

$$\frac{1}{10} = \frac{10}{100}$$

$$0.1 = \frac{10}{100}$$

$$0.1 = 0.10$$

$$\frac{1}{10} = \frac{10}{100}$$

Engineering Marvels

Roller Coasters

Dividing Fractions

Ben Nussbaum

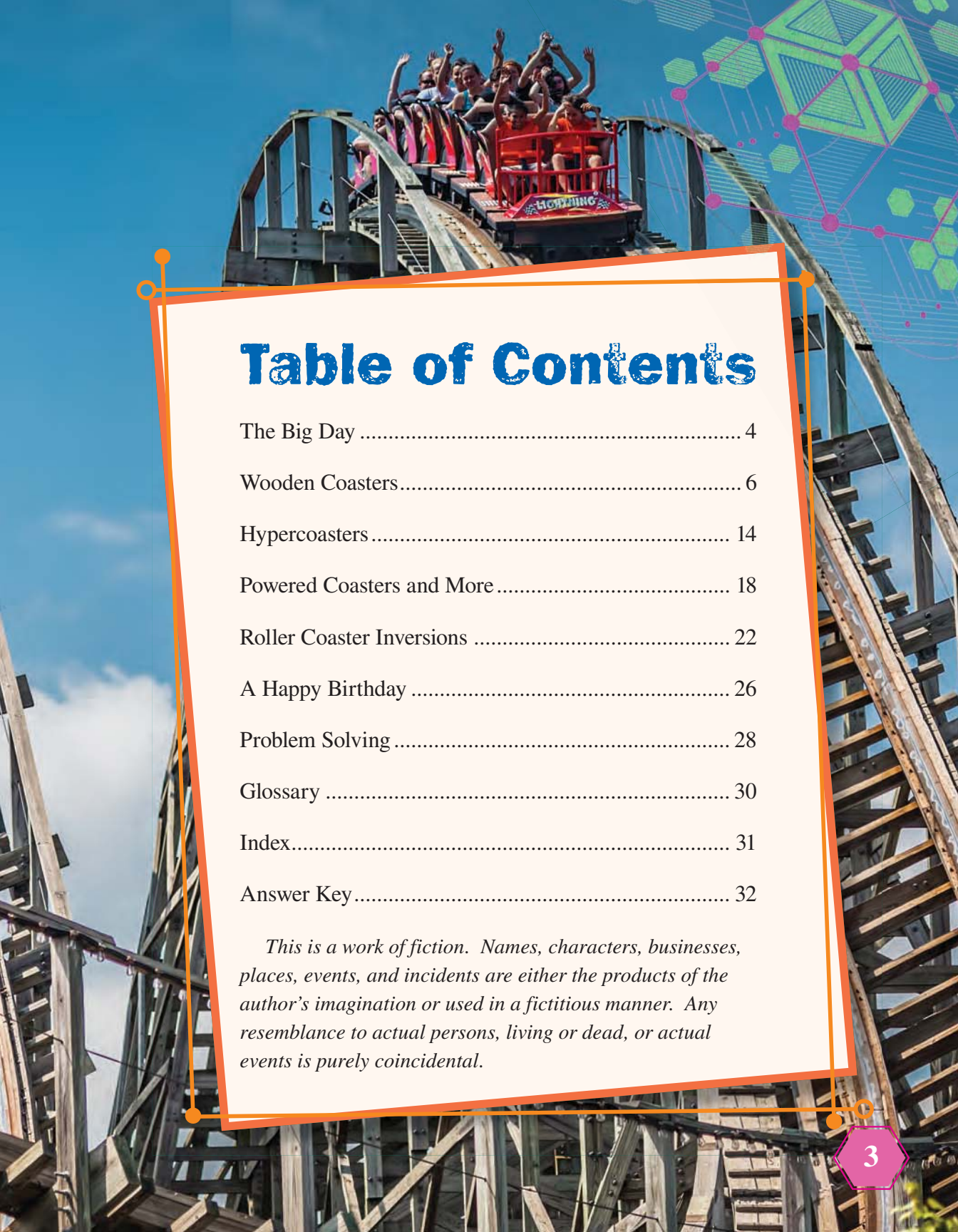


Table of Contents

The Big Day	4
Wooden Coasters	6
Hypercoasters	14
Powered Coasters and More	18
Roller Coaster Inversions	22
A Happy Birthday	26
Problem Solving	28
Glossary	30
Index	31
Answer Key	32

This is a work of fiction. Names, characters, businesses, places, events, and incidents are either the products of the author's imagination or used in a fictitious manner. Any resemblance to actual persons, living or dead, or actual events is purely coincidental.

