10.3 Division Models

ALGEBRA

? Essential Question How can you use strip diagrams to solve division problems?

① ENGAGE the 5 Es

Essential Question

? How can you use strip diagrams to solve division problems?

Start

Lesson Opener

Making Connections

Invite students to tell you what they know about division.

What does division do? (It takes a number and divides it into smaller equal parts.)

Using the Digital Lesson

You may want to discuss how division is related to multiplication.

Learning Task

What is the problem the students are trying to solve? Connect the story to the problem.

• **How many miles does Elya fly total?** (32 miles total)

• **How many miles does Elya fly each time before she stops to talk to friends?** (8 miles)

• **What are you trying to find out?** (How many times Elya stops)

• **What math operation should you use?** (Division)

• **What other ways could you find the answer?** (Possible answers: Add sets of 8 until you reach 32, subtract 8 from 32 until you reach zero.)

Literacy and Mathematics

Choose one or more of the following activities.

• Ask students to write down some reasons why animals in the desert might need to travel far to find food.

• Have students write one sentence about each animal Elya stops to visit on her way to find food.

Are You Ready?

Access Prior Knowledge

Use the *Are You Ready?* 10.3 in the *Assessment Guide* to assess students' understanding of the prerequisite skills for this lesson.

Vocabulary

equation, **dividend**, **divisor**, **quotient**,

GO DIGITAL Multimedia *e*Glossary at *thinkcentral.com*

Materials

counters, MathBoard

GO DIGITAL Resources

For the student

Interactive Student Edition *provides students with an interactive learning environment!*

Math on the Spot Video Tutor

*i*Tools Virtual Manipulatives

Soar to Success Math Online Intervention

For the teacher

Digital Management Center *organizes program resources by TEKS!*

eTeacher Edition

Online Assessment System

Unlock the Problem

Have a volunteer read the problem aloud. Make sure students understand that they need to find how many in each group, or the number of treats each dog will get.

Activity 1 🤚

Be sure students place one counter at a time into each group. After students complete the page, ask:

- **How do you know your answer is correct?** Possible answers: I have an equal number of counters in each group, and the total number of counters equals 20; Think: 5 groups of 4 = 20, so my answer is correct.

Discuss how the parts of the strip diagram are related to the problem. To show that each dog represents one group, you can have students draw a line from each dog to one of the boxes on the strip diagram.

- **Why are there 5 equal boxes in the strip diagram?** Possible answer: there are 5 dogs that will each get an equal number of treats.

- **Compare the strip diagram with using counters. How are they alike and different?** Possible answer: alike: each shows 5 equal groups. Different: the strip diagram shows the total number of dog treats as a number. The counters show each dog treat, instead of numbers.

Strip diagrams are also commonly referred to as *bar models*, so some students may be familiar with both terms.

Name _____

10.3 Division Models
ALGEBRA

? Essential Question How can you use strip diagrams to solve division problems?

🔑 Unlock the Problem (Real World) (Hands On)

A dog trainer has 20 dog treats for 5 dogs in his class. If each dog gets the same number of treats, how many treats will each dog get?

- What do you need to find?
  the number of treats for each dog

🤚 Activity 1 Use counters to find how many in each group.

Materials ■ counters ■ MathBoard

- Use 20 counters.
- Draw 5 circles on your MathBoard.
- Place 1 counter at a time in each circle until all 20 counters are used.
- Draw the rest of the counters to show your work.

Check students' drawings. There should be 4 counters in each group.

There are ___4___ counters in each of the 5 groups.

A strip diagram can show how the parts of a problem are related.

- Complete the strip diagram to show 20 dog treats divided into 5 equal groups.

| 4 | 4 | 4 | 4 | 4 |

20 dog treats

So, each dog will get ___4___ treats.

Differentiated Instruction

ELL Language Support 🕐 Visual Small Group

Strategy: Define

Materials: self-stick notes

- Students can demonstrate an understanding of division words by matching them to the terms in a division equation.
- Write 20 ÷ 5 = 4 on the board. On self-stick notes, write the words *dividend, divisor*, and *quotient*.
- Have students label the terms in the division equation.
- Then, have students define each word. For example: The quotient is 4. The quotient is the answer.

$$20 \div 5 = 4$$
dividend   divisor   quotient

🖐 Activity 2 Draw to find how many equal groups.

