Fact Arrays That Prove Division

Teacher		**Class**	Grade 3
Subject	Math	**Topic**	Multiplication facts
Date		**Room**	
Lesson length	60 minutes	**Country**	United States

Students learn to show facts as arrays and use them to divide. They build, draw, and quiz facts within 100.

Curriculum links

- 3.RA.A.4 Use multiplication and division within 100 to solve problems [1]
- 3.RA.B Understand properties of multiplication and the relationship between multiplication and division [1]
- develop understanding of multiplication and division and strategies for multiplication and division within 100 [2]

Learning objectives

- Students will multiply within 100 using arrays and equal groups.
- Students will use a multiplication fact to find related division facts.
- Students will recall products of two one-digit numbers from memory.

Success criteria

- I can show a fact like 4 x 6 with rows and columns.
- I can use 8 x 5 = 40 to find 40 ÷ 5 = 8.
- I can recall products of two one-digit numbers quickly.

What students already know

Ask class to skip-count by 2s, 5s, 10s and to show 3 groups of 5 fingers. Listen for correct next numbers and equal groups.

Key words

factors	the two small numbers joined by x to make a new number [5]
product	the answer you get after multiplying [5]
array	neat rows of dots lined up in columns [5]
division	splitting a total into equal-sized groups to share [5]

Materials

- Slides 1-11 on projector
- Video clip 1 ready to play
- counters
- grid paper
- pencils
- printed 10 by 10 grids
- Worksheet Task B copies

Before the lesson

- Print grid paper and Worksheet Task B, one per pair
- Test Slide 5 Video clip 1 (0:00-4:03) picture and sound
- Put counters in trays and clear desks for building rectangles

Lesson outline

0–10 min **Starter** 10 min · Whole class

Activate skip-counting and equal groups to get ready for arrays.

YOU DO

1. Show Slide 1: Fast Facts to 100 and read title: Use multiplication to divide in a flash!
2. Show Slide 2 objectives and read them in student words.
3. Say hook and lead skip-count by 2s, 5s, and 10s with claps.
4. Ask class to show 3 groups of 5 with fingers and say the total.

STUDENTS DO

1. Skip-count aloud together by 2s, 5s, and 10s to 100.
2. Show 3 groups of 5 and say 3 x 5 = 15.
3. Turn to a partner and predict how a rectangle proves a fact.

Say: Can you build a rectangle that proves you are right? Today we will use groups and arrays to multiply within 100. You will use one multiply fact to find the divide facts.

Ask: What is 5 x 2 if we skip-count? (10, by saying 2, 4, 6, 8, 10 or 5, 10 [10]) · Why does skip-counting help us multiply by 10? (Students also skip count to multiply by 10 [1])

Check understanding: Thumbs up if you can skip-count by 5s to 50. If many are unsure, chant again slowly pointing to a number line.

Support: Let students follow hops on a printed fact table to 10 to land on each count. **Stretch:** Ask students to skip-count backward from 50 by 5s to preview division.

Use: Slides 1-2

10–22 min **Teaching** 12 min · Whole class

Teach factors, product, and array and link addition to multiplication and division.

YOU DO

1. Show Slide 3 cards and read: Factors are the numbers we multiply. Product is the answer after multiplying. An array is neat rows of dots.
2. Show Slide 4 chain and build 4 bags with 3 marbles each with counters.
3. Model repeated addition, then multiplication, then division on the board.
4. Students repeat the three numbers and point to rows, columns, and total.

STUDENTS DO

1. Say meanings with teacher and point to array rows and total.
2. Copy 4 x 3 = 12 and 12 ÷ 4 = 3 on mini boards.
3. Tell a partner which numbers are sides and which is total.

Say: Factors are the sides of our rectangle. Product is the total inside. One number tells how many squares are on one side, and the other number tells how many are on the other side [5]. We can divide back to split the total.

