

Grade 3 Mathematics Lesson Plan

Wednesday, July 4, 2012, 5th Period

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Research Theme: Mathematics learning that nurtures students who can use
what they have learned
~ Through activities to express own thinking ~

Prior knowledge and ways of thinking we want students to use	Strategies to heighten students' ability to use what they learned	Ways of observing and thinking to nurture
<ul style="list-style-type: none"> ○ Division calculation ○ Division that uses basic multiplication facts. 	<ul style="list-style-type: none"> ○ Developing problems that might heighten students' motivation and interest. ○ Displaying the contents that have been learned. 	<ul style="list-style-type: none"> ○ Analogical thinking Thinking about similar situations and use them to reason in a novel situation ○ Integrated thinking Identifying and summarizing the essential commonality among various situations

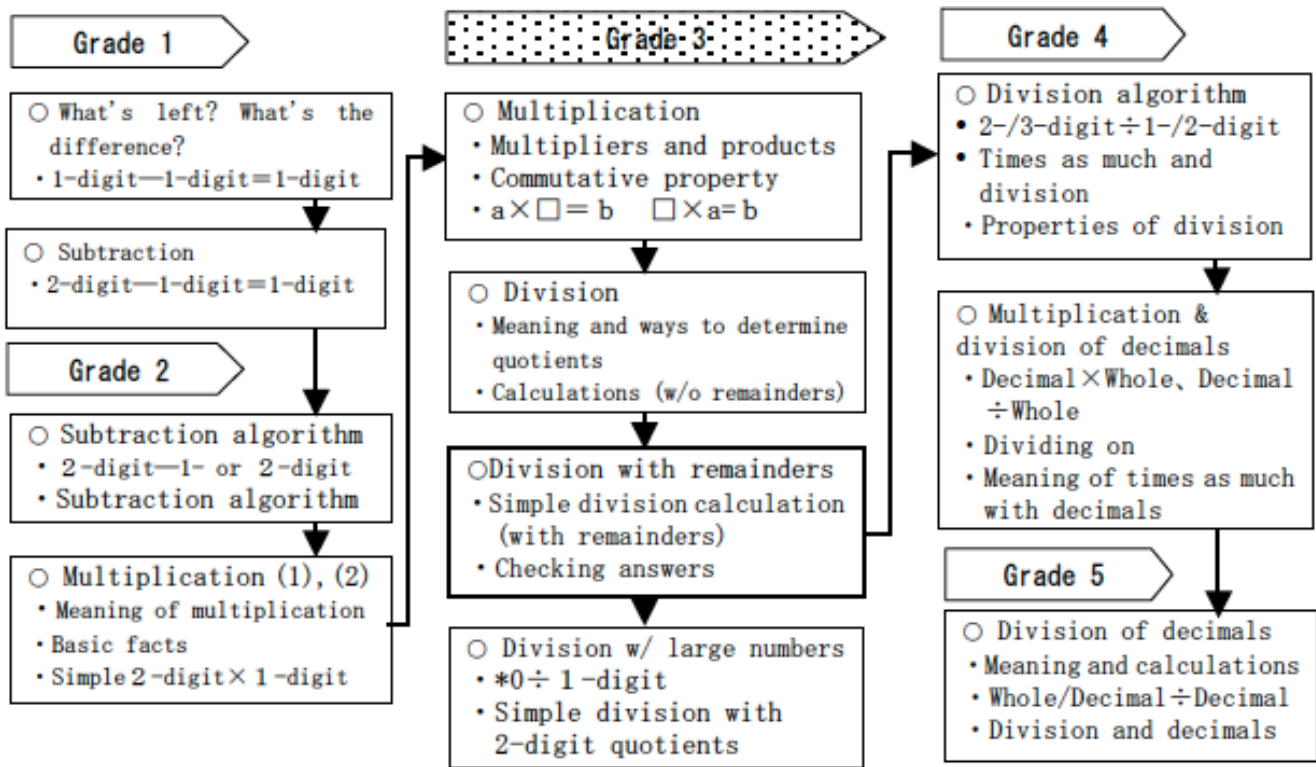
1. Name of the Unit Division with remainders

2. Goals of the Unit and Evaluation Criteria

- Students will understand division situations with remainders and deepen their understanding of the division operation. Furthermore, students will be able to use what they learned.

