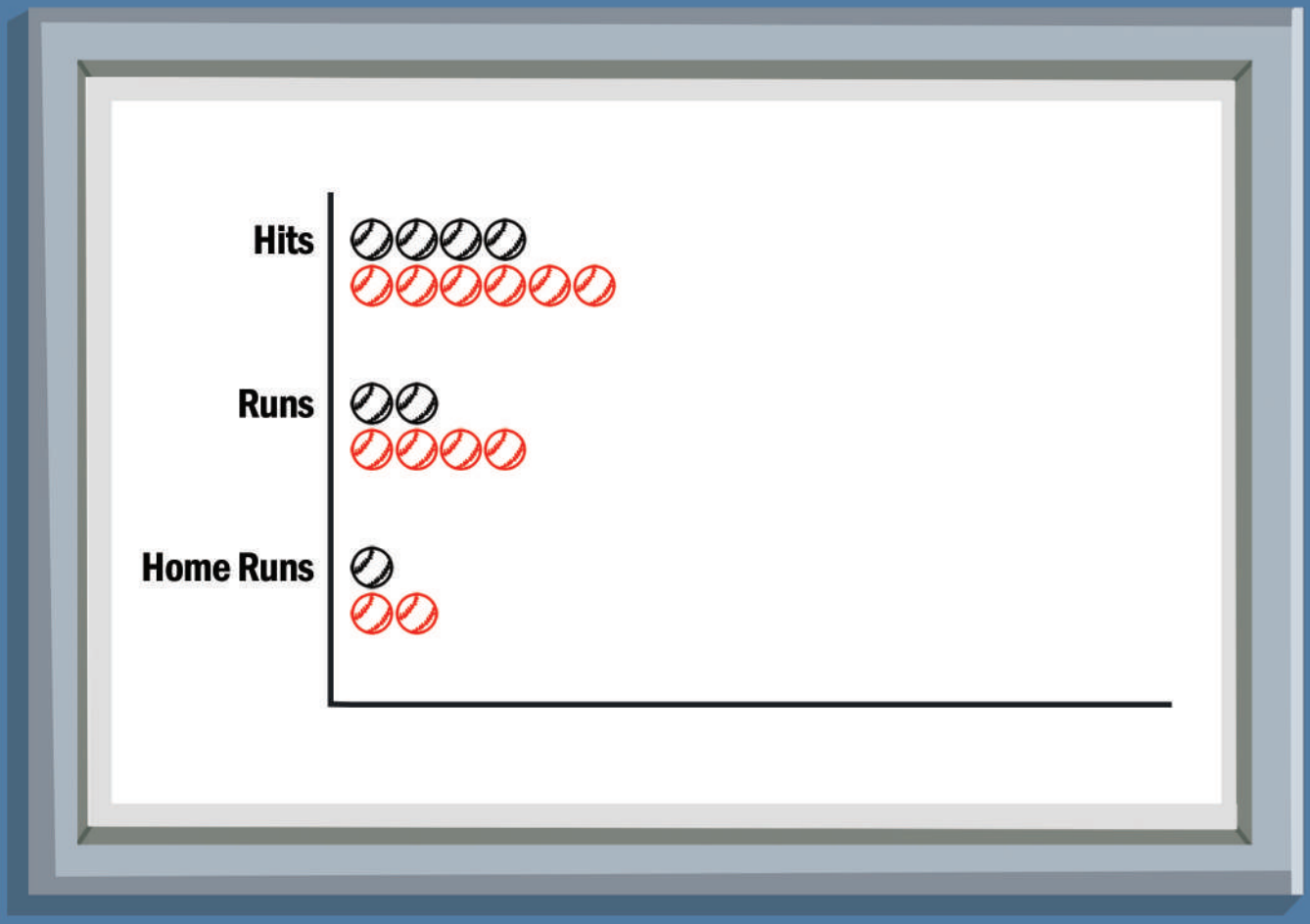
Coach draws 4 balls beside the label that says *Hits*.

She draws 2 beside the label that says *Runs*.

And 1 beside the label that says *Home Runs*.



"That was a good start. But how about Game 2?" asks Coach.
"We got 6 hits," says Davide.
"We got 4 runs," says Rebekah.
"And we got 2 home runs!" adds Roberto.
Coach adds these to the picture graph.



Picture Graphs

Picture graphs use pictures to keep track of data. They show how many pieces of data go in each category.

“Now let’s add Game 3,” says Coach, grinning.

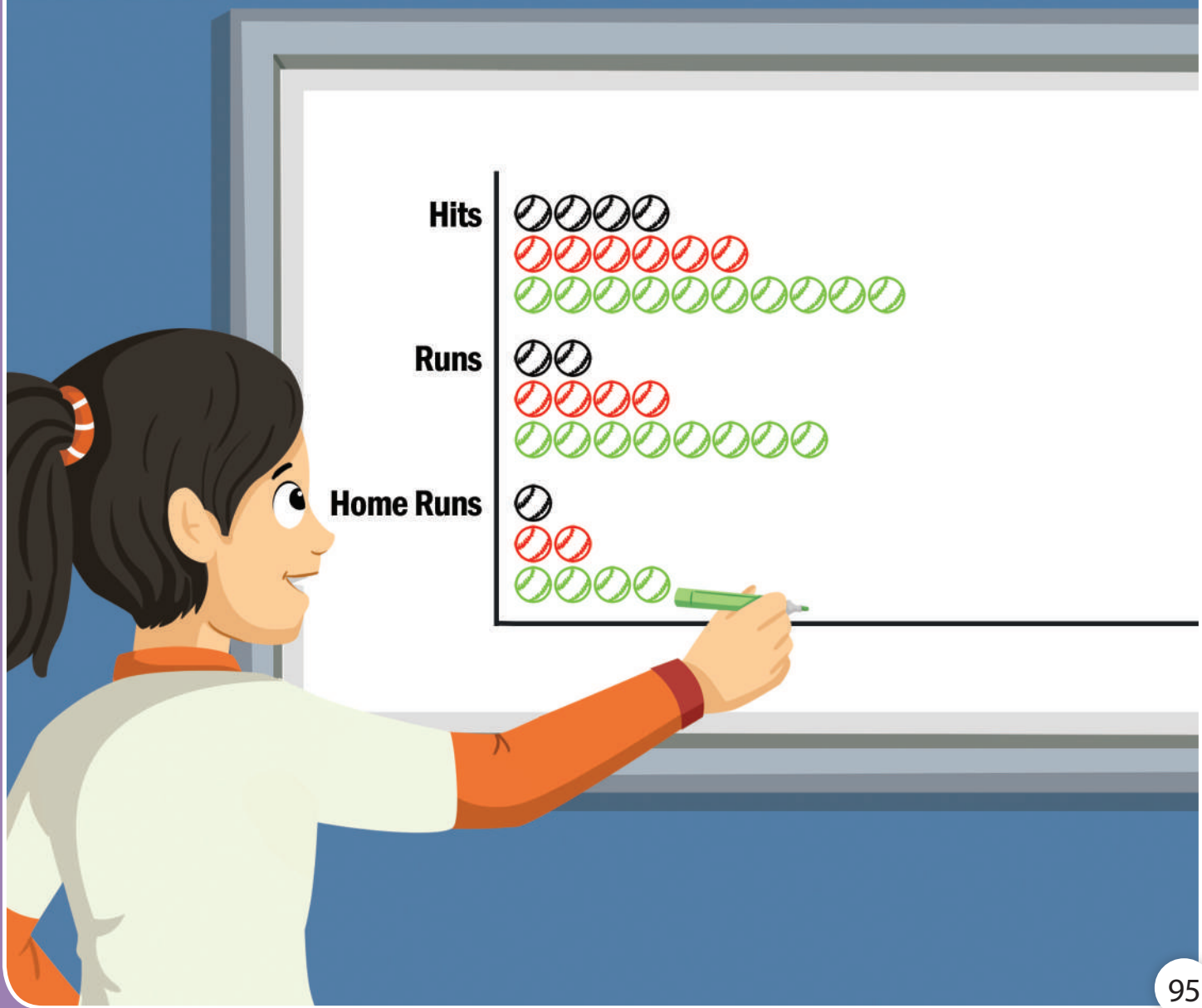
“We did great. We got 10 hits!” says Davide.