A dog trainer has 20 dog treats. If he gives 5 treats to each dog in his class, how many dogs are in the class?
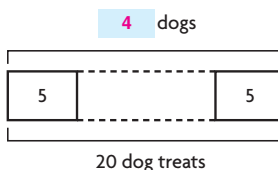
Check students' drawings. There should be 4 groups of 5 counters.

- Look at the 20 counters.
- Circle a group of 5 counters.
- Continue circling groups of 5 until all 20 counters are in groups.

There are __4__ groups of 5 counters.

- Complete the strip diagram to show 20 treats divided into groups of 5 treats.

So, there are __4__ dogs in the class.

4 dogs

5		5

20 dog treats

An **equation** is a number sentence that uses the equal sign to show that two amounts are equal.

Here are two ways to record division.

Write: 20   ÷   5   =   4
              ↑   ↑   ↑
          dividend divisor quotient

$$\text{divisor} \rightarrow 5\overline{)20} \overset{4 \leftarrow \text{quotient}}{}$$
              ↑
          dividend

Read: Twenty divided by five equals four.

Share and Show 📐 MATH BOARD

1. Complete the picture to find 12 ÷ 4. __3__

Check students' drawings.

Possible explanation: you circle groups of 4 counters until all 12 counters are in groups. Then you count the number of groups.

Math Talk 🔷 **Mathematical Processes**
Explain how you know how many groups to make.
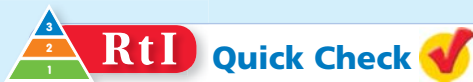
320

Enrich ⏱ | Logical / Mathematical Partners

- Challenge students to draw all the possible strip diagrams with 12 as a dividend. Tell students they might change the number of equal groups as a strategy to help them find all the possible strip diagrams. Remind students that each number of groups must provide for an equal number in each group.
- Have students work in pairs to share their strip diagrams.
- Have students choose one of their strip diagrams and write a story problem to match it.

GO DIGITAL Go to *thinkcentral.com* for additional enrichment activities in the **Enrich Activity Guide**.

Activity 2 🖐

In this activity, students find the number of equal groups, or how many dogs are in each class. Have students show the division using the counters, then interpret the parts of the strip diagram.

- **Why did you circle groups of 5?** because each dog is getting 5 treats
- **What does the box with the number 5 represent?** the number of treats each dog gets
- **What do the dashed lines represent?** We don't know how many dogs there are. That's what we have to find.
- **How is Activity 2 different from Activity 1?** In Activity 2, you are dividing to find the number of groups. In Activity 1, you divided to find the number in each group.

Discuss the different ways to record division. Then review these definitions with the class.

- The *dividend* is the number that is to be separated into equal groups.
- The *divisor* is the number that divides the dividend.
- The *quotient* is the answer to a division problem.

Share and Show

The first problem connects to the learning model. Have students use the MathBoard to explain their thinking.

- **Explain how you solved Exercise 1. Use the terms *division, divisor,* and *quotient* in your explanation.** Possible explanation: I divided the dividend, 12, by the divisor, 4, to find the quotient, 3.

Math Talk 🔷 Mathematical Processes

Use Math Talk to help students focus on using models to divide.

⚠ COMMON ERRORS

Error Students may reverse the order of the dividend and the divisor when writing a division equation.

Example 5 ÷ 15 = 3 instead of 15 ÷ 5 = 3

Springboard to Learning Discuss with students that the dividend is the total number you start with, so it makes sense that it should be the greatest number and come first in a division fact. Then have students set up a division equation with boxes, using a longer box to represent the dividend.

□ ÷ □ = □

Use the checked exercises for **Quick Check**.

RtI Quick Check ✔

IF	a student misses the checked exercises
THEN	**Differentiate Instruction** with RtI Tier 1 Lesson 47

Go Deeper

The strip diagram is a way that helps students see if they are finding the number of equal groups or the number in each group.

For Problems 2–3, ask:

- **Did you find the number of groups or the number in each group?** For Problem 2, the number in each group. For Problem 3, the number of groups.

- **Write a division equation. Then write a story problem that goes with it. Use a strip diagram to show your problem.**

A problem could be: Shari has 40 stickers. She shares them equally among 5 people. How many stickers does each person get?

Problem Solving

H.O.T. Problems

Problem 4 requires more than one step to solve since the dogs are different sizes and receive a different number of treats each day.

Problem 5 requires finding the difference between two quotients.