Interest, Eagerness, and Attitude	Students try to think about the meaning and ways to calculate division in situations where there are remainders based on division situations without remainders.
Mathematical Way of Thinking	Students can think about division situations with and without remainders in an integrated way, and they can represent the meaning and ways of calculating division with remainders using concrete materials, drawings, and expressions/equations.
Mathematical Skill	Students will be able to calculate division with remainders, and they can determine the quotients and the remainders.
Knowledge and Understanding	Students will deepen their understanding of the division operation by knowing the meaning of the remainders and the relationship between the divisor and the remainder

3. Flow of the content



4. State of the students

(1) Small group instruction for mathematics

At the beginning of this school year, new homerooms were created and 2 homeroom teachers and a support teachers for mathematics were assigned. This is the first time students experience mathematics instruction in reduced-size groups (instead of in their own homerooms). The students are separated into 3 groups of more or less equal achievement level.

There is not much difference in students' achievement at this point, yet. All students engage in mathematics lessons eagerly raising their hands and speaking up during lessons. We can sense students' desire for "I want to understand" as they continue to persist when they make mistakes. They write quite a bit in their journals, too. However, there are students who are still trying to master how to take notes, or those who cannot maintain their concentration and look bored from time to time.

From the result of a survey conducted in April, we learned that the number of students who do not feel comfortable with mathematics is not small. According to the survey, 65% and 28% of the students indicated they liked mathematics or somewhat liked mathematics, respectively, while 7% stated that they disliked mathematics somewhat. Those students who indicated they liked mathematics seem to feel that mathematics is "useful," "enjoyable," and "happy when problems are solved successfully." On the other hand, those who disliked mathematics indicated that

mathematics is "hard" and "time consuming." From another survey item, we learned that 47% of students enjoy being able to share their "own ideas." Thus, it appears many students want to publicly share their ideas and the level of interest in participating class discussion is high.

It is our desire to maintain the high level of students' eagerness/desire and their willingness to engage in mathematics learning. In order to do so, we need to identify and provide appropriate support in the areas where students are not comfortable. Moreover, during a lesson, we need to acknowledge individual students' ideas and make them shared understanding of the whole class.

(2) The results and the analyses of the readiness test

Problem	Correct (all questions)	Incorrect
(1) In $12 \div 4$, which is the "divisor" and which is the "dividend"?	46	16
(2) Multiplication equations with missing numbers (e.g., $3 \times [] = 15$, $[] \times 4 = 24$) (4 questions)	59	3
(3) To calculate the following, which facts (e.g. 4's facts, 7's facts) do you use? (5 questions)	53	9
(3) Calculate and find the answers (e.g., $21 \div 3$, $6 \div 1$). (5 questions)	55	7
(4) Calculate $0 \div 7$.	61	1
(5) There are 32 cookies. If you place 8 cookies to a bag, how many bags will there be? (equation and answer)	61	1
(6) Calculate $38 \div 6$. (division with a remainder - not yet learned)	18	44

(Number of Students)

(1) "divisor" and "dividend" [Translator's note: The original Japanese words used are more student-friendly, not the technical terms. The same is true for "multiplicand" and "multiplier" below.]

Many students do not yet understand these terms. Although the terms "multiplicand" and "multiplier" were used in the discussion of multiplication in Grade 2, students' understanding of these terms are not that strong. It may be an indication that although these students can perform calculations correctly, there are still a significant number of students who lacks the essential understanding of mathematical expressions.

(2) Multiplication equations with missing numbers

Almost all students completed these questions successfully. They tend to engage in these types of problems eagerly in everyday lesson.

(3) Using the basic multiplication facts to calculate division

Most students understand that they need to apply the basic multiplication facts to calculate division. However, when students are asked individually, "why can we use the basic multiplication facts?" many students appeared perplexed. Thus, the reality appears to be that many students can calculate mechanically but lack an understanding. Therefore, before the first lesson in the unit, we decided to set up Lesson 0 in which division without remainders will be reviewed.

(4) Division of 0

Almost all students seem to understand.

(5) Word problem with division

Almost all students answered the question correctly. However, in Grade 3, students only need to divide the larger number in a word problem by the smaller number, if there is an indication that the word problem is "division problem," then there is no need for students to interpret the problem. We suspect a significant number of students are solving these types of problems mechanically. Therefore, even though the question was a word problem, it might not indicate much about the students' ability to think and reason.