“Yes! And 8 runs!” says Rebekah.

“And 4 home runs!” says Roberto.

Coach adds those to her chart. Then she taps her pen on the whiteboard.

“Do you see what we’re doing? These numbers add up over time. And they tell us a story.”



“What does the graph show?” asks Coach. “I’ll start.”

“First of all, you’ve done better and better each game. See how the totals went up?”

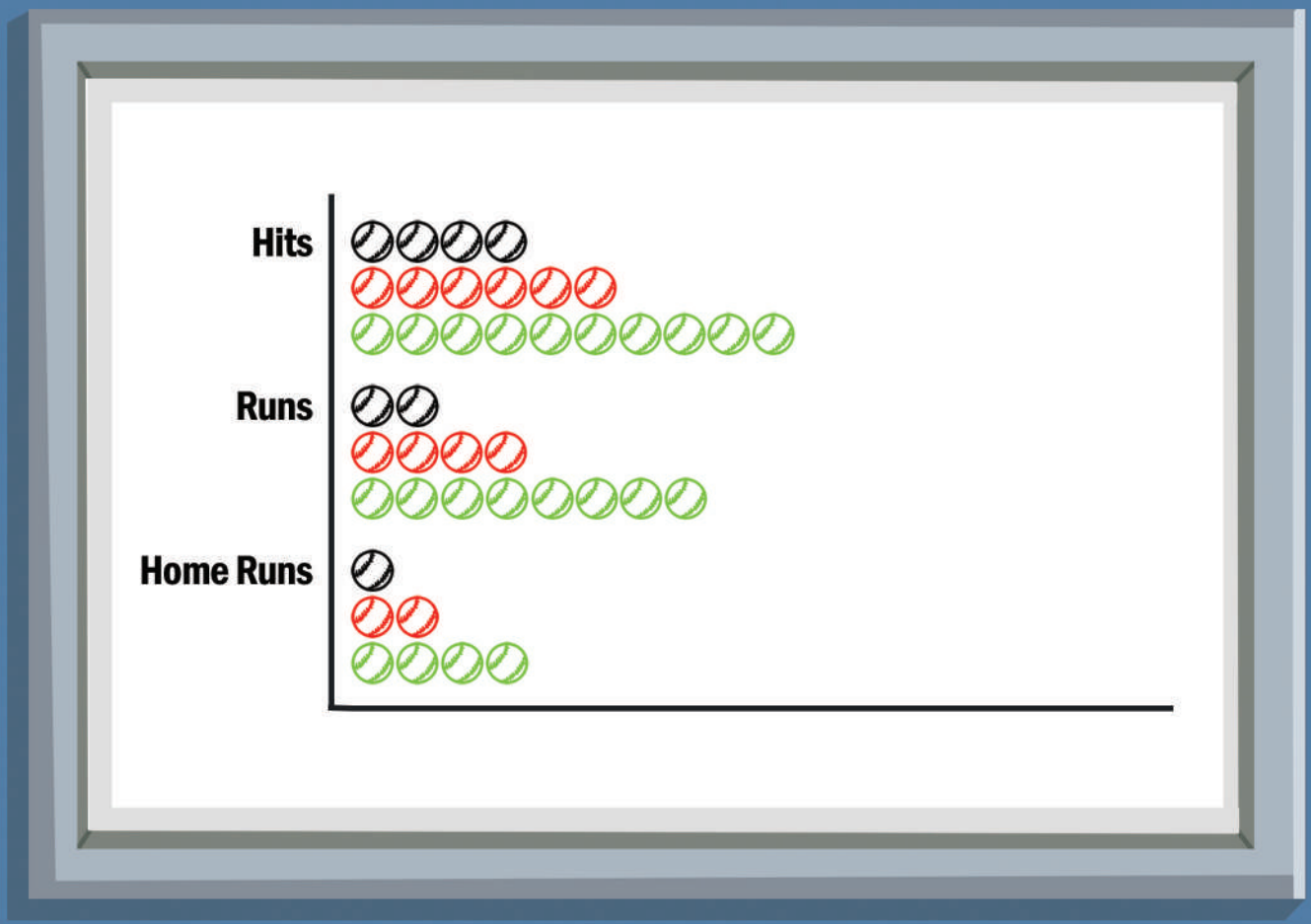
The children nod their heads.

“What else?” asks Coach.

Davide raises his hand. “We’ve got 20 hits and 14 runs. That means only 6 hits didn’t score us any runs!”

Coach nods, smiling.

“Well done!” says Coach.



"So," says Coach, "I know that you're good and that you're improving."

"Yes!" says Rebekah. "We saw that on the chart."

"Let's keep adding to this chart through the season," says Davide.

"It will show us how good we are. But it can also show us how we need to improve."

Coach nods.

"That's right. But for now . . . let's play ball!"

Main Idea

We can use numbers to show us how well we are doing and how we can improve.

CHAPTER
17

What Makes a Triangle?

Lizzy tightens the last bolt.
Her robot is almost done!
Dan-E's eyes light up.
He is ready to start learning!
"Hi, Dan-E! I'm Lizzy."
"Nice to meet you, Lizzy!"

"I'm going to teach you about shapes!"

Dan-E is puzzled. "Why?" he asks.

"I built you to help me in my workshop," Lizzy says.

"When I am working, I need you to follow my instructions.

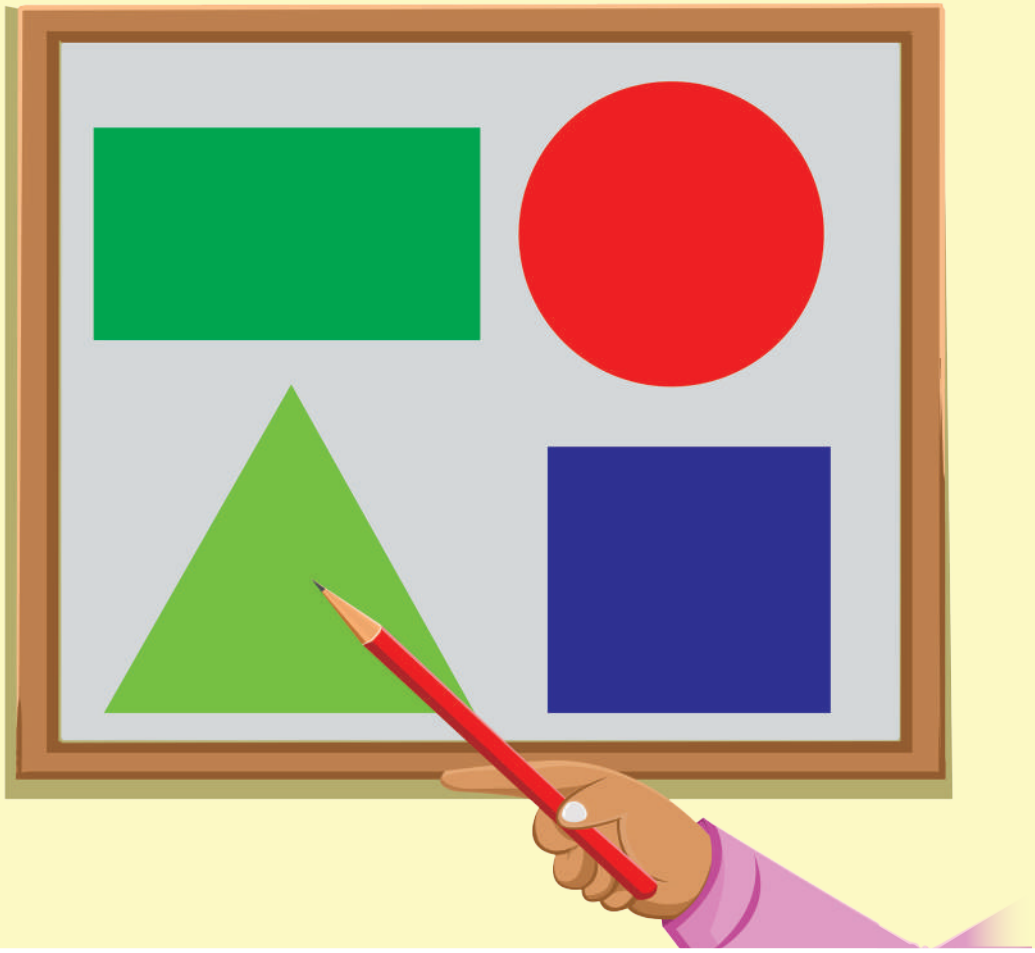
I might ask for a circular saw. Or a triangular ruler. You need to know what to look for!"