The Big Day

“Wake up, sleepyheads! Don’t you remember that today is our birthday? We can’t be late.” Mom and Dad roll over in bed, blink their eyes, and yawn.

Zachary and Elizabeth are twins. They have been looking forward to this day for a long time. To celebrate their birthday, the family is going to Excitement Zone, an amusement park.

Soon, the twins are eating breakfast while Dad packs for the trip. “We have to be at Excitement Zone when it opens,” says Elizabeth, as she eats her scrambled eggs.

“That’s when the lines for the roller coasters are shortest,” Zachary adds.

“I’m looking forward to it,” replies Mom.

“I’m looking forward to coming back home,” Dad mutters from the kitchen. He doesn’t really like roller coasters. Elizabeth quickly reminds him that he promised to ride at least one roller coaster.

The twins have been reading about coasters to prepare for their special day. On the drive, they tell their parents about Russian Mountains. These man-made sledding hills were popular in parts of Russia hundreds of years ago. “They’re sort of like the parents of roller coasters,” declares Elizabeth.

early 1800s roller coaster



LET'S EXPLORE MATH

Zachary and Elizabeth pack some snacks for the trip to the amusement park. They have 2 pounds of trail mix. Each container holds $\frac{1}{4}$ of a pound. How many containers can they fill? Use the model to solve the problem and complete the sentence frames to describe it.

--	--	--	--

--	--	--	--

There are _____ groups of _____ in _____.



The El Toro at Six Flags Great Adventure in New Jersey is the biggest wooden roller coaster in the world!

Wooden Coasters

Excitement Zone isn't far from the family's house. Soon, the family is parking. "Perfect timing," says Zachary. "The park opens in a few minutes."

"Look! You can see the top of Wild Wolverine from here," shouts Elizabeth.

"That's the wooden coaster, right?" asks Mom.

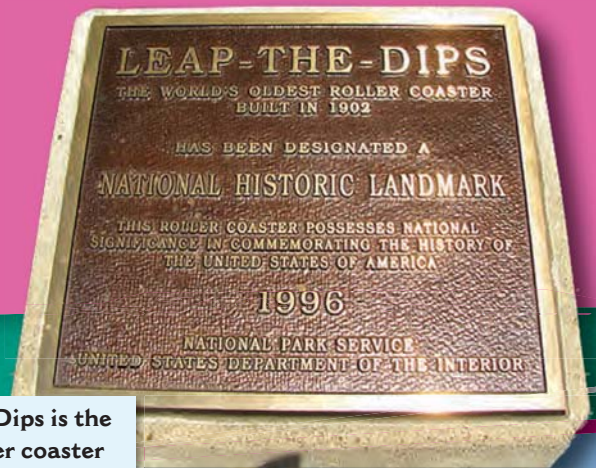
"Even I know that," Dad says with a smile before Zachary or Elizabeth can answer.

The twins have been talking about these coasters for weeks, so the whole family feels like experts. Wild Wolverine is the only wooden coaster in the park. For a long time, all roller coasters were made from wood. Most new coasters are now made from steel. Elizabeth is excited as she stares at the tall structure.

The kids found out a lot of facts during their research. Wooden roller coasters have some special **properties**. The wood always changes a little bit. Humidity, or moisture in the air, makes the wood **expand**. On hot days, the wood **contracts**. The change isn't big, but it happens. Because the wood changes, the ride is always a little different. The ride might feel bumpier one day than the next. But, some people prefer the bumpy ride!

“There’s a wooden roller coaster in Pennsylvania that was built in 1902. It still runs!” Elizabeth exclaims.

“Our great-great-great-great grandparents could have ridden it,” responds Zachary.



Leap-the-Dips is the oldest roller coaster in the United States.



Safety First!

“All that wood looks extremely **rickety**,” Dad says. “If we’re the first people riding it today, aren’t we kind of testing it? Maybe we should hang back and let other people go first.”

“Trust me, it has been tested **thoroughly**,” Elizabeth answers.

“But, the park’s not even open yet,” Dad replies.

“**Maintenance** people get here before the sun rises,” Elizabeth explains. “They climb all over the coaster. They’re called trackwalkers.”

Workers perform maintenance on a roller coaster in England in 1958.

A photograph showing a roller coaster car with several white crash test dummies seated inside. The car is green and has a face painted on its front. It is positioned on a track with blue and green structural elements.

Crash test dummies
test a roller coaster
in New Jersey.