Worked example: 4 bags with 3 marbles each: Add again and again: 3 + 3 + 3 + 3 = 12. Multiply fast: 4 x 3 = 12. Divide back: 12 ÷ 4 = 3. Multiplication can be thought of as repeated addition [4].

Ask: In 4 x 3 = 12, which are the sides and which is the total? (4 and 3 are the numbers we multiply, 12 is the answer after multiplying [5]) · How does the same picture show division? (The related multiplication and division equations can be represented by the same array [1])

Check understanding: Hold up boards showing product of 4 x 3. Reteach with dots if any show 7 or 12 ÷ 3 confusion.

Support: Build only arrays within 30 on a printed grid and count small squares to find the product [5]. **Stretch:** Ask students to draw the turnaround array for 3 x 4 and compare totals.

Use: Slides 3-4

22–35 min **We do** 13 min · Whole class

Model using one known fact to find division facts and remember facts faster.

YOU DO

1. Show Slide 5: Fact family power! Play Video clip 1 (0:00-4:03): Watch how 8 x 5 = 40 is built.
2. Pause for class to say 40 ÷ 5 = 8 and write the family 8 x 5 = 40, 5 x 8 = 40, 40 ÷ 5 = 8, 40 ÷ 8 = 5.
3. Show Slide 6 cards: Flip it, Double 2s, Double 3s and model doubling 2 x 7 to get 4 x 7.
4. Lead choral recall of 4 x 6 and 6 x 4.

STUDENTS DO

1. Watch, listen for 40 ÷ 5 = 8 to match, and say answers with video.
2. Write the four facts for 8, 5, 40 and check with a neighbor.
3. Practice doubling a 2s fact aloud to make a 4s fact.

Say: The opposite of multiplication is division. If you know that 3 x 5 = 15, then you also know that 15 ÷ 3 = 5 and 15 ÷ 5 = 3 [5]. You can double the product of a 2s fact to find a product of 4 and double the product of a 3s fact to find a product of 6 [1].

Worked example: Know 8 x 5 = 40, so 40 ÷ 5 = 8. Flip it: 4 x 6 gives the same as 6 x 4, both equal 24 [5]. Double it: know 2 x 7 = 14, so 4 x 7 = 28 by doubling.

Ask: If 8 x 5 = 40, what two division facts do you know? (40 ÷ 5 = 8 and 40 ÷ 8 = 5, students can use multiplication facts to remember related division facts [1]) · How does knowing 2 x 2 = 4 help with 4 x 2? (Work out 4 x 2 by doubling the first answer [10])

Check understanding: Cold-call four students for one fact each in the 8, 5, 40 family. Replay last 30 seconds if family is incomplete.

Support: Stay with 2s, 5s, and 10s facts that students can skip-count quickly [1]. **Stretch:** Ask if tripling a 2s fact could make a 6s fact and test 2 x 5 to 6 x 5.

Use: Slide 5, Video clip 1 (0:00–4:03), Slide 6

35–52 min **Main activity** 17 min · Pairs

Build arrays in pairs and write matching multiplication and division facts.

YOU DO

1. Show Slide 8: Make an array, like 6 rows of 7 counters. Write its multiply fact and matching divide facts. Mix up and quiz your partner fast.
2. Model 4 rows of 6 counters, draw it, label sides 4 and 6 and total 24.
3. Hand out counters, grid paper, and Worksheet Task B practice questions to build speed with facts and set 12 minutes to build three arrays and answer them.
4. Circulate, ask for missing numbers, and prompt fast recall.

STUDENTS DO

1. In pairs, build arrays with counters, draw on grid paper, and label factors and product.
2. Write two multiplication and two division facts for each array and solve Worksheet Task B: Build speed with these facts.
3. Quiz partner by covering the array and saying facts from memory.

Say: Build a rectangle that proves you are right. One partner builds, the other covers one corner and writes the fact for the two numbers still showing. Then switch and quiz fast from memory.

