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

**TEKS** 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 eGlossary at thinkcentral.com

Resources

- Interactive Student Edition provides students with an interactive learning environment!
- eTeacher Edition
- Math on the Spot Video Tutor
- iTools Virtual Manipulatives
- Soar to Success Math Online Intervention

Lesson 10.5 331A
Investigate

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

Make Connections

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.

Make Connections

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.

\[30 \div 5 = \boxed{6}\]

There are 6 rows of 5 tiles in 30.

So, \(30 \div 5 = 6\).

Differentiated Instruction

**ELL Language Support**

- **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?
Share and Show

Use square tiles to make an array. Solve.

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.

5. 25 tiles in 5 rows
   \( \frac{25}{5} = 5 \)

6. 14 tiles in 2 rows
   \( \frac{14}{2} = 7 \)

7. 28 tiles in 4 rows
   \( \frac{28}{4} = 7 \)

8. 27 tiles in 9 rows
   \( \frac{27}{9} = 3 \)

9. How many rows of 3 are in 15?
   5 rows

10. How many rows of 8 are in 24?
    \( \frac{24}{8} = 3 \)

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.

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.

Math Talk

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

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 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.
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?

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</table>

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 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.

Math on the Spot videos are in the Interactive Student Edition and at thinkcentral.com.
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?

A) 6  B) 20  C) 3

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

A) 24 ÷ 3 = 8  B) 24 ÷ 4 = 6  C) 21 ÷ 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?

A) 18  B) 6  C) 12  D) 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?

A) 40  B) 32  C) 8  D) 9

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

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.

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.

Grab-and-Go! Ready-Made Independent Activities

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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

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.

10. Marla makes this array.

11. Claude makes this array.

12. Sondra runs for 32 minutes. If she runs 4 miles, how many minutes does it take her to run one mile?
   \[A\] 6 minutes
   \[B\] 7 minutes
   \[C\] 8 minutes
   \[D\] 28 minutes

13. There are 25 students on the playground. The students are in teams of 5. How many teams are on the playground?
   \[A\] 6
   \[B\] 5
   \[C\] 4
   \[D\] 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?
   \[A\] 5
   \[B\] 2
   \[C\] 3
   \[D\] 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?
   \[A\] 3
   \[B\] 2
   \[C\] 18
   \[D\] 4

Lesson Check

Fill in the bubble completely to show your answer.

10. What division equation can she write?
   \[A\] \[14 \div 3 = 7\]
   \[B\] \[14 \div 2 = 7\]
   \[C\] \[2 \times 7 = 14\]
   \[D\] \[7 + 7 = 14\]

12. What division equation can he write?
   \[A\] \[24 \div 4 = 6\]
   \[B\] \[24 \div 3 = 8\]
   \[C\] \[4 \times 6 = 24\]
   \[D\] \[6 \times 4 = 20\]

Homework and Practice

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

<table>
<thead>
<tr>
<th>Counters</th>
<th>Number of Equal Groups</th>
<th>Number in Each Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. 6</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4. 30</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>5. 28</td>
<td>7</td>
<td>4</td>
</tr>
</tbody>
</table>

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

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. \[
\begin{array}{c}
9 \\
27 \\
18 \\
9 \\
0
\end{array}
\]

\[36 \div 9 = 4\]

9. \[
\begin{array}{c}
3 \\
6 \\
9 \\
12 \\
15 \\
18 \\
21
\end{array}
\]

\[21 \div 3 = 7\]

**Data-Driven Decision Making**

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

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

*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?  \( \text{TEKS 3.4.H, 3.4.K, 3.5.B} \)

A. \( 20 \div 2 = \)  
B. \( 20 \div 5 = \)  
C. \( 20 - 5 = \)  
D. \( 20 \div 5 = \)


A. \( 40 \div 5 = 8 \)  
B. \( 8 \div 40 = 5 \)  
C. \( 32 \div 4 = 8 \)  
D. \( 40 \div 4 = 10 \)

12. Lillian bought 24 cans of cat food. There were
4 cans in each pack. How many packs of cat
food did Lillian buy?  \( \text{TEKS 3.4.H, 3.4.K} \)

A. 7  
B. 6  
C. 5  
D. 8

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?  \( \text{TEKS 3.4.H, 3.4.K} \)

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

Depth of Knowledge

<table>
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<tr>
<th>DOK Level</th>
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<tr>
<td>1</td>
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<td>10, 13</td>
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Data-Driven Decision Making

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<td>May choose the wrong operation or miss a step of the problem</td>
<td>45, 48</td>
<td>13.10, 13.23</td>
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<td>May miscount the number of squares in each row</td>
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<td>May miscount the number of groups formed or may miss a step of the problem</td>
<td>46</td>
<td>13.22</td>
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*TEKS—Texas Essential Knowledge and Skills; RtI—Response to Intervention