Lizzy points to a green triangle.

"This is a triangle. It's my favorite shape! Notice how it has 3 sides."

Safety Shapes

Some shapes in our world have special meanings. Think about a stop sign next to a crosswalk, or a triangle warning label on a package. Recognizing these shapes can quickly alert us to danger.



“Oh, I see!” says Dan-E.

He points to the rectangle at the top.

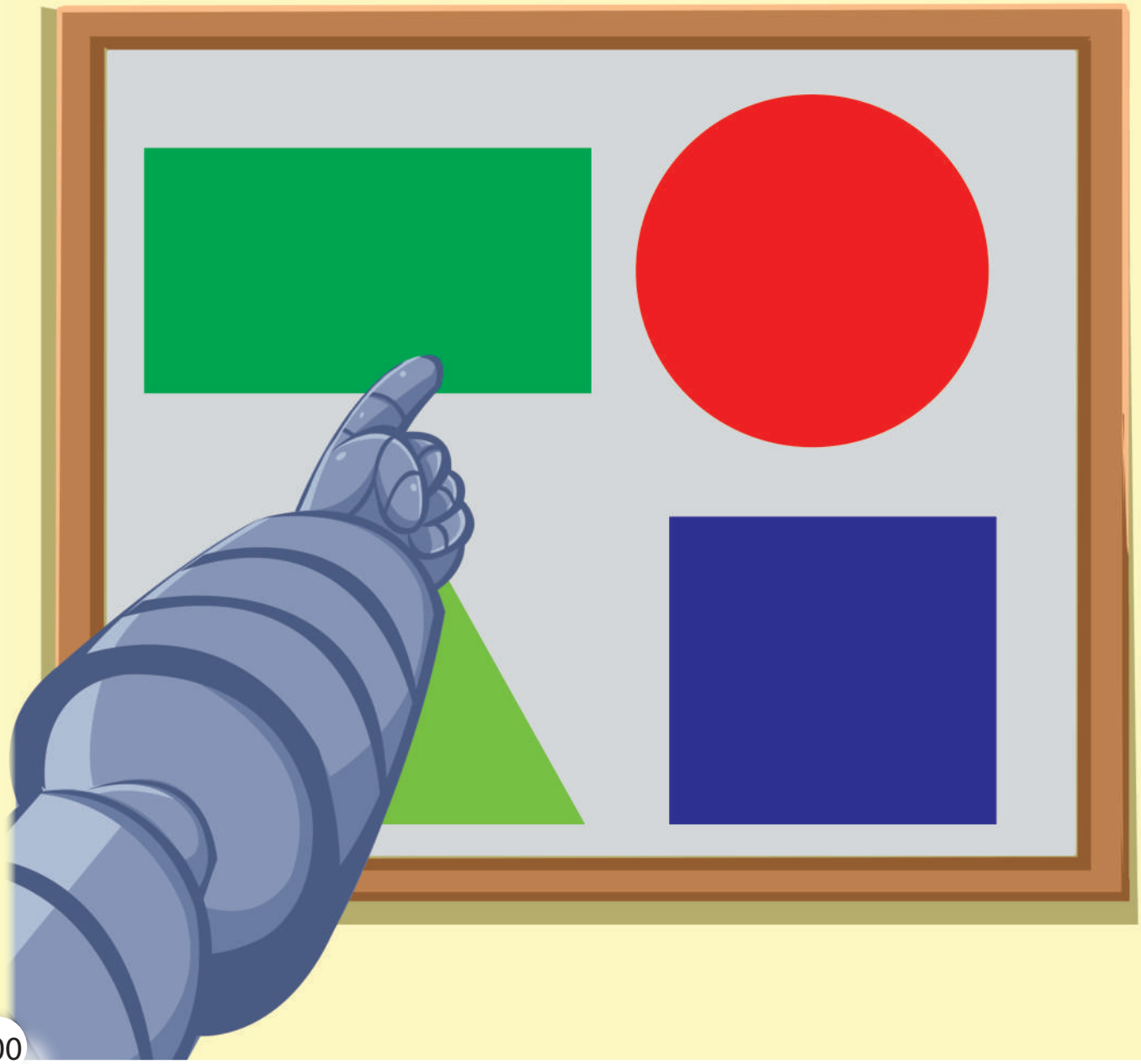
“Is this a triangle?”

Lizzy shakes her head.

“But it’s green!” says Dan-E.

“How many sides do you see?” asks Lizzy.

“1, 2, 3 . . .” counts Dan-E. “4 sides!”



"Oh, I see!" says Dan-E. "This must be a rectangle, too!"

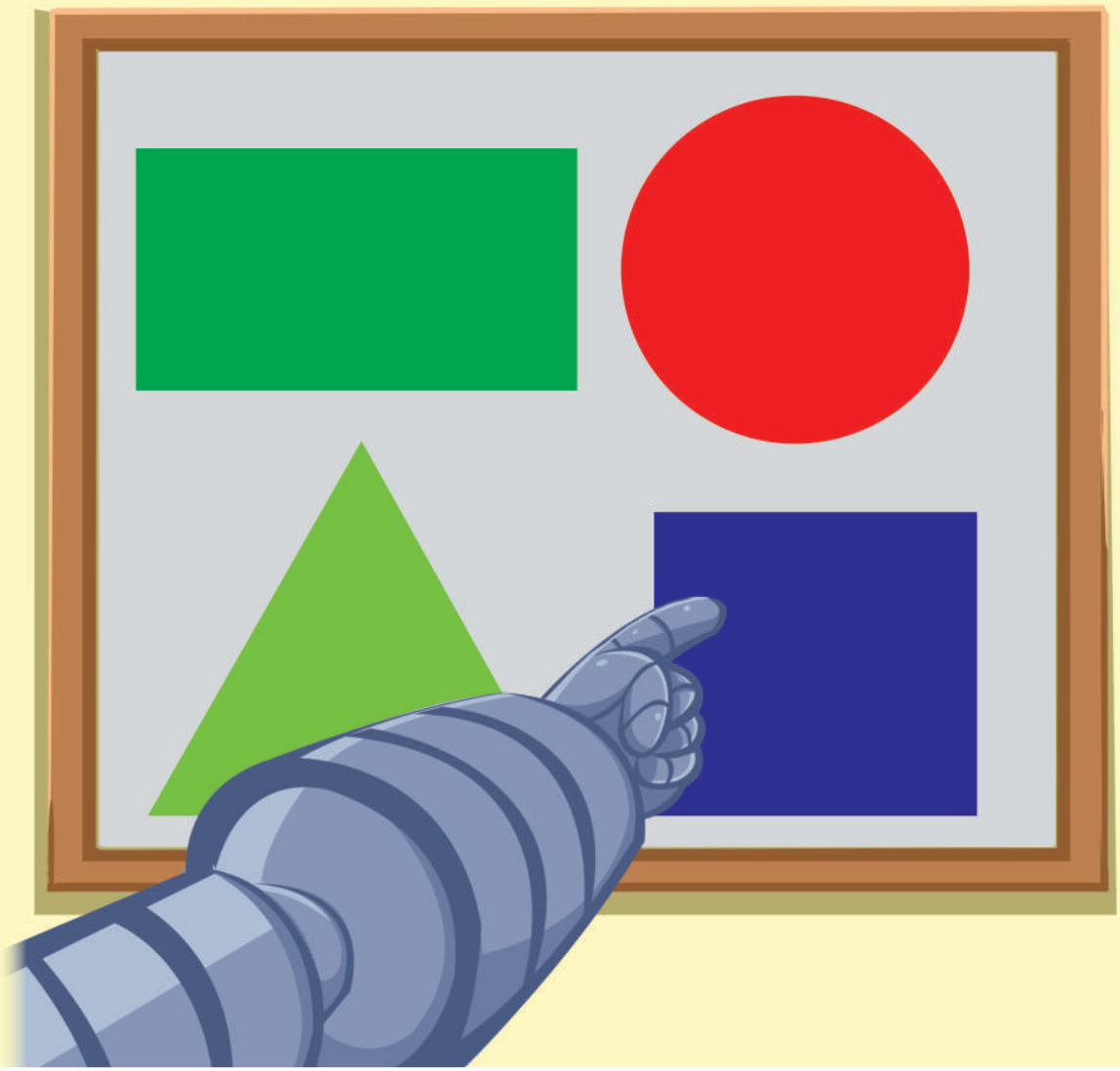
Lizzy grins. "It is a special rectangle! What do you notice about the sides?"

