Title of Unit: Let's think about how to calculate (Multiplication and division with decimal numbers) Grade 4

○Instructional plan (2 lessons)

- 1st lesson: decimal number×whole number **(this lesson)**
- 2nd lesson: decimal number÷whole number

○About this unit

In the textbook, the unit "Let's think about how to calculate" is placed before the unit "multiplication and division with decimal numbers".

Students learned that decimal numbers are -- the numbers to express fractional parts of the quantities which do not fill the unit quantity, and can be added and subtracted like whole numbers in the 3rd grade. In the 4th grade, they deepened their understanding of numbers by learning decimal numbers can be expressed in the same way as whole numbers and the relative size of the numbers.

(1) Idea about posing the problem

In this unit, students understand the meaning of 1.2×3, 5.4÷3 and think about how to calculate using the property of multiplication and the structure of decimal numbers. This unit is designed for the students to understand that they can make mathematical expressions when multiplicand (dividend) is decimal numbers in the same way as whole number. In order to do so, the problem will be presented by using □ for decimal part, and applying a whole number first and then applying the decimal number.

(2) Idea about solving the problem on their own

When students think how to calculate, it's important to encourage them to use figures, tape diagrams, and expressions with words based on what they learned previously. For that purpose, I will allow them to develop an outlook as the whole class and discuss which method they learned can be utilized. If there are students who cannot come up with the idea, I will support them by providing them the hints which linked with items which they previously learned in the guidance between desks.

(3) Idea about the students' presentation and discussion

As this unit provides good opportunity for students to explain their own idea, I will separate them into students who will present expressions and those who will explain with their words so that as many students as possible can provide their explanations.

During the discussion, I'd like to pose the questions that encourage the students to notice the differences between the ideas and find characteristic, commonality, and advantages of each idea.

○Examples of anticipated students' responses and instructional supports

①Students who calculate by changing multiplication into addition.

1.2×3=1.2+1.2+1.2=3.6 Answer 3.6L

→ Admit that they reach an answer and remind them that this time they think "how to multiply".

Encourage them to express the problem situation in a diagram, instead of thinking of expression. Then, let them notice it would be easier to calculate if they change L into dL, because the decimal number becomes a whole number. Or remind them of what they learned in "large numbers": if they think in terms of 100million as the unit, they can calculate 300million+500million as 3+5 and the answer is 800milion so that they can apply it to decimal numbers.

②Calculate by changing L into dL

1.2L=12dL 12×3=36

36dL=3.6L Answer 3.6L

③Calculate in terms of 0.1 as the unit to make it a whole number

1.2×3

↓0.1 as the unit

12×3=36

↓0.1as the unit

3.6 Answer 3.6L

→Admit they think of the numbers in terms of 0.1 as the unit in both. Remind them of the structure of decimal numbers (10 times of 1.2 is 12) and the property of multiplication (if you make the multiplicand 10 times as much, the answer will be made 10 times as much) and allow them to think whether the property can be used.

④Calculate by making it 10 times as much to make it a whole number

1.2×3=□

↓×10↑÷10

12×3=36 Answer 3.6L

December 1st (Thur.)

There are 3, □ L bottles of juice. How much juice is there altogether?

Put number into □.

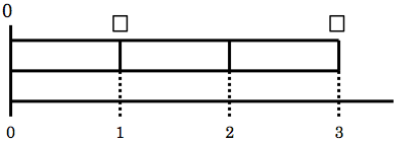
□=2 2×3=6

□=3 3×3=9

□=1.2 1.2×3=?

Reason…・can be solved with the volume of a bottle×the number of bottles

・tape diagram



Even if □ is decimal number, multiplication expression can be made.

1.2×3

Let's think about how to calculate 1.2×3

Board Writing Plan

My idea

①Change multiplication into addition

1.2×3=1.2+1.2+1.2

=3.6 Answer 3.6L

③Calculate in terms of 0.1 as the unit

1.2×3

↓0.1 as the unit

12×3=36

↓0.1as the unit

3.6 Answer 3.6L

★The number is changed into a whole number when the student calculates.

★As it is based on small unit, it can be used at any time.

Summary

・It can be calculated when the decimal number is changed into a whole number.

・It can be calculated even with decimal numbers when the property of multiplication is used.