(6) Division with remainders

This is the focus of the current unit, and the students have yet to learn it formally. Those students who answered correctly labeled "remainder" clearly, indicating they have learned this content at home or *juku*'s. However, for $38 \div 6$, some students responded $6 + 2$, and their responses were counted as correct. Another students responded "6·2." These responses seem to indicate the students' disposition to use what they have previously learned. Therefore, we would like to teach lessons that can take advantage of this type of reasoning.

5. Plans to increase students' ability to use their prior learning

i. Designing the lesson opening that will heighten motivation and interest

Problems that may heighten students' motivation and interest

Many problems of "division without remainders" and "division with remainders" to help students sense the enjoyment of partitioning many things. In addition, to make connections to students' everyday life, we chose to use the problem context involving sharing of snacks. It is hoped that such a problem would make it easier for students to relate to the problem situations and become motivated and interested in the lesson.

Setting up the learning environment in which students feel safe and confident in applying their prior learning

As we studied division in May of this year, many students appeared to engage in the lessons with comfort because they felt confident that they can do the calculations. However, as noted

earlier, many of them are using memorized facts mechanically and unable to answer the question, "why can we use the basic multiplication facts?" Therefore, before the first lesson of the unit, Lesson 0 is set up to review "using the basic multiplication facts to division calculations without remainder." Through this lesson, it is hoped that students understand the meaning of the use of the basic multiplication facts in division. Moreover, we will begin the lesson with divisions without remainder with the numbers like 12 and 15 so that students feel confident that calculations can be completed. Then, a division problem with a remainder will be displayed and students will be asked "How is this problem different from the others?"

ii. Designing mathematical activities that increase the ability to express own ideas

① Setting up a problem situation that will promote a variety of thinking

In the beginning, a mixture of "divisions without a remainder" and "divisions with remainders" will be displayed, and the students' thinking will be broadened. Then, as the lesson progresses, students' understanding will be gradually deepened and focused. Then, at the end of the lesson, an extension task will broaden students' thinking once again. In addition, actually packages of pudding will be used so that students can connect the problem solving situation with their everyday experiences.

② "Today's learning" - deepening understanding through reflecting on the day's learning

At the end of a lesson, students have been writing journals, "today's learning." At first, their entries were short, but gradually, more students started including specifics. For example, in the addition unit, a number of students were writing about the differences from what they learned in Grade 2. Other students wrote entries that anticipated future learning. For example, some wrote, "Since I can now regroup twice with addition, I want to learn to regroup in many places with subtraction." Thus, we can see that students are deepening their understanding through journal writing.

6. Unit Plan (10 lessons, today's lesson is the 2nd of the 10 lessons)

	Goals	○Learning Activity	◇ Prior learning to be used • Design to nurture the ability to use [Evaluation]
0	<Review of prior learning> Students will understand and be able to explain how to find the answers for division without remainders.	<ul style="list-style-type: none"> ○ Discuss what we already know about division. ○ Write the explanation of how to find the answer for division without remainders ($15 \div 3$) in the notebook using diagrams and expressions/equations. ○ Remember the relationship between multiplication and division. 	◇ Answers for division problems may be found by using the basic multiplication facts. [Interest, Eagerness, and Attitude] Students are thinking about and trying to explain ways to find the answers for division without remainders.

		$\square \div \triangle = \bigcirc \Leftrightarrow \triangle \times \bigcirc = \square$ ○ Write the appropriate expression/equation and think about the meaning of each number.	[Understanding and Knowledge] Students understand ways to find the answers for division without remainders. Also, students understand the relationship between multiplication and division.
① Division with remainders [6 lessons]			
1	Students will be able to calculate division with remainders using concrete materials (counters).	○ Students will write expressions/equations for division problem situations with remainders. ○ Discuss the meaning of remainders.	◇ Division means to create equal sized groups (meaning of division). ◇ Reasoning through manipulation (based on the manipulations, clarify the meaning of a remainder). [Interest, Eagerness, and Attitude] Students are trying to find the answers for division with remainders using concrete materials. [Mathematical Skill] Students will be able to calculate the answers for division with remainders using concrete materials.
2	Students will think about ways to find the answers for division with remainders and explain them in notebooks. Students will understand that the answers for division with remainders can be found by using the basic multiplication facts. Today's Lesson	○ Think about ways to find the answers for $16 \div 3$ and record them in notebooks. ○ Share students' ideas (using diagrams, the basic multiplication facts). ○ Sort various division expressions into those with remainders and those without remainders.	◇ How to find quotients. • Have an extension problem, "How can we change division with remainders so that there will be no remainders?" [Mathematical Way of Thinking] Students will find ways to find the answers for division with remainders and record them in notebooks. [Knowledge and