"They are all the same length," says Dan-E.

"That's right," says Lizzy. "This is a special kind of rectangle. It's called a square."

Shapes Rule

There are rules for what makes a shape a shape. Rectangles always have 4 sides. But squares always have 4 equal sides! That means squares are always rectangles—but rectangles aren't always squares!



"I think I understand," says Dan-E.

He points to the circle.

"But I don't know what this is!"

"I'll tell you!" says Lizzy.

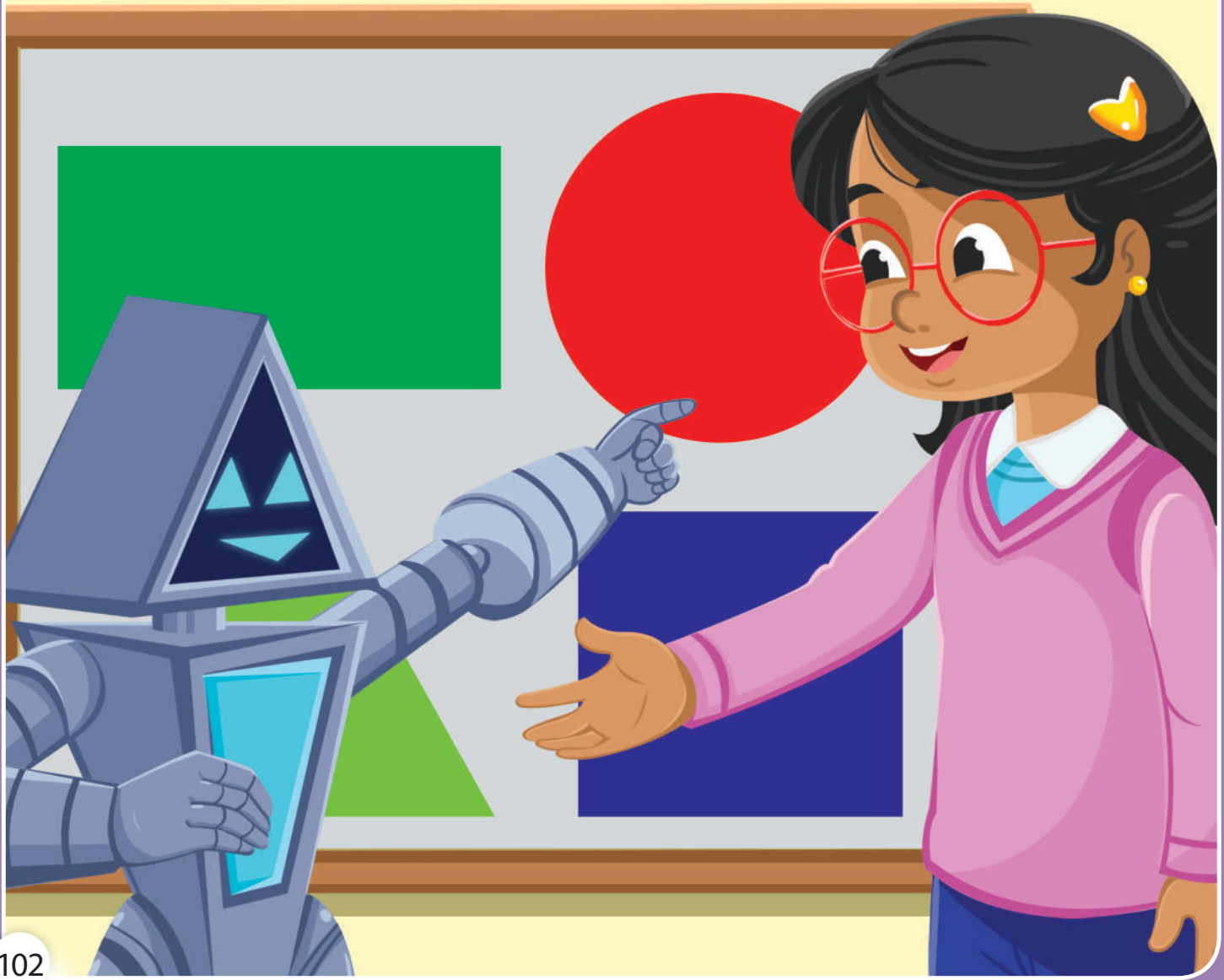
Lizzy traces her finger around the shape.

"This shape doesn't have any corners," she explains.

"It's round. That makes it a circle!"

What's It Not Got?

Sometimes we work out what something is by what it doesn't have. A circle is a good example. It doesn't have any corners at all.



Dan-E spots himself in the mirror.

"Now I really do see!" says Dan-E. "I am made of triangles!"

Lizzy cheers. "Well done, Dan-E!"

Main Idea

Shapes have features that define them.

CHAPTER
18

The Great Pyramid

This is the Great Pyramid of Giza, in Egypt.
It was built a very long time ago.
But how did people build it?
The ancient Egyptians did not have our tools.
They did not have our measurements either.
How did they manage to build such a big structure?
And how has it stood for so long?

The pyramid is a strong and sturdy shape.

It has lasted a long time.

Look at the picture. Do you see what it is built from?

It is built from lots of rectangular stone blocks!

The blocks were fit together by the builders.

With a lot of work, the pyramid shape was built from these rectangular blocks.

Why is a pyramid such a strong shape?

