

Multiplication: Fact Fluency

- Strand:** Number and Number Sense
- Topic:** Increasing fluency by using a variety of efficient strategies to solve multiplication facts.
- Primary SOL:** 4.4 The student will
- a) demonstrate fluency with multiplication facts through 12×12 , and the corresponding division facts.
- Related SOL:** 4.4b

Materials

- Multiplication Fact Cards (attached)
- Score Card (one per player; attached)
- chart paper or large paper
- grid paper (optional)

Vocabulary

decompose, division, factor, partitioning, product, sum

Student/Teacher Actions

1. Reviewing and developing strategies encourages students to use the language of groups and things in a group and also supports increasing fluency with the facts. Throughout the lesson, encourage the students to share strategies they use when finding the product. These strategies are important for the students to explore so they can develop a deeper understanding of what it means to multiply. Some of the strategies students may use to solve the multiplication problems may include recall, commutative property (they do not need to know the term), partial products, using friendly numbers, partitioning or decomposition strategies, repeated addition, and looking at the relationship between the factor and product. By using strategies and flexible thinking, it will enhance the students' ability to reason multiplicatively.
2. Write the fact 6×7 on the board and ask the students to solve the multiplication fact mentally. Instruct the students to find more than one way to solve the problem and to hold their hand with thumbs-up over their heart when they have more than one strategy. Allow the students several minutes to think. Once the students have solved the problem, have a volunteer share the strategy he/she used to solve this problem. Write the strategies on the board for the class to see. Then ask for a volunteer who solved the problem differently. Continue to ask for volunteers. Below are some the strategies that the students may use to solve this multiplication fact.
 - Using related facts to solve the problem 6×7 , such as knowing that 7 groups of 5 is 35, and when you add one more to each group or one more group of 7 it equals 42.

- Using decomposition and partial product to break apart the factor 6 as $3 + 3$. Some students may then say that you have 3 groups of 7 added to 3 more groups of 7; $(3 \times 7) + (3 \times 7) = 42$.
- Some students may break apart the factor 7 as 5 and 2 instead and will solve by finding six groups of five added to six groups of two; $(6 \times 5) + (6 \times 2) = 42$.
- The students may use the commutative property, instead of focusing on 6 groups of 7, they could solve 7 groups of 6.
- Others students may know 7 groups of 7 is 49 and will subtract one group of 7 to equal the product of 42.

Once the various strategies students shared have been recorded, ask, *“Do you see any strategies that are similar?”* Pick a strategy and ask, *“Why does this strategy work?”* *“Which strategies are most efficient or will allow you find the answer in the least amount of time?”* *“Do you think the same strategy is the best to use for every fact?”*

3. Next write multiplication fact 8×9 on the board and ask students to solve mentally. Allow students several minutes to solve this fact. Encourage your students to solve the multiplication fact more than one way. As a class, discuss and share the multiple ways the students used to solve this fact. Once the students have shared, prompt them to discuss how they could use the multiplication fact 8×10 to solve 8×9 , if this strategy was not shared by your students. Pose questions similar to those above. Connect this fact to division, and ask, *“What if I had 72 cookies and I was sharing them with nine friends. How many cookies would each of my friends receive?”*
4. Next, break the students into small groups. Give the students the multiplication fact 11×12 to solve. Tell the students that they are to work together to come up with several different strategies to solve this fact. On their chart paper, they are to model each strategy to justify their answer. Some strategies and models may include:
 - Using related facts and compensation to solve the problems such as 10×12 and add another group of 12 or 12×12 and subtract a group of 12.
 - Using partial product and breaking apart the factor 11. Some students may break 11 as 10 and 1; $(10 \times 12) + (1 \times 12)$.
 - Some students may break apart the factor 12 instead and will solve $(10 \times 12) + (2 \times 11)$.
 - The students may use the commutative property and solve the problem 12×11 .

Once the groups have solved the problem in multiple ways, have each group share the strategies they used. Pose questions as before for students to compare strategies, explain why the strategies work, and which strategies are most efficient.

5. Students will have the chance to practice using the strategies in the context of a game. The game encourages efficiency that will lead to fact fluency. Cut the multiplication cards into sets so that each pair or small group of students has a set, and provide a score sheet for each group. The students should use the strategies discussed in the lesson to solve the problems if they do not recall the product. First, place all of the multiplication fact cards (attached) facedown, then each student will take turns turning over a card. If the student answers their fact card correctly and is able to justify their answer, they get to keep the card. Students should keep track of their products on the Score Card. After

solving three multiplication problems, the player with the highest sum of those products wins all of the cards from that round. Continue to play until all of the cards have been solved. The players with the most cards at the end wins the game. Please note that the multiplication facts with a factors of zero, 1, 2, 5, and 10 are not included in this list because those are facts students should have mastered in third grade.