Math on the Spot Video Tutor

Through the *Math on the Spot Video Tutor*, students will be guided through an interactive solving of this type of H.O.T. problem. Use this video to also help students solve the H.O.T. problem in the Interactive Student Edition. With these videos and the H.O.T. problems, students will build skills needed in the TEXAS assessment.
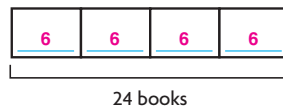
GO DIGITAL **Math on the Spot** videos are in the Interactive Student Edition and at *thinkcentral.com*.

Name _____

Complete the strip diagram to solve. Then write a division equation for the strip diagram.

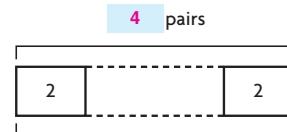✓ **2.** There are 24 books in 4 equal stacks. How many books are in each stack?

6	6	6	6

24 books

6 books; 24 ÷ 4 = 6

✓ **3.** There are 8 matching socks. How many pairs of socks can you make?

__4__ pairs

2	- - - - -	2

8 socks

4 pairs; 8 ÷ 2 = 4

Problem Solving (Real World)

Use the table for 4–5.

4. **H.O.T.** **Multi-Step** Kevin bought a box of Puppy Chips for his dogs. If he gives his small dog 2 treats each day and his big dog 4 treats each day, for how many days will one box of treats last?

7 days

Dog Treats	
Type	**Number in Box**
Chew Sticks	14
Chewies	25
Dog Bites	30
Puppy Chips	42

5. **H.O.T.** **Multi-Step** Pat bought one box of Chew Sticks to share equally between his 2 dogs. Mia bought one box of Chewies to share equally among her 5 dogs. How many more treats will each of Pat's dogs get than each of Mia's dogs? **Explain**.

2 more treats; Possible explanation: 14 ÷ 2 = 7, so each of Pat's dogs will get 7 treats. 25 ÷ 5 = 5, so each of Mia's dogs will get 5 treats. 7 − 5 = 2, so Pat's dogs will each get 2 more treats than Mia's dogs.

Module 10 • Lesson 3   321

Differentiated Instruction

RtI RtI Tier 1 Lesson 47

Name _____

LESSON 47 **Algebra • Division Models**
OBJECTIVE Model division by using equal groups and strip diagrams.
3.4.H, 3.4.K, 3.5.B

Use counters to find 15 ÷ 5.

Step 1 Use 15 counters. Draw 5 circles to show the number of equal groups.

Step 2 Place 1 counter at a time in each circle.

Step 3 Continue until you have placed all 15 counters.

Step 4 Count the number of counters in each circle.

There are 3 counters in each of the 5 groups.

You can use a strip diagram to show how the parts of a problem are related.
- There are 15 counters.
- There are 5 equal groups.
- There are 3 counters in each group.

3	3	3	3	3

15 counters

Write a division equation for the diagram.
15 ÷ 5 = 3

Write a division equation for the picture.

1. **12 ÷ 4 = 3 or**
   12 ÷ 3 = 4

2. **14 ÷ 2 = 7 or**
   14 ÷ 7 = 2

3. **24 ÷ 3 = 8 or**
   24 ÷ 8 = 3

TEKS Number and Operations 93

Enrich 47

Name _____ Enrich 47

Speedy Math

Solve each problem. For each exercise, the quotient has a matching letter. Place the letter above the exercise number to find the answer to the question.

1. 20 ÷ 5 = **4**
2. 42 ÷ 7 = **6**
3. 25 ÷ 5 = **5**
4. 45 ÷ 9 = **5**
5. 36 ÷ 4 = **9**
6. 12 ÷ 6 = **2**
7. 48 ÷ 8 = **6**

What is the fastest animal on land?

KEY	A	B	C	E	H	I	R	T
	2	3	4	5	6	7	8	9

C **H** **E** **E** **T** **A** **H**
1. 2. 3. 4. 5. 6. 7.

8. **Stretch Your Thinking** Make up your own division exercises and puzzle to answer the question "What animal really likes carrots?" The answer is a "rabbit."

Check students' work.

Enrich E47

Daily Assessment Task

**Fill in the bubble for the correct answer choice.
You may use models or strategies to solve.**

6. **Multi-Step** A day on Earth is 24 hours long. A day on the dwarf planet Eris is 8 hours long. How many Eris days are equal to 2 Earth days?

   (A) 16   (C) 4

   ● 6   (D) 40

7. Jaclyn uses 21 cups of flour to make bread. Each loaf of bread takes 3 cups of flour. How many loaves of bread is Jaclyn making?