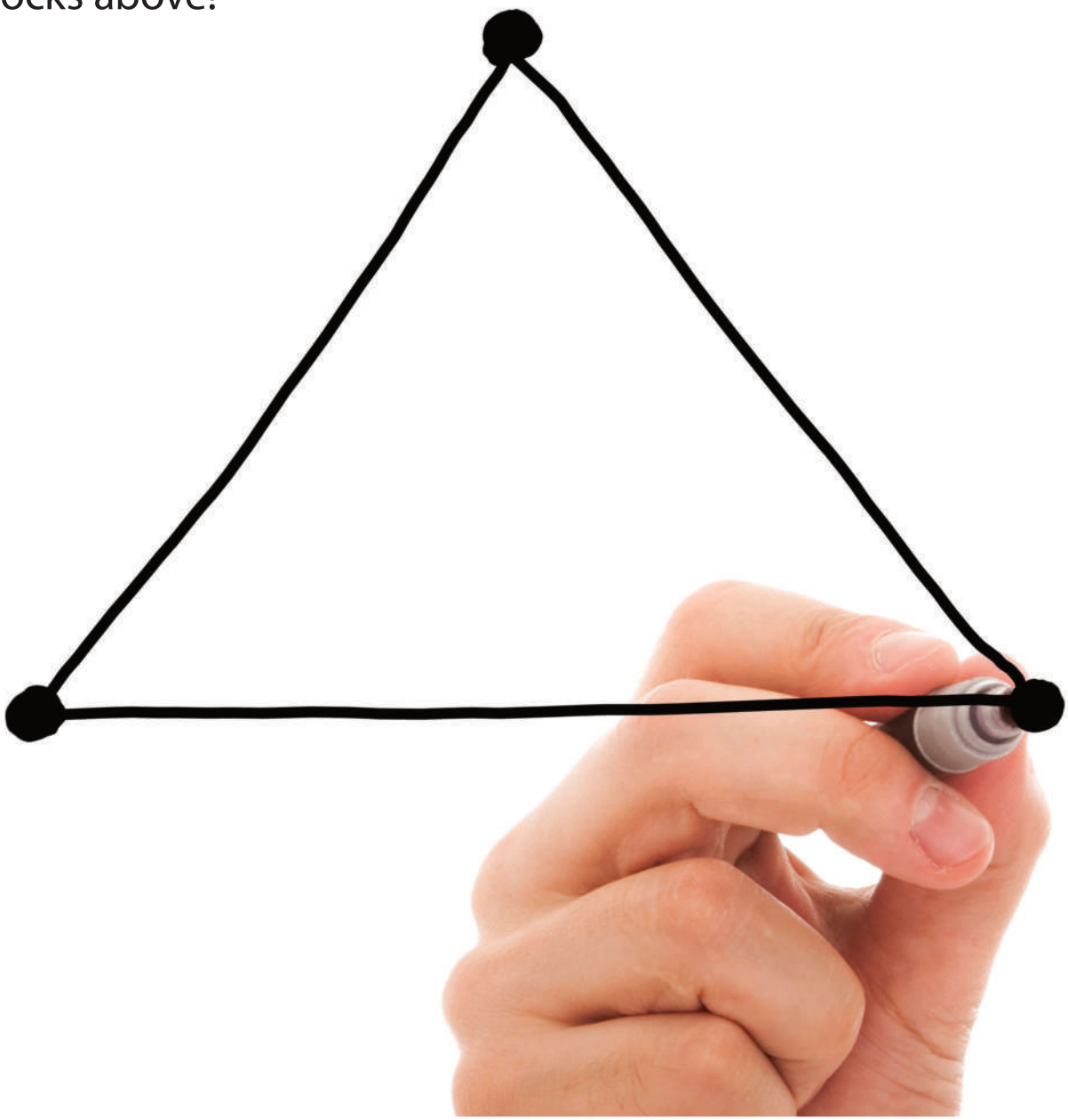
It's because of triangles!

The pyramid's sides are triangles.

They are thinnest at the top and widest at the bottom.

That means the building is heaviest at the bottom and lightest at the top.

The blocks on the bottom support the weight of the blocks above!



Building the pyramids was not easy.

The Great Pyramid is made from more than 2 million stone blocks!

These had to be measured, cut, and moved.

We think the builders used logs to roll the blocks.

They may have also used ramps to get the logs up the pyramid.

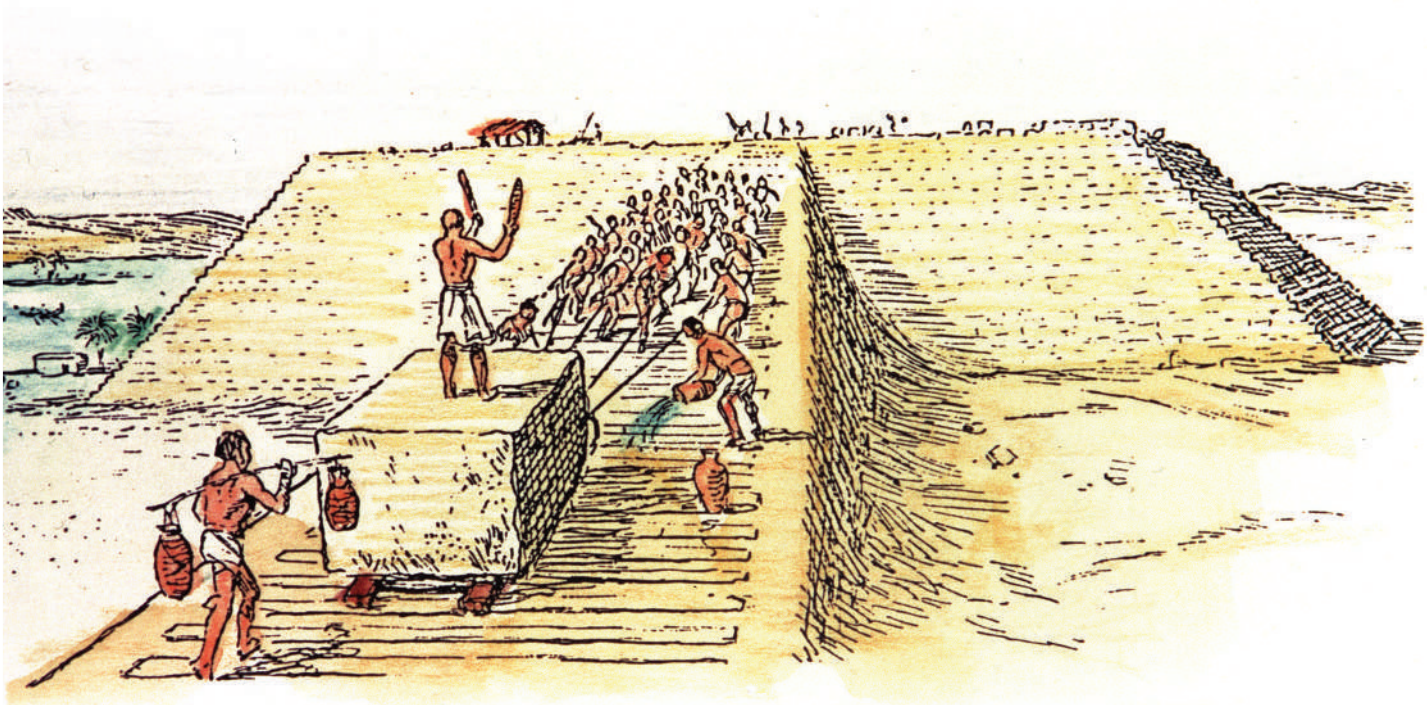
Then the builders had to fit the blocks together.

They filled in any gaps!

Building the pyramids took a lot of hard work.

Thousands of people worked to build them.

It took years.



But also . . .

The pyramids were perfectly designed.

The architects measured the angles carefully.

They didn't want their pyramids to fall down!

Such a large building needed very exact math.

How did they do it?

They used observations and measurement!

Ancient Architects

Some of the pyramid architects have their own tombs. They left records about how they designed and built the pyramids. We know that these architects were well rewarded for their skill!

The pyramids were built very many years ago.

But modern builders use the same skills! Architects think about angles and shapes.

We want buildings that look nice and are useful.

And we don't want them to fall over!

Heavens Above

The sun, moon, and stars were important to the ancient Egyptians. They used them to help design the pyramids! They studied how the sun moves across the sky. They used this information to decide where to put their pyramids.

Main Idea

Ancient buildings show that builders had knowledge of angles and shapes.

CHAPTER 19

The Shape of Things

Look at all these scenes from around the world.

Look at all of the different buildings!

They are made of different materials and different shapes.

How are they similar? How are they different?

Math is used around the world to make buildings and cities.

New buildings need to fit in the space that is available.

This is the Flatiron Building.

It is in New York City.

The architect designed this building in the shape of a triangle so that it would fit in this space.

What other shapes do you see in the building?

Sometimes buildings are designed to stand out!

This is the Dancing House.

It is in Prague, a city in the Czech Republic.

Why do you think it is called that?

It is made up of many shapes.

You can find rectangles, squares, and cylinders in the design.

What else do you notice?

This pyramid is outside of an art museum that is called the Louvre.

It is in Paris, France.