Worked example: Build 6 rows of 7 counters = 42 dots. Write 6 x 7 = 42, 7 x 6 = 42, 42 ÷ 6 = 7, 42 ÷ 7 = 6. The related multiplication and division equations can be represented by the same array [1].

Ask: You built 4 rows of 6. What facts does it prove? (4 x 6 = 24, 6 x 4 = 24, 24 ÷ 4 = 6, 24 ÷ 6 = 4 [5]) · If you know 5 x 8 = 40, how do you find 40 ÷ 8? (Use the same three numbers, 40 ÷ 8 = 5, students can use a multiplication equation to find division [1])

Check understanding: Collect one array drawing per pair and check four correct facts. Pull small group to rebuild with counters if rows and total are mixed.

Support: Give a printed 10 by 10 grid and color only small arrays within 30, then count squares to find the product. **Stretch:** Build two different arrays with the same product and explain what you notice.

Use: Slide 8, Worksheet Task B

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52–60 min **Plenary** 8 min · Whole class

Prove facts with a word problem and check recall of products and division.

YOU DO

1. Show Slide 10 and read: 6 boxes, 9 cupcakes in each box. How many in all? What 2 division facts prove it?
2. Give 2 minutes think-pair-share, then take answers and draw the array.
3. Show Slide 11 true-or-false statements and vote true or false with fingers.
4. Link back to success lines and set homework.

STUDENTS DO

1. Think, then pair-share the cupcake total and division proofs.
2. Vote true or false and explain using arrays or flip rule.
3. Self-check against success lines with thumbs up or sideways.

Say: Multiplication is used when we need to combine groups of equal sizes [9]. Show the cupcake boxes as an array. Use your multiply fact to prove the divide facts.

Worked example: 6 boxes, 9 in each box: 6 x 9 = 54 cupcakes [9]. Proof: 54 ÷ 6 = 9 and 54 ÷ 9 = 6. True: 8 x 5 = 40, so 40 ÷ 5 = 8 with same three numbers.

Ask: How many cupcakes and how do you know? (54, because 6 x 9 = 54 [9]) · Is 3 x 7 = 7 x 3 true? Why? (True, order does not change the answer, called the commutative property [5])

Check understanding: Exit votes on Slide 11. If many miss the division proof, remodel 6 x 9 array tomorrow before new facts.

Support: Provide sentence frame: __ groups of __ equals __ to describe 3 groups of 5 which equals 15 [5].
Stretch: Ask students to write the missing number in 6 x __ = 42 and explain the known fact used.

Use: Slides 10-11

Common mistakes

Mistake	How to spot it	How to fix it
Thinks 4 x 6 and 6 x 4 give different answers	Writes 24 for one order and another number for the flip	Turn the same array and show 4 x 6 gives the same as 6 x 4, both equal 24 [5]
Mixes up which number is the total in division	Writes 5 ÷ 40 = 8 or 8 ÷ 40 = 5	Cover the product at the top and show the two numbers still showing make the divide fact [1]
Counts array dots by ones and loses track	Slow counting, totals off by 1 or 2 for arrays to 100	Count by rows or skip-count, since developing strategies for multiplication within 100 needs groups [2]

Support

- Use printed 10 by 10 grids and build only arrays within 30 first
- Let students check facts on a fact table, then try from memory

Stretch

- Build two different arrays with the same product and explain the pattern
- Write missing numbers like 6 x __ = 42 and prove with division

For the LSE or teaching assistant

Sit with target pairs in main activity, help lay counters in neat rows, prompt covering one corner to find the missing fact, and keep Worksheet Task B to 4-6 facts.

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Check for understanding

Question	Answer
8 x 5 = 40. What is 40 ÷ 5?	8
Write both orders and product: 4 x 6 = ?	4 x 6 = 24 and 6 x 4 = 24
6 boxes with 9 cupcakes each. Total and one division proof?	54 cupcakes; 54 ÷ 6 = 9 or 54 ÷ 9 = 6

Homework

Complete Worksheet Task F times table grid using facts you now recall.

Sources

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