10.5 Model with Arrays
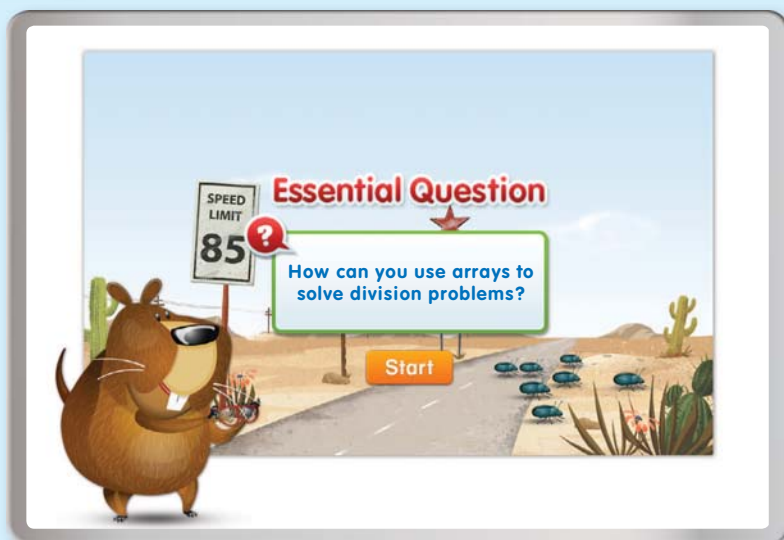
? Essential Question How can you use arrays to solve division problems?

Lesson Opener

Making Connections

Invite students to tell you what they know about division.

How have you divided numbers? (By making equal groups) **How can you model division?** (By using models or diagrams, or by acting out the division) **What questions can you answer with division?** (How many groups, or how many in a group)

Using the Digital Lesson

You may wish to give students extra practice with dividing into groups using counters or base-ten blocks, and then transferring their models onto drawings and diagrams.

Learning Task

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

- **What is Doc watching?** (Beetles crossing the road)
- **How many beetles are there in total?** (28)
- **How many beetles are in each group?** (7)
- **What does Doc want to know?** (How many groups of 7 will cross)
- **What operation will Doc use to find the answer?** (Division)

Literacy and Mathematics

Choose one or more of the following activities.

- Ask students how Doc knows to use division to answer the question. Ask what prompts Doc to ask how many groups will cross the road (Doc notices the beetles are crossing in groups of 7).

- Have students work with partners to create a dialogue from the scenario and problem, perhaps with one student acting out Doc and the other asking Doc questions about what is happening and what Doc wants to find out.

Texas Essential Knowledge and Skills

TEKS Number and Operations—3.4.H
Determine the number of objects in each group when a set of objects is partitioned into equal shares or a set of objects is shared equally

3.4.K Solve one-step and two-step problems involving division within 100 using strategies based on objects; pictorial models, including arrays, area models, and equal groups

TEKS Algebraic Reasoning—3.5.B
Represent and solve one- and two-step division problems within 100 using arrays and equations

MATHEMATICAL PROCESSES
3.1.C Select tools, technology, and techniques
3.1.E Create and use representations to organize, record, and communicate mathematical ideas

Are You Ready?

Access Prior Knowledge

Use the *Are You Ready?* 10.5 in the *Assessment Guide* to assess students' understanding of the prerequisite skills for this lesson.

Vocabulary

Multimedia *e*Glossary at *thinkcentral.com*

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

Investigate 🖐 Hands On

Work together with students to complete the steps of the activity. Be sure students make equal rows of 5.

Make Connections 🖐 Hands On

Help students connect the array to a division equation.

- **Why is 30 the dividend?** because that is the number of tiles being divided, or separated into equal groups

- **What represents the quotient in this array?** The number of rows is the quotient.

- **To divide, you have used drawing equal groups or circling equal groups, repeated subtraction, counting back on a number line, and arrays. Which method do you think is the easiest? Explain.**

Have several students explain their choices. Students' explanations may include the following:

- Drawing or circling the groups—it's easier when you can see the problem in a picture.

- Repeated subtraction—it's faster to keep subtracting than to make a drawing.

- Number line—it's easy to count the jumps to get the quotient.

- Array—it's easy to put the tiles in equal rows and then count the number of rows.

Name _____

10.5 Model with Arrays

? Essential Question How can you use arrays to solve division problems?
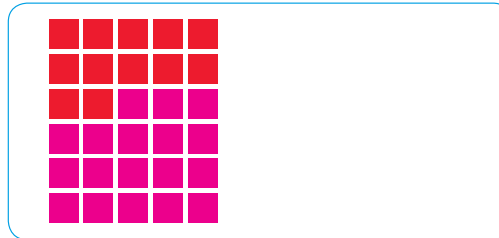
Investigate 🖐 Hands On

Materials ■ square tiles

You can use arrays to model division and find equal groups.