It's the same shape as the Great Pyramid—but it is very different.

This pyramid is made of glass and metal. You can see through it!

Guests go through the pyramid to enter the museum. It was designed by the Chinese American architect I. M. Pei. The pyramid is a piece of art itself.

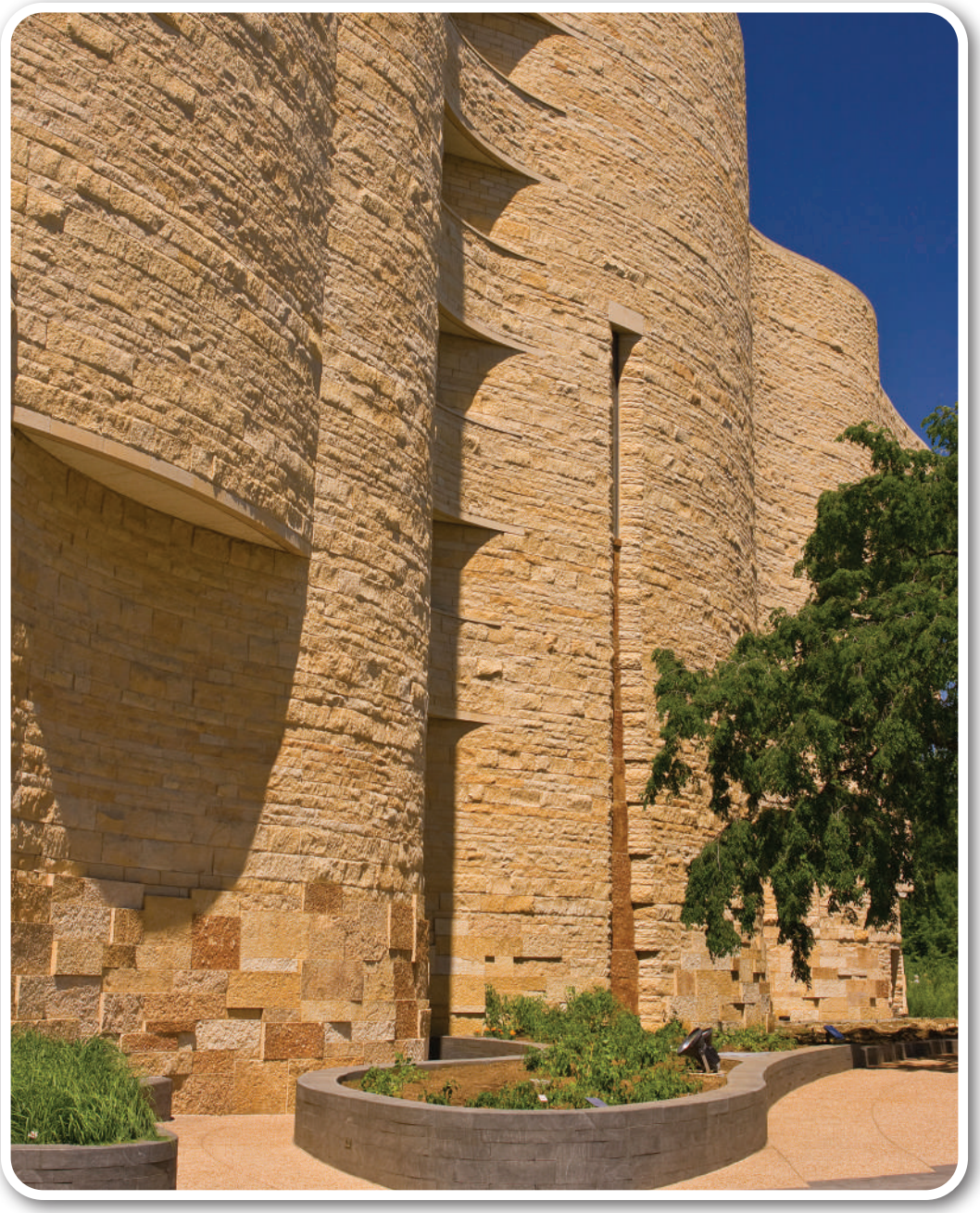
Let's Reflect

The Louvre Pyramid is surrounded by water. When you look at the pyramid and its reflection, you see a different shape!

This is the National Museum of the American Indian in Washington, DC.

The Native American architect Douglas Cardinal created the original design of the building. He wanted it to look like rock worn down by wind and water.

He used shapes and colors found in nature.



We have one last city to visit!

This is a street in Amsterdam.

Amsterdam is a city in the Netherlands.

Notice that these buildings are very tall and narrow.

Long ago, the owners had to pay the city money based on the width of their house.

The money owed to the city for a tall, thin house would be less than for a short, wide house!

Owners used math to figure out how to have a bigger house but pay the city less money.

Main Idea

Shapes are used in buildings for different reasons.

CHAPTER 20

Pizza Party!

Do you like pizza?

Have you ever had a pizza party?

Lots of people around the world enjoy pizza.

And it's not just because they like the cheese, the tomatoes, and the toppings!

It's also because pizza is easy to share.

A few hundred years ago, the first pizzas were made in Naples, Italy.

Pizza makers used their hands to shape the pizza into a circle.

Today, pizzas are still usually circular.

One reason for this is that the pizza cooks evenly.

Another is that it is easy to slice.

To cut pizza, many people use a pizza slicer.

It is a sharp wheel that cuts in straight lines.

People usually want their slices to be the same size.

One way to divide a pizza is to cut it in half.

Then you can cut the halves in half.

That makes 4 slices, right?

You can keep cutting the slices in half.

However, the slices might get pretty small if you keep doing this.

If the slices are getting too small, it might be time for more pizza!

Slice and Dice

Are circles easier to divide than other shapes? Can you slice a rectangle or a square the same way? How can you cut a triangle?

When you have a pizza delivered, it comes in a box.

The box protects the pizza and keeps it warm.

Pizzas are easy to stack and carry when they are in boxes.

Did you ever wonder why a pizza is round but its box is square?

Square boxes are cheaper to make and easier to put together.

And having extra space around the pizza in the box makes it easier to pick up a piece! Now that is smart math!

When it comes to food and drink, math is everywhere.

There must be the right amount of food for the number of people eating.

Ingredients must be measured out exactly.

Foods in the oven must be cooked at the correct temperature and for the right amount of time.

Math helps us with that!

Planning a pizza party can be a lot of fun. Eating the pizza is even more fun!

Main Idea

We can use math to fairly share our favorite foods.

CHAPTER
21

Growing by Numbers

Where do fruits and vegetables come from?

Most people would say a garden or a farm.

But how do people know what to plant and when?

What plants grow well together?

And how do we make the best use of soil, water, and time?

Let's take a look!

Gardeners and farmers often grow their plants in rows.

Using rows helps them get the most out of the space they have.

Usually, each row has its own type of plant!

Other times, they grow more than one type of plant together.

We Sisters Three

Native Americans called corn, beans, and squash the Three Sisters. They knew the plants grow well together. Squash plants keep soil shaded. Beans climb up tall corn plants.

Farmers and gardeners plan their rows. This makes the best use of the soil and water.

Plants need light and air, too!

Some plants are climbing vines.

Farmers plan how to make space for every plant.

They want to make the best use of the space they have.

They make sure that the plants have everything they need to grow.

People in the community share the garden.

They each get their own spot to grow their plants.

A square or a rectangle makes a good shape to arrange rows of plants in.

It is also easy to get around. Do you see the walkways?

Sometimes the soil is not good for planting.

People build flower beds off the ground and fill them with better dirt for the plants!

If you had a community garden plot, what plants would you like to grow?

You would need to plan out where you would grow each plant.

You would also need to make sure your plants had everything they needed to grow.

But think of how rewarding it is to eat and share what you have grown!

Farmers grow food to sell.
They need to know how much they have grown!
How can they find this out?
One way is to count.
Another way is to weigh each type of food.
Then they will know how much they have to sell.

Main Idea

Math helps gardeners and farmers plan how to use land and take care of plants.