★The number is changed into a whole number when the student calculates.

②Calculate by changing L into dL

1.2L=12dL

12×3=36

36dL=3.6L Answer 3.6L

④ Calculate by using the property of multiplication

1.2×3=□

↓×10↓×10

12×3=36

36÷10=3.6

Answer 3.6L

★The number is changed into a whole number when the student calculates.

★As the property is used, it can be used any time.

About the lesson (1/2)

Objective: Explain how to calculate 1.2×3 by using what students previously learned, making reasoning clear, and using diagrams or mathematical expressions

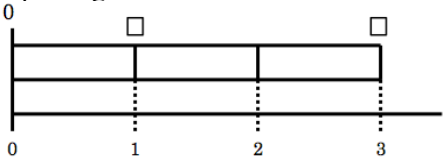
Grasp the Objectives

There are 3, □L bottles of juice. How much juice is there altogether?

T: Let's put the number into □.
If □=2, what mathematical expression will you have?
C: 2×3=6 and answer is 6L.
T: Why is it 2×3?
C: As there are 3 bottles of 2L, so 2×3.
C: If it is expressed in mathematical expression with words, it is expressed by (the volume of a bottle)×(the number of bottles)
T: If □=3, what mathematical expression will you have?
C: 3×3=9 and answer is 9L.
T: If □=1.2, what mathematical expression will you have?
C: 1.2×3.
T: Why?
C: Because when □=2 or 3, we could calculate with (the volume of a bottle)×(the number of bottles).
C: If it is expressed in a tape diagram, 1.2L for each one and three times of it will be the answer. I think multiplication can be used.
T: Then today let's think how to calculate with decimal numbers.

Let's think about how to calculate 1.2 x 3

Mathematical expression with words
(the volume of a bottle)×(the number of bottles)
Tape diagram



Outlook

T: What method will be applicable?
C: As multiplication can be changed into addition and I can solve addition with decimal numbers, I think it is good idea to calculate it by addition.
C: As L is large unit, I'll calculate by changing it into small unit.
C: I will calculate by making 1.2 10 times as much to make it a whole number.

Individual-Problem-Solving

①Change multiplication into addition	②Calculate by changing L into dL	③Calculate in terms of 0.1 as the unit	④Calculate by using the property of multiplication
1.2×3 1.2+1.2+1.2 =3.6 Answer 3.6L	1.2L=12dL 12×3=36 36dL=3.6L Answer 3.6L ㎝	1.2×3 ↓0.1 as the unit 12×3=36 0.1as the unit ↓ 3.6 Answer 3.6L	1.2×3=□ ↓×10 ↓×10 12×3=36 36÷10=3.6 Answer 3.6L

Presentation/Review

T: Let's find points which are the same or good in the methods which were presented.
C: The methods of ②, ③, ④ are different, but the way they are calculated as 12×3 by considering them as whole numbers is the same.
C: I think if we change it into addition, we can solve the problem accurately.
C: It seems we will have less mistakes when we calculate with whole numbers rather than calculating with decimal numbers.
C: When we use the small unit, the decimal number is changed into a whole number, and it becomes easier to calculate.
T: Are there any methods which can be used to solve other problems even if the problems do not involve the unit of L?
C: The solution ③ can be used any time if we consider it with the number which is appropriate for the problem as the unit.
C: The solution ④, uses what we learned, the property of multiplication, that is "if the multiplier is the same, when we make the multiplicand □ times as much, the answer will be also made □ times as much". When I calculate it by making 1.2 10 times as much, then dividing the product by 10, I get the answer, 3.6. I think we can use this method any time because the property of multiplication is used.

Summary

T: Today we learned multiplication with decimal numbers, 1.2×3.
Let' summarize what we learned.
C: We learned we can get the answer by changing the decimal number into a whole number, by changing L into dL, or thinking in terms of 0.1 as the unit.
C: W learned the property of multiplication can be used for decimal numbers. I could calculate when I used the property.

Can be calculated when decimal numbers are changed into whole numbers.
Can be calculated with decimal numbers when the property of multiplication is used.

Evaluation: Did the students think about 1.2×3 based on the calculation with whole numbers and explain it?