A. Count out 30 tiles. Make an array to find how many rows of 5 are in 30.

B. Make a row of 5 tiles.

C. Continue to make as many rows of 5 tiles as you can.

How many rows of 5 did you make? **6 rows**

Make Connections 🖐 Hands On
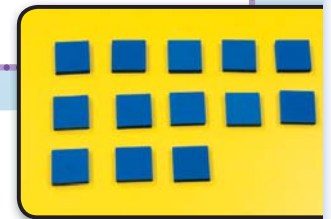
You can write a division equation to show how many rows of 5 are in 30. Show the array you made in Investigate by completing the drawing below.

Math Idea
You can divide to find the number of equal rows or to find the number in each row.

$30 \div 5 = \blacksquare$

There are **6** rows of 5 tiles in 30.

So, $30 \div 5 =$ **6**.

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Module 10 **331**

🧑‍🤝‍🧑 Differentiated Instruction

ELL Language Support ⏱ Spatial Small Group

ELPS 2.D.1, 2.I.3, 3.F.2

Strategy: Identify Relationships

Materials: square tiles

- Students can model division using a real world array.

- Have students count the total number of desks in the classroom. Tell them you want to divide the desks into 5, 6, or 7 equal rows (depending on the total number of desks).

- Have students use tiles to show how to rearrange the desks to divide them into the given number of rows.

- **How many desks are in each row? What division equation represents the model?**

Use square tiles to make an array. Solve. Check students' arrays.

1. How many rows of 3 are in 18?

   6 rows

✅ 2. How many rows of 6 are in 12?

   2 rows

3. How many rows of 7 are in 21?

   3 rows

4. How many rows of 8 are in 32?

   4 rows

Make an array. Then write a division equation. Check students' arrays.

Possible equations are given.

5. 25 tiles in 5 rows

   25 ÷ 5 = 5

✅ 6. 14 tiles in 2 rows

   14 ÷ 2 = 7

7. 28 tiles in 4 rows

   28 ÷ 4 = 7

8. 27 tiles in 9 rows

   27 ÷ 9 = 3

9. How many rows of 3 are in 15?

   15 ÷ 3 = 5

10. How many rows of 8 are in 24?

   24 ÷ 8 = 3

Possible explanation: you count the number of rows when you know the number in each row. You count the number of tiles in each row when you know the number of rows.
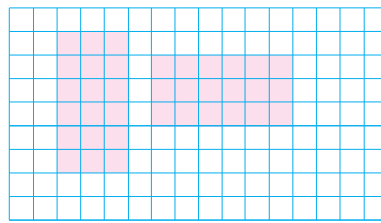
Math Talk 🖊 Mathematical Processes

Explain when you count the number of rows to find the answer and when you count the number of tiles in each row to find the answer.

11. **Write Math** ▶ Show two ways you could make an array with tiles for 18 ÷ 6. Shade squares on the grid to record the arrays.
    Check students' drawings.

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Share and Show

Exercises 5–8 are examples of partitive division. Before students complete the page, ask a volunteer to explain how he or she will find the answer to Exercise 5. Separate 25 tiles into 5 groups by placing one tile in each of 5 rows. Place one tile at a time in each row until all tiles are used. Count the number of tiles in each row to find the quotient.

Remind students to write the division equations their arrays represent.

Use the checked exercises for **Quick Check**. Students should show their answers for the Quick Check on the MathBoard.

Math Talk 🖊 Mathematical Processes

Use Math Talk to focus on students' understanding of using arrays to model division.

RtI **Quick Check** ✅

IF	a student misses the checked exercises
THEN	**Differentiate Instruction** with RtI Tier 1 Lesson 49

Go Deeper

After students complete Problem 11, ask them to explain how drawing a model on grid paper to solve a division problem is like making an array and how it is different. Possible explanation: the grid and the array both show rows and columns. In the grid, there is no space between the rows and columns. Instead of placing tiles in an array, you color in squares on the grid paper.

Enrich 🕐 | **Visual / Kinesthetic** **Individual**

Materials: 1-Centimeter Grid Paper (see eTeacher Resources)

- Write the following numbers on the board.

18	20	24	30

- Have students choose one of the numbers.
- They should draw as many arrays as possible to represent that number on the grid paper. Each array should have from 1 to 10 rows and columns.
- Then have students write a corresponding division equation for each array.