			Understanding] Students understand that division with answers can also be found by using the basic multiplication facts.
3	Students will understand the relationship between the divisor and the remainder.	<ul style="list-style-type: none"> ○ Investigate the relationship between the divisor and the remainder in the case of $13 \div 4$. ○ By changing the dividend 14, 15, ..., think about the relationship between the divisor and the remainder. 	<ul style="list-style-type: none"> ◇ Reasoning based on manipulation of concrete materials (using the meaning of remainders as the basis). <p>[Knowledge and Understanding] Students understand that the remainder is less than the divisor.</p>
4	Students will understand that the division operation can be applied to partitive (fair sharing) situations.	<ul style="list-style-type: none"> ○ Think about the appropriate expression for partitive division situations and how to find the answer by making sense of the situation. ○ Discuss their ideas and summarize ways to calculate partitive division. 	<ul style="list-style-type: none"> ◇ Calculation methods for quotitive (measurement) division without remainders. ◇ Reasoning with mathematical expressions. <p>[Mathematical Way of Thinking] Students are thinking about ways to calculate partitive division with remainders and explaining their methods using concrete materials, diagrams and/or expressions (or equations).</p>
5	Students will understand how to check the results of calculation for division with remainders. They will also develop the disposition to check their calculations routinely.	<ul style="list-style-type: none"> ○ Think about ways to check the answers for calculation of division with remainders. ○ Practice checking calculations. 	<ul style="list-style-type: none"> ◇ How to check the answers for division without remainders. ◇ Reasoning with diagrams (students are trying to capture phenomena and situations using diagrams)

6	Students will practice calculations, including division with remainders.	○ Calculation practice, including checking the results.	◇ Practice for calculation of division without remainders. [Mathematical Skill] Students can calculate division with remainders and check the results of their calculations.
② Problems that require students to think about the meaning of remainders. [2 lessons]			
7 8	Students will deepen their understanding of remainders in situations.	○ Understand problem situations and write and calculate the appropriate expressions. • Situations in which Quotient +1 will be the answer • Situations in which Quotient will be the answer	◇ How to calculate division without remainders ◇ Reasoning with diagrams ◇ Reasoning with mathematical expressions (expressing phenomena and situations using mathematical expressions) • To help students make sense of situations, have them first draw diagrams. [Knowledge and Understanding] Students understand how to deal with quotients and remainders depending on the problem situations
③ Summary [2 Lessons]			
9	Students will solve problems applying what they have learned.	○ Complete "Power Builder."	[Mathematical Skill] Students can solve problems using what they have learned.
10	Students will consolidate and master what they learned.	○ Complete "Mastery Problems" and calculation practice problems.	[Knowledge and Understanding] Students have mastered what they have learned.

7. Today's lesson (Lesson 2 of 10)

(1) Goals

- Students will think about ways to find answers for division situations with remainders and explain their methods in their notebooks.
- Students will understand that they can also use the basic multiplication facts even when there are remainders.

(2) Flow of the lesson

	<p>○ Learning activities T: <i>Hatsumon</i> and instruction C: Anticipated responses</p>	<p>◇ Prior learning to be used • Design to improve students' ability to use what they have learned [Evaluation] ◆ Ways of observing and thinking to be mastered</p>
<p>Understanding the task/Plan</p>	<p>Understand the problem Look at several division expressions and figure out which ones may involve remainders.</p> <p>T: From these expressions, let's find division expressions that will give us remainders. Can someone pick one?</p> <p>C: This one. T: Why did you select this one? C: Just because (intuitive)/it is not in the basic multiplication table, etc T: Let's think about this more carefully.</p> <p>T: (Select $16 \div 3$) Does this look like the one we studied yesterday?</p> <p>Recall what they did (use counters to separate them into groups).</p> <p>T: Do we need counters to calculate all of these expressions? It's a little tedious, isn't it? So, let's think about ways to find the answers without using counters.</p> <p>T: Let's think about ways to find the answer for $16 \div 3$ using what we have learned so far. Write down your methods in your notebooks so that you can share how you found the answer later.</p> <p>C: If it were $15 \div 3$, I can use the multiplication facts, but ...</p>	<p>• By displaying many expressions, increase students' motivation.</p> <p>$15 \div 3, 16 \div 3, 17 \div 3, 8 \div 4, 13 \div 4, 26 \div 4, 25 \div 5, 43 \div 6, 56 \div 7, 81 \div 9$ (5 division without remainders and 5 division with remainders)</p> <p>• Help students make connections to the previous lesson.</p> <p>Have the display materials from the previous lesson ready.</p> <p>• Help students anticipate a simpler method than using concrete materials (counters) to increase their interest in the task.</p>