   (A) 8   (C) 24

   (B) 18   ● 7

8. **Multi-Step** Ryan has a package of striped mini-kites that he divides equally between 2 friends. Kara has a box of rainbow mini-kites that she divides equally among 4 friends. How many more mini-kites does each of Ryan's friends get than each of Kara's friends?

Mini-Kites	
Color	Number in Package
Solid	8
Striped	10
Rainbow	16

   ● 1   (C) 5

   (B) 9   (D) 4

TEXAS Test Prep

9. **Use a Diagram** Ed buys 5 bags of treats. He buys 15 treats in all. How many treats are in each bag?
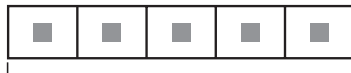
▪	▪	▪	▪	▪

   15 treats

   (A) 5   ● 3   (C) 4   (D) 2

Daily Assessment Task RtI

Can students use strip diagrams to solve division problems?

IF	THEN
NO	• **Soar to Success Math** Warm-Up 13.23
YES	• **Enrich** 47 • **Homework and Practice** Lesson 10.3

⭐ TEXAS Test Prep Coach

Test Prep Coach helps teachers to identify common errors that students can make.

In the Test Prep exercise, if students selected:

A They used the number of groups as the number in each group.

C They miscounted 1 extra treat in each bag.

D They miscounted 1 less treat in each bag.

? Essential Question   **Write Math**

How can you use strip diagrams to solve division problems? Possible answer: I can draw a whole separated into equal groups. Then I can find the number in each group.

Grab-and-Go! Ready-Made Independent Activities

Differentiated Centers Kit

Literature
Corey's Cookie Caper
Students read about how Corey and Carly divide cookies equally among friends and family.

Activities
Comparing 2 and 5
Students complete orange Activity Card 9 by modeling and comparing division facts for 2 and 5.

Homework and Practice

Name _____

10.3 Division Models
ALGEBRA

Complete the strip diagram to solve. Then write a division equation for the strip diagram.

1. Alice has 25 dimes in 5 equal stacks. How many dimes are in each stack?

5	5	5	5	5

25 dimes

5 dimes; 25 ÷ 5 = 5

2. Toby has 12 action figures in sets of 3. How many sets does Toby have?

4	4	4

12 action figures

4 sets; 12 ÷ 3 = 4

Problem Solving *Real World*

Use the table for 3–6.

3. If a gardener plants the rose bushes into 7 equal rows, how many bushes are in each row?

5 rose bushes

4. If Mia puts the box plants into 3 equal rows, how many plants will be in each row?

7 box plants

Plants at the Nursery	
Plant	**Number in all**
Rose bush	35
Azalea	15
Box plant	21
Lilac bush	25

5. Lawrence arranges the azalea and box plants into 6 equal rows. How many plants are in each row?

6 plants

6. Mrs. Kimura wants to put an equal number of azalea plants and lilac bushes into 5 equal rows. How many plants will be in each row?

8 plants in each row

Lesson Check **TEXAS Test Prep**

Fill in the bubble completely to show your answer.

7. Ethan has 24 baseball cards that he divides among himself and 3 friends. How many cards does each person get?
- ● 6
- Ⓑ 8
- Ⓒ 21
- Ⓓ 27

8. Beth sews an equal number of buttons onto 6 puppets. If she has 42 buttons, how many buttons does each puppet get?
- Ⓐ 9
- Ⓑ 6
- ● 7
- Ⓓ 8

9. Susi buys 4 boxes of granola bars. She buys 20 bars in all. How many granola bars are in each box?
- Ⓐ 16
- ● 5
- Ⓒ 4
- Ⓓ 24

10. A group of 35 scouts go on a camping trip. If the scouts sleep in tents in groups of 5, how many tents will they need?
- Ⓐ 8
- ● 7
- Ⓒ 30
- Ⓓ 9

11. Multi-Step Ms. McCall divides 24 crayons among her 4 students. Then, she divides 28 markers among her 4 students. How many more markers will each of the students get than crayons?
- Ⓐ 4
- Ⓑ 2
- ● 1
- Ⓓ 10

12. Multi-Step There are 27 plums divided equally in 3 bowls and 35 apricots divided equally into 7 bowls. How many more plums than apricots are there in one bowl of each?
- Ⓐ 12
- Ⓑ 3
- Ⓒ 5
- ● 4

Homework and Practice

Use the Homework and Practice pages to provide students with more practice on the concepts and skills of this lesson.