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

Problem Solving

🌶️ H.O.T. Problems

Problem 13 requires students to generalize from the 6 by 5 array on page 331 to find a new array with 8 tiles in each row.

Problem 15 is a multi-step problem. Students divide to find the number of customers who bought plants on each of the two days, and then add to find the total number of customers.
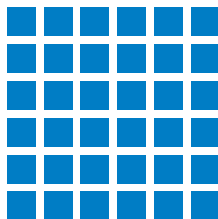
For Problem 16, students must use the given clue to solve the problem. Students may use tiles or draw an array, as needed, to solve the problem.

⚠️ **COMMON ERRORS**

Error Students may make an incorrect array for a division problem.

Example How many rows of 3 are in 18?

Springboard to Learning Review with students that if the problem asks for rows of 3, you put that number in each row and count the number of rows to get the answer. If the problem gives the number of rows, you start by making that many rows with one tile in each row. You keep adding one tile to each row until all the tiles are used. Then you count the number of tiles in each row.

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 _____

Problem Solving (Real World)

12. Thomas has 28 tomato seedlings to plant in his garden. He wants to plant 7 seedlings in each row. How many rows of tomato seedlings will Thomas plant?

Write Math ▶ Show Your Work

___4 rows of seedlings___

13. 🌶️ H.O.T. **Use Math Language**
Tell how to use an array to find how many rows of 8 are in 40.

Possible answer: make rows of 8 until all 40 tiles are used. There are 5 rows of 8 in 40.

14. Faith plants 36 flowers in 6 equal rows. How many flowers are in each row?

___6 flowers___

15. 🌶️ H.O.T. **Multi-Step** There were 20 plants sold at a store on Saturday and 30 plants sold at the store on Sunday. Customers bought 5 plants each. How many customers in all bought the plants?

___10 customers___

16. 🌶️ H.O.T. **Multi-Step** Lionel made an array with 24 tiles. The number of rows is 5 more than the number of tiles in each row. How many rows are in Lionel's array?

___8 rows; Check student's drawings.___

Module 10 • Lesson 5 **333**

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Differentiated Instruction

RtI Tier I Lesson 49

Name _____

LESSON 49 **Model with Arrays**
OBJECTIVE Model division by using arrays.

3.4.H, 3.4.K, 3.5.B

You can use arrays to model division.
How many rows of 6 tiles each can you make with 24 tiles?

Use square tiles to make an array. Solve.

Step 1 Count out 24 tiles. Make an array to find how many rows of 6 are in 24.

Step 2 Make as many rows of 6 as you can.

You can make 4 rows of 6.
There are 4 rows of 6 tiles in 24.
So, $24 \div 6 = 4$.

Use square tiles to make an array. Solve. *Check students' arrays.*

1. How many rows of 7 are in 28?
___4 rows___

2. How many rows of 5 are in 15?
___3 rows___

Make an array. Then write a division equation. *Check students' arrays.*

3. 18 tiles in 3 rows
$18 \div 3 = 6$

4. 20 tiles in 4 rows
$20 \div 4 = 5$

5. 14 tiles in 2 rows
$14 \div 2 = 7$

6. 36 tiles in 4 rows
$36 \div 4 = 9$

TEKS Number and Operations 97

Enrich 49

Name _____ Enrich 49

Array Puzzles

Use the clues to help solve the puzzle. You can use tiles or draw the array on a separate sheet of paper.

1. I am an array made with 24 tiles. I have 8 tiles in each row. How many rows do I have?
___3 rows___

2. I am an array with 4 equal rows. I have 16 tiles in all. How many tiles are in each of my rows?
___4 tiles___

3. I am a square-shaped array. I have 7 rows. How many tiles do I have in all? (Hint: A square has 4 sides of equal length.)
___49 tiles___

4. I am an array made with 24 tiles. My number of rows is 2 more than the number of tiles in each of my rows. How many rows do I have?
___6 rows___

5. I am an array with 7 tiles in each row. My number of rows is 4 less than the number of tiles in each of my rows. How many tiles am I made with in all?
___21 tiles___

6. I am an array made with 40 tiles. I have an odd number of rows and an even number of tiles in each of my rows. The number of my rows plus the number of tiles in each of my rows equals 13. How many rows do I have?
___5 rows___

7. Write Math Write your own array puzzle. Include the answer.
Possible answer: I am a square-shaped array. I have 5 rows. How many tiles do I have in all? 25 tiles

Enrich E49

Daily Assessment Task

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

17. **Multi-Step** Mrs. Weston is baking 24 oatmeal raisin cookies. There will be 4 rows of cookies on the cookie tray. She has already put one row of cookies on the tray. How many more cookies does she have left to put on the tray?