Independent Problem Solving	<p>Students will think about ways to find the answer for $16 \div 3$ and record their methods in their notebooks.</p> <p>C1: Draw a diagram representing how they manipulated concrete materials (counters). Write an explanation in words.</p> <p>C2: Expressions/equations, words, and diagrams to explain. C2-1: $3 \times 5 = 15$, $15 + 1 = 16$ ($16 - 15 = 1$) C2-2: $3 + 3 + 3 + 3 + 3 = 15$, $15 + 1 = 16$ C2-3: $3 \times 1 = 3$ $3 \times 2 = 6$ $3 \times 3 = 9$ $3 \times 4 = 12$ $3 \times 5 = 15$, $15 + 1 = 16$</p> <p>[Translator's Note: In Japan, the number in each group is written first.]</p> <p>C3: Cannot get started.</p> <p>C4: Student can calculate but cannot explain. Just write "$16 \div 3 = 5$, remainder = 2."</p>	<p>◇ Division without remainders can be calculated using the basic multiplication facts.</p> <ul style="list-style-type: none"> • On the display board in the classroom, create a section in which what we have studied will be highlighted. Display in the section, "$15 \div 3$ can be calculated using the 3's multiplication facts." • With C3, remind him/her that we used counters in the previous lesson. Have him/her draw a diagram to represent the method with the counters. Then, ask him/her if the method can be represented using mathematical expressions and equations. • With C4, remind him/her how we calculated division without remainders ($15 \div 3$). • It does not matter at this point how students figure out the remainder or record their answers. <p>[Mathematical Way of Thinking] Students think about ways to find the answers for division with remainders and write their explanations in their notebooks.</p>
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Discussion	<p>Share their own ideas and listen to other students' ideas.</p> <p>(Have C1, C2-1, C2-2, and C2-3 share their ideas.)</p> <p>T: Let's listen carefully how your friends figured out the answer and thinking about the similarity to and the difference from your own idea."</p> <p>C: All of them have the answer of "5 remainder 1."</p> <p>C: C2-1 and C2-3 are doing the same thing.</p> <p>T: Can someone else explain the method of C2-1? C: ~</p> <p>T: How did we find the answers for $15 \div 3$? C: We used the 3's multiplication facts. C: It's the same for $16 \div 3$.</p> <p>(T: But, we don't have 16 in the 3's multiplication facts. Why is it possible to use the 3's multiplication facts to find the answer for $16 \div 3$?)</p> <p>Write the equations and learn how to record and read the answers.</p> <p>T: The calculation you did is written as "$16 \div 3 = 5$ remainder 1." When there is a remainder, we say that it is not divisible. When there is no remainder, we say it is divisible.</p>	<p>◆ Reasoning to unify ideas; Reasoning with analogy "Calculation for division with remainders can be carried out using the same method for division without remainders."</p> <ul style="list-style-type: none"> • Help students become interested in other students' ideas by comparing and contrasting with their own ideas. • By identifying the similarities, help students unify various ideas. • By asking students to explain other students' ideas, provide more opportunities for students to make public presentations. • In case students' understanding is insufficient, have additional questions ready.)
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Application problems and Summary	<p>Sort expressions into "divisible" and "not divisible" (record in the notebooks).</p> <p>T: OK, let's use this method to calculate division to sort many division expressions. Let's first select division expressions that can be solved using the 3's multiplication facts. Then, those that can be solved using the 4's multiplication facts. ~</p> <p>T: Now, let's sort these division expressions into "divisible" and "not divisible."</p> <p>(T: What do we need to change to make $16 \div 3$ so that it will be divisible?)</p> <p>Write "Today's learning."</p> <p>T: Let's write "Today's learning."</p>	<p>[Mathematical Way of Thinking] Students understand that division with remainders can also be calculated using the basic multiplication facts.</p> <ul style="list-style-type: none"> • Have an extension question ready. • Before students write their journal entries, remind them what today's task was. In addition, encourage students to write the details of "how they thought."
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