Title of Unit: Let's think about how to calculate (Multiplication and division with decimal numbers) Grade 4

○Instruction plan (2 lessons)

- 1st lesson: decimal number×whole number
- 2nd lesson: decimal number÷whole number **(this lesson)**

○About this unit

In the previous lesson, students learned that they can calculate decimal number×whole number by changing the decimal number into a whole number by thinking in terms of 0.1 as the unit, or making it 10 times as much. This unit is designed for the students to notice they can calculate if the decimal number is changed into a whole number through the study of multiplication with decimal numbers, and think what kind of methods of calculation can be used in the case of division.

In the 5th grade, it will develop into leaning whole number×decimal number, decimal number×decimal number, whole number÷decimal number, and decimal number÷decimal number. As they will come down to what students learned in this unit, it is important for the students to learn firmly the way of thinking for changing decimal numbers into whole numbers.

(1) Idea about posing the problem

I'd like students to be aware that the mathematical expression, decimal number÷whole number holds true by presenting the problem statement using □, and expressing it in a mathematical expression with words or a tape diagram. Also I'd like them to think as they calculated whole number×decimal number by changing decimal numbers into whole numbers in the previous lesson, they will be able to solve the problem with the same method. For that purpose, it is important to allow students to check what they previously learned any time.

(2) Idea about solving problem on their own

When students think how to calculate, it is important to encourage them to think based on what they learned previously. Students will be allowed to check what they learned any time by looking at learned items which are drawn on paper and displayed in the classroom, or by looking back what they wrote on their notebooks. I'd like them to remind that they could calculate by changing decimal numbers into whole numbers and encourage them to think they can use the same method.

(3) Idea about the student's presentation and discussion

As this unit provides good opportunity for students to explain their own idea, I'd like as many students as possible to provide their explanations. During the discussion, as the idea of changing decimal numbers into whole numbers which students learned in the previous lesson is also important for this lesson, I'd like the students who had failed to reach the idea to be aware of it this time. For that purpose, if there are remarks about it, I'd like to take them up and make them distinguished on blackboard.

○Examples of anticipated students' responses and instructional supports

①If it is expressed in a diagram, the volume of a bottle is more than 1L. So first, divide it into 1L for each bottle and then divide the remaining 2.4L into 3 bottles.

→Admit they understood the answer is more than 1L as they expressed it in a diagram. Let them notice it would be easier to calculate if they change L into dL, because the decimal number becomes a whole number. Or remind them of what they learned in "large numbers": if they think in terms of 100million as the unit, they can calculate 300million+500million as 3+5 and the answer is 800milion so that they can apply it to decimal numbers.

②As 5.4L equals 54dL, 54÷3=18
18dL equals 1.8L. Answer 1.8L

③As 5.4L is made of fifty four 0.1L,
54÷3=18
1.8L is made of eighteen 0.1L. Answer 1.8L

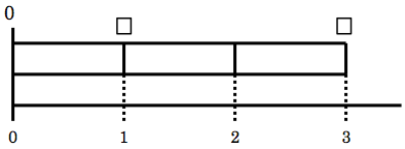
→Admit they think of the numbers in terms of 0.1 as the unit in both. Remind them of structure of decimal numbers (10times of 5.4 is 54) and the property of division (if you make the dividend 10 times as much, the quotient will be made 10 times as much) and allow them to think whether the property can be used.

④If I make 5.4 10 times as much, it becomes 54. 54÷3=18
As the dividend was made 10 times as much and quotient was 18, the quotient should be divided by 10 to have the answer. The answer is 1.8. Answer 1.8L

December 1st (Thur.)

If □L juice is divided equally into 3 bottles, how much juice will each bottle have?

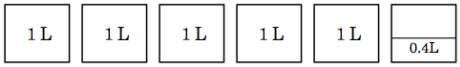
Divide 6L into 3
expression 6 ÷ 3
(the total volume) (the number of bottles)
Divide 5.4L into 3
5.4 ÷ 3



Board Writing Plan

Let's think about how to calculate 5.4÷3

〈my idea〉 ①Express in a diagram.