Ⓐ 6   ● 18

Ⓑ 20   Ⓓ 3

18. **Representations** Which division equation is shown by the array?

● $24 \div 3 = 8$ Ⓒ $24 \div 2 = 12$

Ⓑ $24 \div 4 = 6$ Ⓓ $21 \div 3 = 7$

19. **Multi-Step** Hajune finds 9 black rocks one week and 9 black rocks the next week. He wants to keep the rocks in a box with 3 rows. How many black rocks can he put in each row?

Ⓐ 18   Ⓒ 12

● 6   Ⓓ 3

⭐ **TEXAS Test Prep**

20. Sally makes an array using 36 coins. If she puts 4 coins in each row, how many rows does she make?

Ⓐ 40   Ⓒ 8

Ⓑ 32   ● 9

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Daily Assessment Task **RtI**

Can students use arrays to solve division problems?

IF	THEN
NO	• **Soar to Success Math** Warm-Up 13.17
YES	• **Enrich** 49 • **Homework and Practice** Lesson 10.5

⭐ **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 subtracted 4 from 36.

B They added 36 and 4.

C They incorrectly divided by 6.

? **Essential Question**   **Write Math**

How can you use arrays to solve division problems?
Possible answer: I can find how many equal groups by placing that number of tiles in each row of an array until all tiles are used. The number of rows is the answer. I can divide the tiles into a number of rows, placing 1 tile at a time in each row, until all the tiles are used. The number of tiles in each row is the answer.

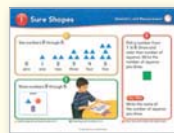# Grab-and-Go!™ **Ready-Made Independent Activities**

Differentiated Centers Kit

Literature
The Garden Fence
Students read the book and use division facts to find how much wood they need to build a fence.

Activities
Missing Sides
Students complete blue Activity Card 19 by using division to find the length of a missing side.

Homework and Practice

Name _____

10.5 Model with Arrays

Make an array. Then write a division equation. Check students' arrays.

1. 21 tiles in 3 rows

$$21 \div 3 = 7$$

2. 36 tiles in 6 rows

$$36 \div 6 = 6$$

3. 16 tiles in 8 rows

$$16 \div 8 = 2$$

4. 18 tiles in 3 rows

$$18 \div 3 = 6$$

5. How many rows of 4 are in 32?

$$32 \div 4 = 8$$

6. How many rows of 4 are in 16?

$$16 \div 4 = 4$$

Problem Solving Real World

7. Hannah has a collection of 27 seashells. She wants to put 9 shells on each shelf. How many shelves does Hannah need?

3 shelves

8. Dexter buys 18 fish. He wants to put an equal number of fish into 3 fishbowls. How many fish will he put in each fishbowl?

6 fish

9. Quentin is making a tile design with 35 tiles. He wants to put the tiles in rows. How can he set up the tiles so there are an equal number of tiles in each row?

He can make rows of 7 tiles until there are 5 rows of tiles. Or he can make 5 rows of 7 tiles.

Module 10 • Lesson 5   335

Lesson Check

TEXAS Test Prep
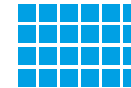
Fill in the bubble completely to show your answer.

10. Marla makes this array.

What division equation can she write?

- Ⓐ $14 \div 3 = 7$
- ● $14 \div 2 = 7$
- Ⓒ $2 \times 7 = 14$
- Ⓓ $7 + 7 = 14$

11. Claude makes this array.

What division equation can he write?

- ● $24 \div 4 = 6$
- Ⓑ $24 \div 3 = 8$
- Ⓒ $4 \times 6 = 24$
- Ⓓ $6 \times 4 = 20$

12. Sondra runs for 32 minutes. If she runs 4 miles, how many minutes does it take her to run one mile?

- Ⓐ 6 minutes
- Ⓑ 7 minutes
- ● 8 minutes
- Ⓓ 28 minutes

13. There are 25 students on the playground. The students are in teams of 5. How many teams are on the playground?

- Ⓐ 6
- ● 5
- Ⓒ 4
- Ⓓ 7

14. **Multi-Step** Jennifer collects 9 animal cards and 21 nature cards. She wants to arrange them on a bulletin board in 6 rows. How many cards will be in each row?

- ● 5
- Ⓑ 2
- Ⓒ 3
- Ⓓ 7

15. **Multi-Step** Zach is planting a garden of 27 tomato plants. He puts the plants into rows of 9. If he has already planted one row, how many more rows does he need to plant?