Assessment

- **Questions**

- What will happen to the product if I double one factor and take half of the other factor? For example: $4 \times 12 = 48$. If I double one factor and take half of the other factor, the new problem would read 8×6 . What happens to the product? Does it matter which factor I take half or double? Do you think the problem 2×24 will have the same product as 4×12 ? Why or why not.
- How would you explain to a young child how to solve the multiplication fact 8×7 ?

- **Journal/writing prompts**

- The teacher wrote the following multiplication problem on the board for the students to find the product.

$$12 \times 9$$

Each student solved the problem differently.

- Student 1 said they would solve the fact 6×9 and then double the product to get the answer to 12×9 .
- Student 2 said they would solve the problem 12×10 and subtract 12 to figure out the product.
- Student 3 said they would also solve the problem 12×10 but instead would subtract 9 to figure out the product.
- Student 4 said they would decompose the factor 9 into 4 and 5. Then solve $(12 \times 4) + (12 \times 5)$ to get their answer.
- Student 5 said they would decompose the factor 12 into 10 and 2. Then solve $(10 \times 9) + (2 \times 9)$ to get their answer.

Identify the student(s) who solved this problem correctly. Model each student's idea to prove their strategy works. Which strategy would you use to solve this problem? Is there another strategy you could use to solve this fact? Use pictures or words to explain your answer.

- Look at the following table:

Number of groups	1	2	4	10
Number in each group	12	24	48	120

How could you use this table to solve the multiplication fact 12×8 ? Is there more than one way to solve this problem?

- **Other Assessments**

- Give the students a multiplication problem and have them use two different strategies to solve it.
- Give the students a two-digit by one-digit problem to solve. Encourage the students to use strategies to solve the problem.

Extensions and Connections

- Give a multiplication problem and encourage the students to identify other problems that are related to the given problem. For example: Because $4 \times 5 = 20$, I know that $4 \times 10 = 40$ and $4 \times 100 = 400$. I also know that 4×90 is 360 because I subtracted $400 - 40$ to equal 360. Have the students continue to identify the multiplication problems related and explain the connection within each fact.
- Included in this lesson are Multiplication Facts. There are several different activities you can use with these cards. One idea is to have the students play a game where they each turn over a fact and the student with the highest product wins both cards. Continue to play until a student runs out of cards. Another idea is to have the students group all of the facts with the same products together, look at the relationship between the facts, and justify why they have the equivalent products.

Strategies for Differentiation

- Use grid paper as a template for students to pictorially represent an array for a fact and show the partitioning or decomposition.
- Adapt the Fact Card game to gradually have students work with subsets of the facts. For example, use fact cards for zero, 1, 2, 5, and 10 to review the facts from third grade. Then use a set of fact cards that includes 2, 4, 6, 8, and 12 to develop the idea of doubling when a factor is even. Then use a set of fact cards with 3, 6, 9, and 12. That leaves 7 and 11 to have students work with. Continue building up to a set that contains the facts through 12×12 .
- Use manipulatives such as base-10 blocks, counters, and unit cubes in addition to number lines and arrays to help students progress from concrete to representational to abstract.
- For students with a deeper understanding of mathematics, allow them to explore multiplication problems with multiple digits. Encourage the students to consider how they might adapt the strategies used with multiplication facts to think multiplicatively to figure out the answer.

Note: The following pages are intended for classroom use for students as a visual aid to learning.

Multiplication Fact Cards

3×3	3×4
3×6	3×7
3×8	3×9
3×11	3×12

4×4	4×6
4×7	4×8
4×9	4×11
4×12	6×6

6×7	6×8
6×9	6×11
6×12	7×7
7×8	7×9

7×11	7×12
8×8	8×9
8×11	8×12
9×9	9×11

9×12	10×11
10×12	11×11
11×12	12×12
7×0	1×1

Score Card

Player's Name: _____

Round 1:

Multiplication Fact Card	Product
Sum of products:	

Round 2:

Multiplication Fact Card	Product
Sum of products:	

Round 3:

Multiplication Fact Card	Product
Sum of products:	