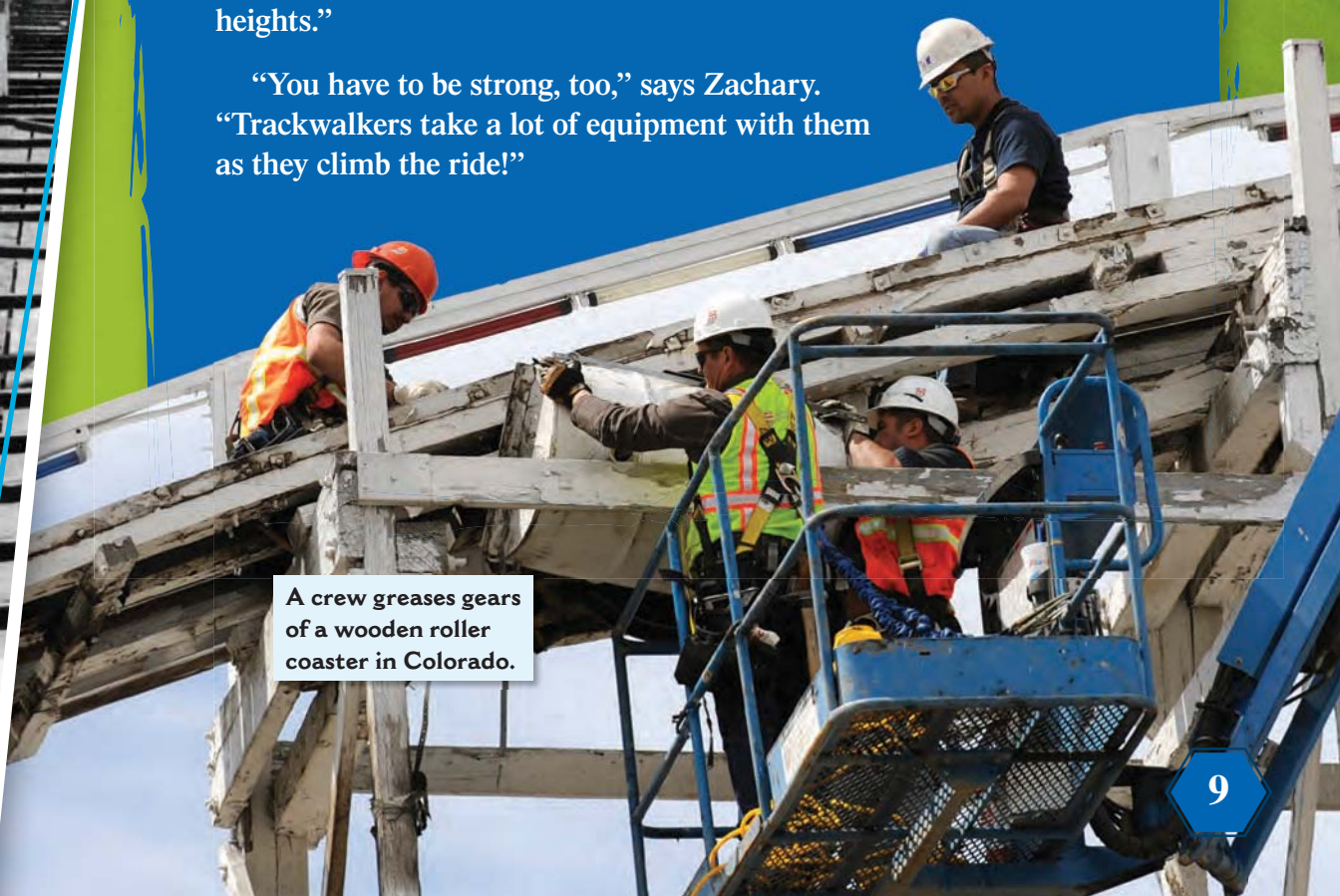
“After they inspect everything,” Zachary adds, “they test the coaster. They use sandbags to **simulate** the weight of riders.”

“I suppose that makes me feel a little better,” says Dad.