CHAPTER
22

Artful Math

Look at this picture. It is a mosaic.

Mosaics are works of art.

But they are not made from pencils or paint.

Instead, they are made from small, colorful tiles.

Look at the colors and the shapes in this mosaic.

It is amazing that the artist can make a picture out of shapes!

People started making mosaics long ago.

Mosaics are made all around the world.

They can be made from almost anything.

Some are made of tiles, broken pots, or colorful glass.

Others are made of rocks or shells.

These pieces can be stuck onto a wall or a floor.

Different pieces make up the pattern.

Tiles and Tesserae

The tiles used in mosaics are called *tesserae* (tes-sur-ee). This word comes from the ancient Romans. Many of the mosaics they made are still around today!

Look at this mosaic.
Isn't it lifelike?
It shows someone called Empress Theodora.
She lived around 1,500 years ago.
The whole mosaic is made of colored tiles.
You can see how the tiles are put together in rows.
The rows of colorful tiles make the scene come to life.
You can see people's faces and colorful clothing.
You can even see the water in the fountain.

Mosaics take a lot of planning to make!
First, the artist measures how much space they have.
They sketch the image they want to make.
They sort their tiles by type and color.
Then they start putting them together, row by row.
You can try this yourself!

A lot of math goes into making a mosaic.

The artist uses different shapes.

They think about how the shapes fit together.

They design how to make new shapes from the colored tiles.

And don't forget, they must plan how to use the space they have!

Using math helps artists be creative.

Look at this mosaic.

Think about how hard the artists worked to plan and make this!

This mosaic is a very old and impressive work of art.
It shows Alexander the Great (and his horse!).
Look closely at all the tiles. They are very tiny.
There are thousands and thousands of them.
There are many colors.
Think about how hard the artist worked on this.
Think about all the math they used.
Math is everywhere in art.

Main Idea

Mosaic artists use math and plan carefully to make their art.

CHAPTER
23

Time to Tell Time

Did you know that telling time is based on systems made up long ago?

There are 12 months in a year.

There are 24 hours in a day.

There are 365 days in a year.

People did not just pick these numbers.

They are based on observations.

It all started by observing the sky.

The ancient Egyptians used the sun to tell time.

They counted how many days it took Earth to travel around the sun.

They made a calendar that was 365 days long.

The Egyptians were not the only ones to count days in a year.

The ancient Maya in Mexico also had a 365-day calendar!

People around the world could observe the same things in nature, even if they never met.

The ancient Babylonians used the moon to tell time.

They noticed that the moon was full 12 times a year.

They made a calendar with 12 months.

Each month was a cycle of the moon.

This calendar was 354 days long.

That's shorter than the calendar we use today.

That means the Babylonians counted years differently from us.

The image shows the Babylonians showing a calendar to their ruler.

The ancient Egyptians used math and numbers to tell time more exactly.

The number 12 was important to the ancient Egyptians.

They broke the daytime into 12 parts.

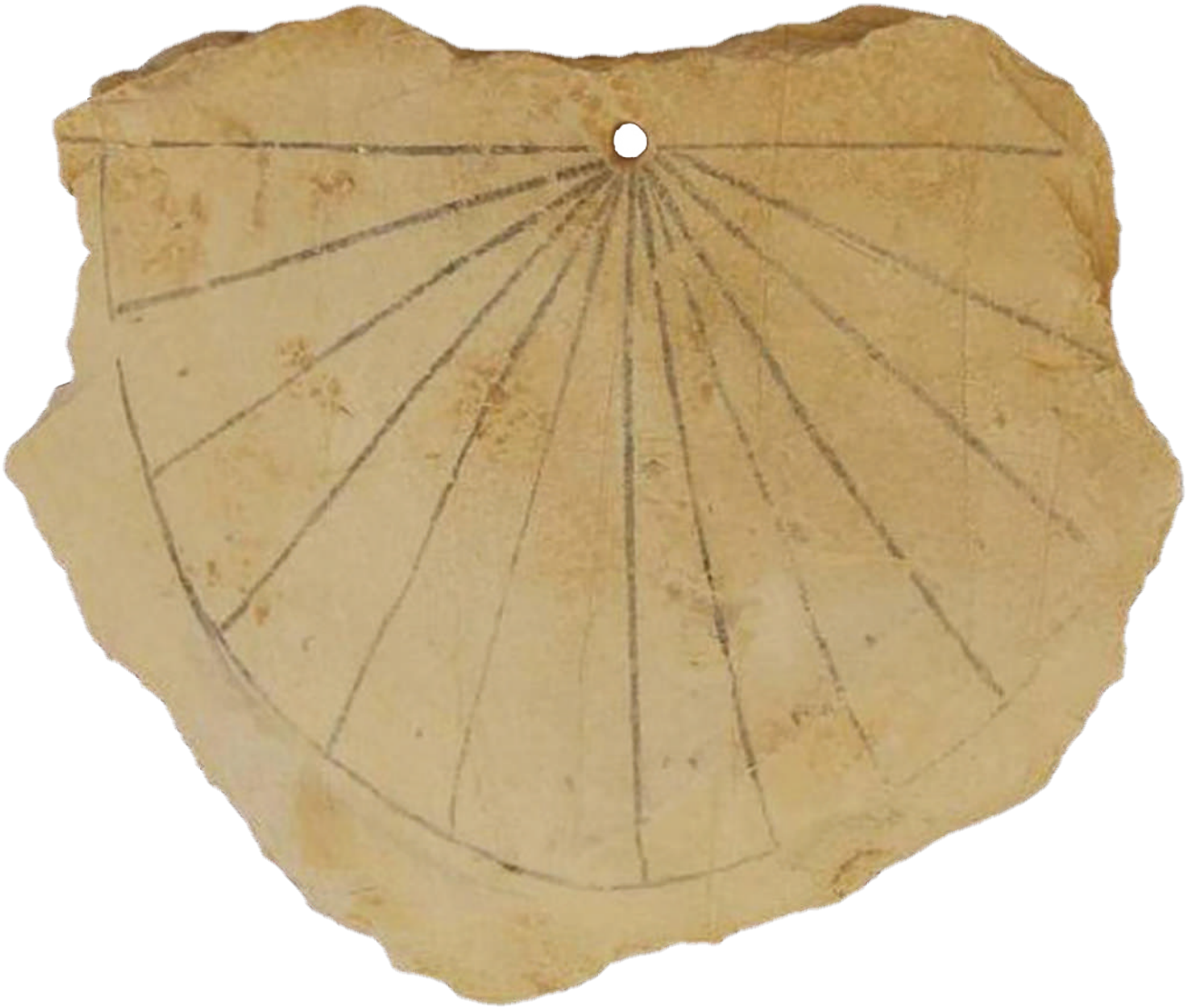
They also broke the nighttime into 12 parts.

We call these parts hours.

Adding 12 and 12 gives us 24 hours each day!

We still divide time the same way today.

Egyptians used a tool called a sundial to tell time during the day.
The picture shows a sundial from ancient Egypt.
A pole or straight post is placed in the hole.
The sun casts shadows on the lines on the rock.
Shadows change and move throughout a day.
The location of the shadow let people know what time it was.



People around the world use different calendars.
One example is the Chinese lunar calendar.
Like the Babylonians, it follows the 12 moon cycles.
The Lunar New Year is an important celebration.
It marks the beginning of the Chinese New Year.
It is the first new moon of the year.
What other calendars do you know of?
What special days are marked on your calendar?

Main Idea

People throughout history have made up systems to keep track of time.