1 bottle, 1 bottle, 1 bottle, Remaining2.4L

③Calculate in terms of 0.1 as the unit
As 5.4L is made of 54 0.1L
54÷3=18
18L is made of 18 0.1L
Answer 1.8L

④Property of multiplication/division
5.4÷3=1.8
↓×10 ↑÷10
54÷3=18
Answer 1.8L

②Change L into dL
5.4L=54dL
54÷3=18
18dL=1.8L
Answer 1.8L

②③④ are changed into whole numbers.
③④ can be used any time.

Summary

・Same as multiplication with decimal numbers, it can be calculated when the decimal number is changed into a whole number.

・It can be calculated even with decimal number when the property of multiplication/division is used.

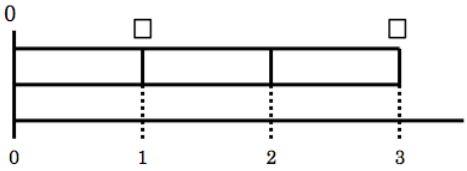
About the lesson (2/2)

Objective: Explain how to calculate 5.4÷3 by using what students previously learned, making reasoning clear, using diagrams or mathematical expressions

Grasp the Objectives

If □L juice is divided equally into 3 bottles, how much juice will each bottle have?

T: If the number which will be put into □ is 6, what mathematical expression will you have?
C: If it is 6L, it will be 6÷3=2. The reason we will have that mathematical expression is the total volume ÷ the number of bottles = the volume of a bottle.
T: If the number which will be put into □ is 5.4, what mathematical expression will you have?
C: The total volume is 5.4 and the number of bottles is 3. As we want to have the volume of a bottle, the mathematical expression will be 5.4÷3.
C: If we express it in a tape diagram, we will be able to understand it.



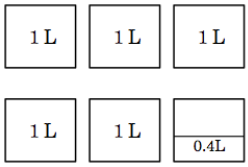
Let's think about how to calculate 5.4÷3

Outlook

T: How should we think about it?
C: I think if we express it in a diagram, we will be able to understand it.
C: 5.4L equals 54dL.
C: 5.4L is the amount made of fifty four 0.1L.
C: As we used the property of multiplication at the time of multiplication, I think the property can also be used this time.
C: We can calculate it by changing decimal numbers into whole numbers as we did for multiplication.

Individual-Problem-Solving

① Express in a diagram



If 5L is divided into 3 bottles, each bottle will have 1L, and there will be 2.4L left over.
As 2.4L is 24dL, each bottle will have 8dl.
1+0.8=1.8 Answer 1.8L

② Change L into dL
As 5.4L is 54dL,
54÷3=18
18dL is 1.8L
Answer 1.8L

③ Calculate in terms of 0.1 as the unit.
As 5.4L is made of 54 0.1L .
54÷3=18
As 1.8L is made of 18 0.1L. Answer 1.8L

④ Use the property of multiplication/division
5.4÷3=□
↓×10 ↓×10
54÷3=18
As the quotient is made 10 times as much,
□×10=18
18÷10=1.8
□=1.8
Answer 1.8L

Presentation/Review

T: Let's find points which are the same or good in the methods which were presented.
C: It is good to express in a diagram, because it becomes easy to find an answer.
C: 54÷3 is carried out in ②, ③, ④.
C: Although they are changed into dL, or calculated in terms of 0.1 as the unit, what it comes down to is that they are calculated with whole numbers by being made 10 times as much.
C: In the previous lesson, we changed the decimal numbers into whole numbers using the property of multiplication. I think using the same property will make it easy to calculate this time too, because decimal numbers will be changed into whole numbers.
C: I think the solution ③ is good, because it can be used any time when we consider it with the number which is appropriate for the problem as the unit.
C: The property of multiplication/division, "if the multiplier is made □ times as much, the product will be also made □ times as much", could be used at the time of multiplication. I think it is better to use this property when we divide decimal numbers, because it can be used any time.

Summary

T: Today we learned division with decimal numbers, 5.4÷3.
Let' summarize what we learned.
C: We learned we can get the answer by changing the decimal number into a whole number, by changing L into dL, or thinking in terms of 0.1 as the unit.
C: We learned the property of multiplication/division can be used for decimal numbers.

Can be calculated when decimal numbers are changed into whole numbers, same as multiplication with decimal numbers.
Can be calculated with decimal numbers when the property of multiplication/division is used.

Evaluation: Did the students think about how to calculate 5.4÷3 based on the calculation with whole numbers and explain it?