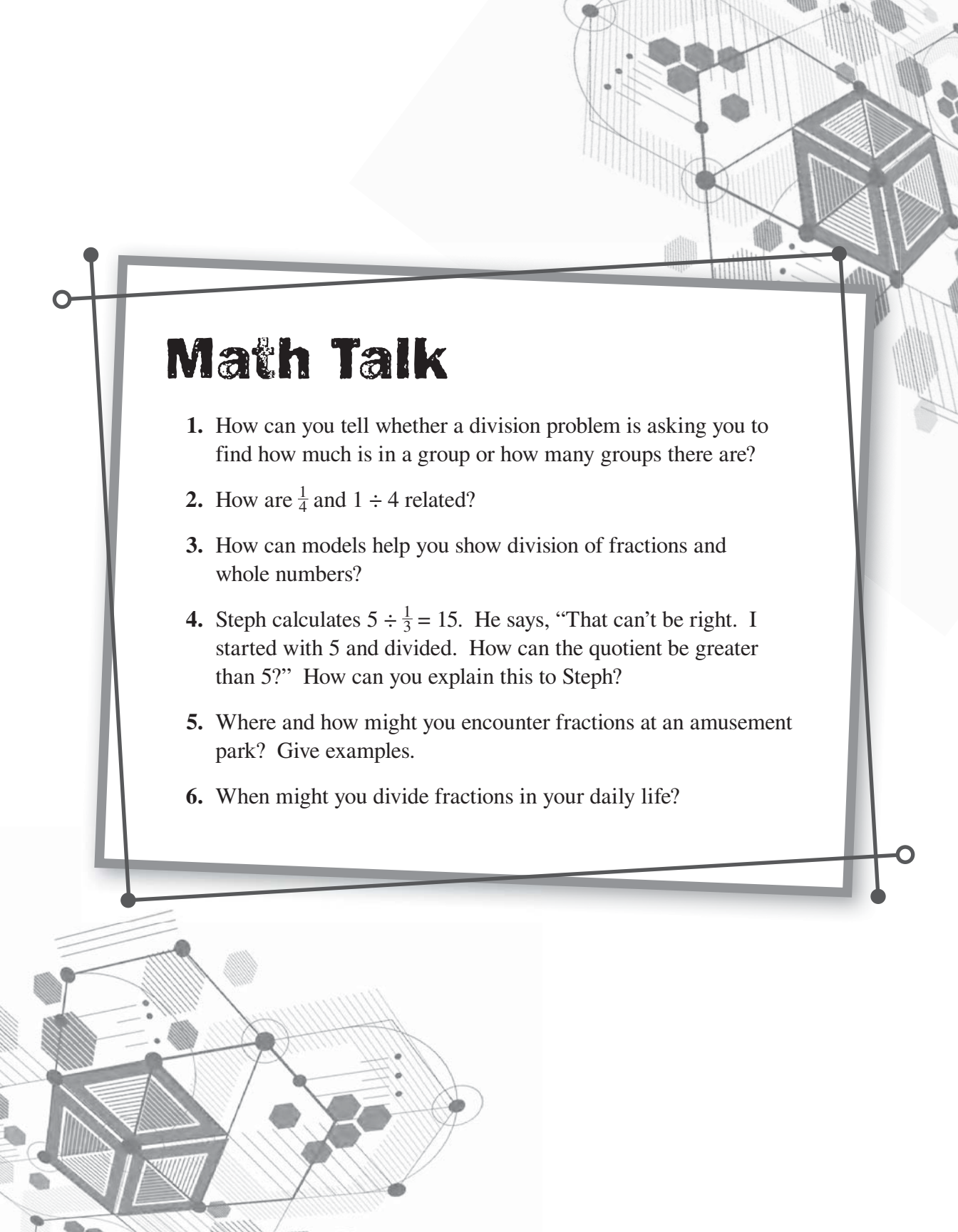
“They also check other things, such as emergency brakes,” Zachary chimes in. “The whole process takes hours. And when the park is closed for the winter, all of the cars are taken off the tracks. They are taken apart, cleaned, and parts are replaced if needed.”

“I think working on a roller coaster would be really fun,” says Elizabeth. “As long as you’re not terrified of heights.”

“You have to be strong, too,” says Zachary. “Trackwalkers take a lot of equipment with them as they climb the ride!”

A photograph showing a crew of four workers in safety gear (hard hats, high-visibility vests) working on a wooden roller coaster. One worker is on a blue scissor lift, while others are on the wooden structure. They are greasing the gears of the coaster.

A crew greases gears
of a wooden roller
coaster in Colorado.



Math Talk

1. How can you tell whether a division problem is asking you to find how much is in a group or how many groups there are?
2. How are $\frac{1}{4}$ and $1 \div 4$ related?
3. How can models help you show division of fractions and whole numbers?
4. Steph calculates $5 \div \frac{1}{3} = 15$. He says, “That can’t be right. I started with 5 and divided. How can the quotient be greater than 5?” How can you explain this to Steph?
5. Where and how might you encounter fractions at an amusement park? Give examples.
6. When might you divide fractions in your daily life?