Grade 8 Mathematics
Number and Number Relations: Lesson 6

Read aloud to the students the material that is printed in **boldface type** inside the boxes. Information in regular type inside the boxes and all information outside the boxes should **not** be read to students. Possible student responses are included in parentheses after the questions.

NOTE: The directions read to students may depend on the available materials. Read only those parts of the lesson that apply to the materials you are using.

Any directions that ask you to do something, such as to turn to a page or to hand out materials to students, will have an arrow symbol (⇨) by them.

Purpose of Lesson 6:

- In this lesson, the tutor and the students will
  - ✓ add, subtract, and multiply fractions; and
  - ✓ solve real-world problems involving addition, subtraction, and multiplication of fractions.

Equipment/Materials Needed:

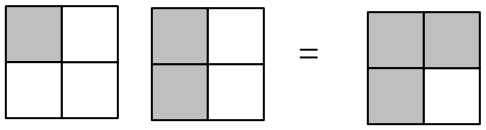
- Copies of Student Sheets 13 and 14
- Paper and pencils.

Preparations before beginning Lesson 6:

- Run one (1) copy of Student Sheets 13 and 14 for each student.
- Have paper and pencils available.

Lesson 6: Number and Number Relations

⇨ Write these equations on the board and draw the pictures.
one apple + two apples = three apples
1 apple + 2 apple = 3 apples
one fourth + two fourths = three fourths
1 fourth + 2 fourths = 3 fourths



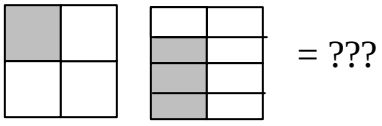
$$\frac{1}{4} + \frac{2}{4} = \frac{3}{4}$$

Say:

We are going to start today's lesson with addition and subtraction of fractions.
If I add 1 *apple* and 2 *apples*, I get 3 *apples*.
If I add one *fourth* and two *fourths*, I get three *fourths*.
In these problems, when I added, the *number* of "things" changed, but the *kind* on "things" did not. Apples stayed apples and fourths stayed fourths. So what does this comparison have to do with adding and subtracting fractions? If the denominators or "things" are the same, you simply add the numerators and use the same denominator. When fractions have the same denominators, they are said to have *like denominators*.

⇨ Give problems 1 – 4 on Student Sheet 13. Have students discuss their answers. Answers: 1) 5 sixths 2) 2 fifths 3) 9/9 or 1 4) 0/9 or 0

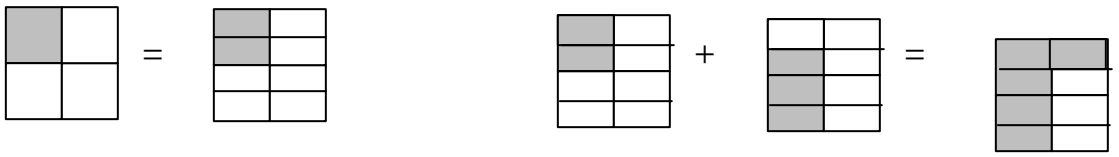
⇨ Write these equations on the board and draw the pictures.
1 apple + 3 oranges = 4 pieces of fruit
one fourth + three eighths = ???
1 fourth + 3 eighths = ???



$$\frac{1}{4} + \frac{3}{8} = ???$$

Say:

When I add apples and oranges, the "things" are different so the "things" in my answer must be different. When adding fractions, we must make the denominators or "things" the same. We have *unlike* denominators, and we need to have *like* denominators. How do we choose which denominator or "thing" to use? In the problem above, it was pretty easy to choose a denominator. You could divide the picture of fourths into eighths; 1/4 = 2/8. These fractions, 1/4 and 2/8 are *equivalent* fractions. They name the same amount. Add 2/8 + 3/8. What is your answer? (5/8)



Say:

How could you find which denominator to use to add 1/4 and 2/5? When you skip count, you say the *multiples* of a number: for example, if you skip count by 5's, you say 5, 10, 15, 20, 25, 30 etc. These numbers are all multiples of 5. Tell me the first 6 multiples of 4. (4, 8, 12, 16, 20, 24)

⇨ Write the multiples of 5 and 4 on the board.
5 ⇨ 5, 10, 15, 20, 25, 30
4 ⇨ 4, 8, 12, 16, 20, 24

Say:

Do 5 and 4 have any of the same multiples? (Yes. 20) **Because 20 is a multiple of both numbers, it is called a *common multiple.* I want one of you to write the first 6 multiples of 3 on the board. Now someone else should write the first 6 multiples of 6 on the board.**
3 ⇨ 3, 6, 9, 12, 15, 18
6 ⇨ 6, 12, 18, 24, 30, 36
Do these 2 numbers have any multiples in common? (Yes. 6, 12, and 18.) **Which is the smallest multiple that they have in common?** (6) **The smallest common multiple that numbers have in common is called the *least common multiple.* This number can be very useful in adding and subtracting fractions and mixed numbers.**

Now let's look back at our problem: 1/4 + 2/5. We want to use the same denominator or a common denominator. When we listed the multiples of 4 and 5, what was the common multiple? (20) **So 20 will be the denominator we will use. Let's see how to write 1/4 with a denominator of 20 and 2/5 with a denominator of 20.**

⇨ Write these problems on the board.

$$\begin{array}{rcccc} \frac{1}{4} & = & \frac{?}{20} & = & \frac{5}{20} \\ +\frac{2}{5} & = & +\frac{?}{20} & = & +\frac{8}{20} \\ \text{--------} & & \text{-------} & & \text{--------} \end{array}$$

Say:

To change 1/4 to some number of 20ths, you need to find the numerator of 20. How could find the numerator? (You could think of what number you would multiply 4 by to get 20.) **What number is that?** (5) **To find the numerator of 20, multiply 1 x 5. The numerator is 5; 1/4 = 5/20.**

How many 20ths does 2/5 equal? (8/20) **How did you find the numerator: 8?** (You could think of what number you would multiply 5 by to get 20. That number is 4; so 4 x 2 is 8.) **You now have like fractions, so you can just add them. What is the answer to the problem 1/4 + 2/5?** (13/20)

I want you to use this process to subtract 2/3 – 1/6. Remember that we listed the multiples of 3 and 6. What were the common multiples that we found? (6, 12, and 18.) **Which was the smallest or *least common multiple?*** (6) **Let's use the least common multiple as our denominator. How do I write 2/3 with a denominator of 6.** (Think of what number you used to get from 3 to 6. This number is 2, so multiply 2 by 2. 2/3 = 4/6.) **What should you do now to finish the problem?** (Subtract 1/6 from 4/6, you get 3/6.) **Can you think of another way to write 3/6?** (Yes. 1/2) Note: The answer 3/6 is correct, but not in its simplest form. Many tests require students to write the answer in the simplest form, so it is a good idea to practice this process.

⇨ Give problems 5 – 8 on Student Sheet 13. Talk about each answer.

Answers:

5) $\frac{13}{10}$ or $1\frac{3}{10}$ 6) $\frac{1}{9}$ 7) 0 8) $\frac{16}{15}$ or $1\frac{1}{15}$

Say:

Let's look at multiplication of fractions now. Take a sheet of paper and fold it in half. What is each part called? (1/2) **Now fold it in half again. What is each part now called?** (1/4) **What is 1/2 of 1/2?** (1/4)
We could write this problem as this:

$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

When you multiply fractions, you simply multiply the numerators and multiply the denominators. Multiply 3/8 x 1/5. What do you do first? (multiply the numerators) **What is 3 x 1?** (3) **What do you do next?** (multiply the denominators) **What is that product?** (40) **What is the answer to the problem?** (3/40)

Multiply 3/8 x 2/3. Did anyone get 6/24? (Yes.) **Did anyone get 1/4?** (Yes.) **Both of those answers are correct. How can two answers both be correct?** (1/4 is in simplest terms.) **Many of the tests you take will ask for the answer in its simplest form, so it is wise to write your answers in the simplest form.**

⇨ Give problems 9 – 12 on Student Sheet 13. Discuss the answers. If students get different answers, see whether it is just that one is in simplest terms and the other is not.

Answers:

9) 2/36 or 1/18 10) 8/24 or 1/3 11) 1/20 12) 12/12 or 1

Say:

Can you write 5 as a fraction? (All whole numbers can be written with a denominator of 1; so $5 = \frac{5}{1}$.) **When you multiply a whole number times a fraction, or a fraction times a whole number, you can write the whole number as a fraction; then multiply.** What is 5 x 2/4? **How should you write the problem?** (5/1 x 2/4.) **What is the answer to the problem?** (10/4, 5/2, or 2 and 1/2.)