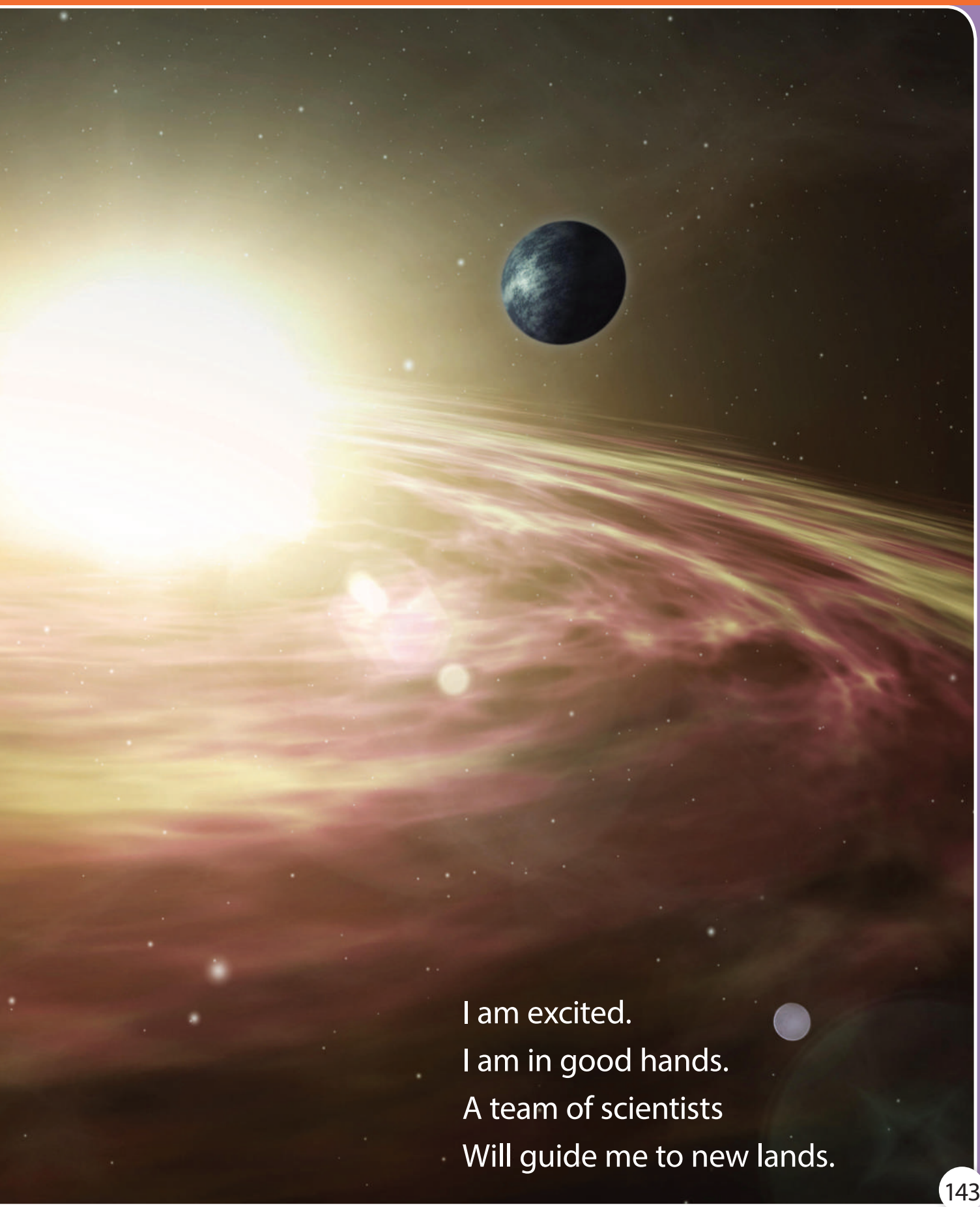
CHAPTER
24

Out in Space

If I were an astronaut,
What would I do?
I would travel through space
And enjoy the view.

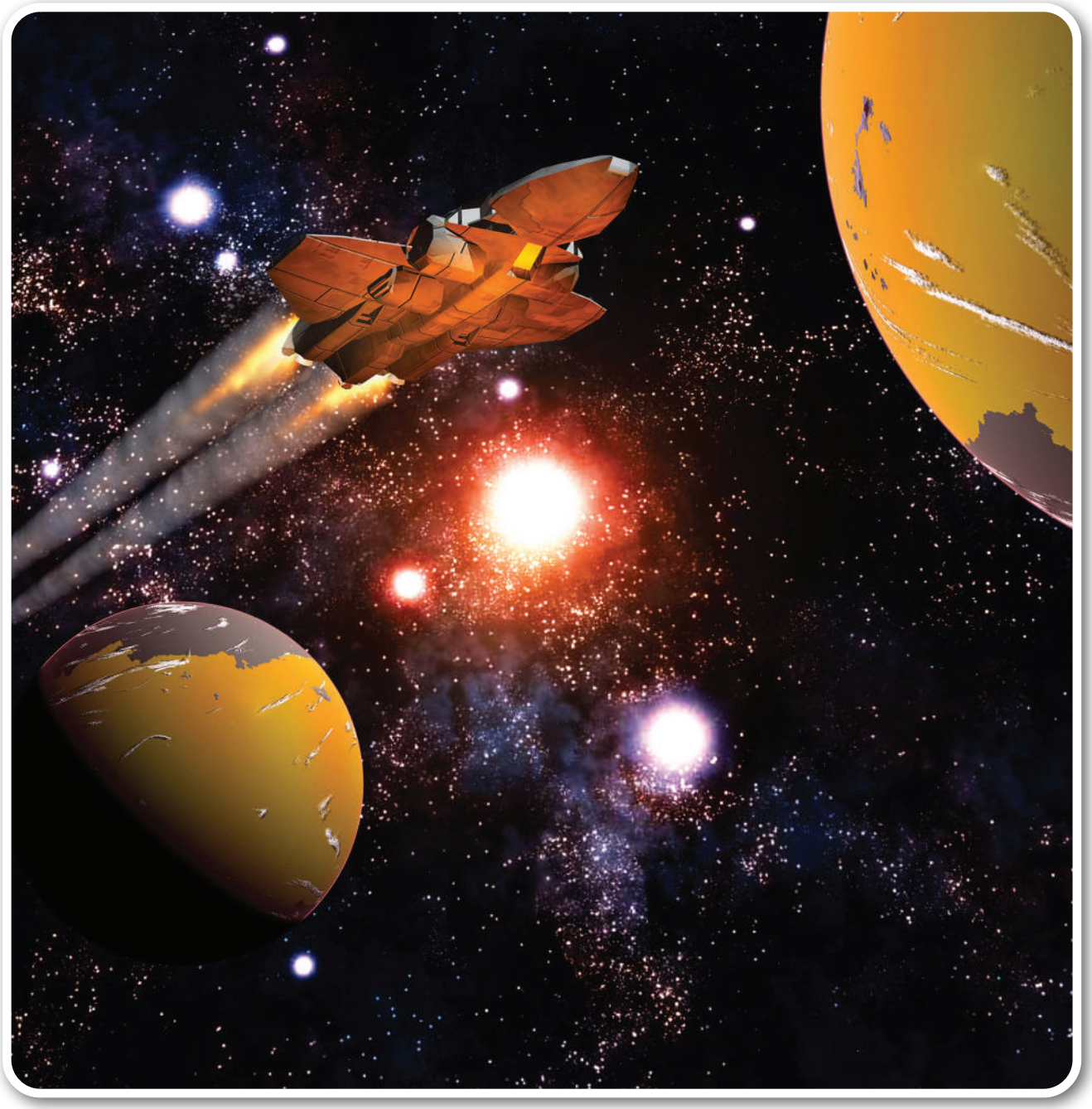
My spaceship would take me
To places so far—
Millions of miles
Beyond the closest star.


How much food will I need?
How much air will I breathe?
Will I need special clothes?
What is my ship's speed?



I am excited.
I am in good hands.
A team of scientists
Will guide me to new lands.

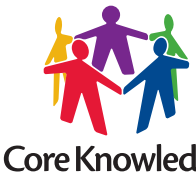
They add, divide,
Measure, and prepare.
They built my space rocket
With so much care.



I will explore new planets,
I'll run tests out in space.
I'll bring the results home
To make Earth a better place.

Main Idea

We use math in poetry.



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