- Ⓐ 3
- ● 2
- Ⓒ 18
- Ⓓ 4

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Homework and Practice

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

Name _____

✓ Module 10 Assessment

Vocabulary

Choose the best term from the box to complete the sentence.

1. The __dividend__ is the number that is to be divided in a division problem. (p. 320)

2. You __divide__ when you separate into equal groups. (p. 313)

Concepts and Skills

Use counters or draw a quick picture on your MathBoard. Make or circle equal groups. Complete the table. ↳ TEKS 3.4.H, 3.4.K

	Counters	Number of Equal Groups	Number in Each Group
3.	6	2	3
4.	30	6	5
5.	28	7	4

Make an array. Then write a division equation. ↳ TEKS 3.4.H, 3.4.K, 3.5.B

Check students' arrays.
Possible equations are given.

6. 32 tiles in 4 rows

   $32 \div 4 = 8$

7. 28 tiles in 7 rows

   $28 \div 7 = 4$

Write a division equation. ↳ TEKS 3.4.H, 3.4.K

8.
$$
\begin{array}{cccc}
36 & 27 & 18 & 9 \\
-\ 9 & -\ 9 & -\ 9 & -\ 9 \\
\hline
27 & 18 & 9 & 0
\end{array}
$$

$36 \div 9 = 4$

9.

$21 \div 3 = 7$

Module 10   337

✓ Data-Driven Decision Making   RtI

Based on the results of the Module 10 Assessment, use the following resources to strengthen individual or whole class instruction.

Item	Lesson	TEKS*	Common Error	Intervene With RtI* Tier 1 Lessons	Soar to Success Math
3–5	10.2	3.4.H, 3.4.K	May confuse the number of equal groups and the number in each group	46	13.22
6–7	10.5	3.4.H, 3.4.K, 3.5.B	May confuse the divisor and the quotient	49	13.17
8–9	10.4	3.4.H, 3.4.K, 3.5.B	May write the division equation incorrectly	48	13.10

*TEKS—Texas Essential Knowledge and Skills; **RtI**—Response to Intervention

Formative Assessment

Use the Module Assessment to assess students' learning and progress. The formative assessment provides the opportunity to adjust teaching methods for individual or whole class instruction.

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

10. Desiree has 20 stickers. She gives the same number of stickers to each of 3 friends and 2 of her sisters. Which equation can be used to find the number of stickers each person receives? TEKS 3.4.H, 3.4.K, 3.5.B

  Ⓐ $20 \div 2 = \blacksquare$ Ⓒ $20 - 5 = \blacksquare$

  Ⓑ $20 \times 5 = \blacksquare$ ● $20 \div 5 = \blacksquare$
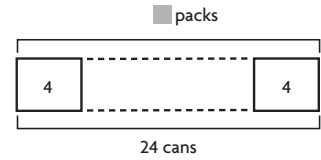
11. Which division equation does the array show? TEKS 3.4.H, 3.4.K, 3.5.B

  ● $40 \div 5 = 8$ Ⓒ $32 \div 4 = 8$

  Ⓑ $8 \div 40 = 5$ Ⓓ $40 \div 4 = 10$
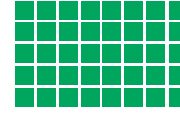
12. Lillian bought 24 cans of cat food. There were 4 cans in each pack. How many packs of cat food did Lillian buy? TEKS 3.4.H, 3.4.K

  Ⓐ 7   Ⓒ 5

  ● 6   Ⓓ 8

■ packs

| 4 | | 4 |

24 cans

13. At a sporting goods store, there are 35 football caps in stacks of 5 caps each. There are 28 baseball caps in stacks of 7 caps each. How many stacks of football and baseball caps are there altogether? TEKS 3.4.H, 3.4.K

Record your answer and fill in the bubbles on the grid. Be sure to use the correct place value.

Depth of Knowledge	
DOK Level	**Items**
1	3–9, 11–12
2	10, 13

✔️ Data-Driven Decision Making 🔺 RtI

Item	Lesson	TEKS*	Common Error	Intervene With RtI* Tier 1 Lessons	Soar to Success Math
10	10.1, 10.4	3.4.H, 3.4.K, 3.5.B	May choose the wrong operation or miss a step of the problem	45, 48	13.10, 13.23
11	10.5	3.4.H, 3.4.K, 3.5.B	May miscount the number of squares in each row	49	13.17
12	10.3	3.4.H, 3.4.K, 3.5.B	May use the strip diagram incorrectly	47	13.23
13	10.2	3.4.H, 3.4.K	May miscount the number of groups formed or may miss a step of the problem	46	13.22

*TEKS—Texas Essential Knowledge and Skills; **RtI**—Response to Intervention