⇨ Give problems 13 – 16 on Student Sheet 13. Discuss the answers. If students get different answers, see whether the reason is simply that one answer is in simplest terms and the other is not.

Answers: 13) 4/4 or 1 14) 24/3 or 8 15) 50/5 or 10 16) 44/3 or $14\frac{2}{3}$

⇨ Give problems 17 – 20 on Student Sheet 13. Discuss the answers. The purpose of the problems in 17 and 18 is to help students see the difference in addition and multiplication of fractions. The purpose of the problems in 19 and 20 is to show students that sometimes fractions are easier to work with than decimals. They should get the same answers in parts a and b.

Answers:

17) a. 5/8 b. 3/32 18) a. 11/15 b. 2/15

19) a. 3/20 b. 0.15 20) a. 1/8 b. 0.125

⇨ Give problems 1 – 10 on Student Sheet 14. Discuss the answers.

Answers:

1) 9 aces
2) 6/4 hours; 3/2 hours; or 1 and 1/2 hours
3) Joe; 4/10 or 2/5 or of a mile
4) 3/6 yards or 1/2 yard
5) 12 yards
6) 1/10 of a pound
7) $11
8) 1/6 of a quart

⇨ Have one student summarize today's lesson. The students need to understand that in addition and subtraction, you find common denominators before you perform the operation; in multiplication, you do not.

Student Sheet 13 (Number: Lesson 6)

Add or subtract the following fractions and mixed numbers.

1. 1 sixth + 4 sixths

2. 8 fifths – 6 fifths

3. $\frac{2}{9} + \frac{7}{9}$

4. $\frac{2}{9} - \frac{2}{9}$

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5. $\frac{7}{10} + \frac{3}{5}$

6. $\frac{7}{9} - \frac{2}{3}$

7. $\frac{1}{2} - \frac{2}{4}$

8. $\frac{2}{3} + \frac{2}{5}$

Solve each problem. Write the answers in simplest terms.

9. $\frac{2}{9} \times \frac{1}{4}$

10. $\frac{4}{8} \times \frac{2}{3}$

11. $\frac{1}{5} \times \frac{1}{4}$

12. $\frac{4}{3} \times \frac{3}{4}$

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13. $4 \times \frac{1}{4}$

14. $12 \times \frac{2}{3}$

15. $\frac{2}{5} \times 25$

16. $22 \times \frac{2}{3}$

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17. a. $\frac{3}{8} + \frac{1}{4}$
    b. $\frac{3}{8} \times \frac{1}{4}$

18. a. $\frac{1}{3} + \frac{2}{5}$
    b. $\frac{1}{3} \times \frac{2}{5}$

19. a. $\frac{1}{5} \times \frac{3}{4}$
    b. 0.2×0.75

20. a. $\frac{1}{2} \times \frac{1}{4}$
    b. 0.5×0.25

Student Sheet 14 (Number: Lesson 6)

Solve each problem. Write the answers in simplest form.

1. In a recent tennis match, Pete served 90 times. He scored an ace $\frac{1}{10}$ of the time. How many aces did he score?

2. At a recent tennis match, 3 sets were played. The first set lasted $\frac{1}{4}$ hour; the second lasted $\frac{3}{4}$ hour; and the third lasted $\frac{1}{2}$ hour. How long did the entire match last?

3. Trudy lives $\frac{9}{10}$ of a mile from school. Joe lives $\frac{1}{2}$ of a mile from school. Who lives the closer and how much closer does this person live?

4. For the Mardi Gras costumes, $\frac{1}{3}$ yard of ribbon is needed for the hat and $\frac{1}{6}$ yard of ribbon is needed for the neckline. How much ribbon is needed for each costume?

5. Using your answer from problem 4, how many yards of ribbon will be needed for 24 costumes?

6. You have a bag of candy that is $\frac{1}{4}$ full. The bag of candy weighed $\frac{4}{10}$ of a pound when it was full. How much does the bag of candy weigh now?

7. Bryant saw the sweater he has been wanting on sale for $\frac{1}{3}$ off the original price of $33. How much would he save if he bought the sweater on sale?

8. There was $\frac{2}{3}$ of a quart of milk in the refrigerator. One-half quart is needed to make cookies for the party. How much milk will be left?