Grade 6

Math

Coursebook

Oak Meadow

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Table of Contents

Introduction

Lessons

Lesson 1

Multiplication and Division

Mental Math

Mental math games have only one rule: do the math in your head. This brain warm-up helps you get ready for math work just like physical warm-ups help athletes prepare to do their best. You'll find mental math games at the start of each lesson, with a couple variations included. Feel free to make up your own mental math games, and to include other people—you can take turns challenging each other. Plan to do a few minutes of mental math before each math session.

Version 1: Using a deck of cards and a partner, each player turns over one card at a time and lays it faceup on the table. Whoever turned over the highest card has to multiply the two numbers together and say the answer aloud. Keep going until the whole deck is used up. All face cards count as 10, and ace counts as either 1 or 11.

Version 2: Using a deck of cards and a partner, Player 1 draws two cards at a time, keeping them hidden from the other player. Player 1 multiplies the cards and says the total aloud. Player 2 has three chances to guess the value of the two cards Player 1 is holding. After Player 1 reveals the cards, the cards are set aside. Player 2 draws two cards and the game continues. Keep going until the whole deck is used up.

ASSIGNMENT SUMMARY

- ☐ Play mental math games.
- ☐ Complete the Skills Check worksheet.
- ☐ Read New Skills instruction.
- ☐ Complete New Skills Practice.
- ☐ Complete Lesson 1 Test and Learning Checklist.

Skills Check

Complete the following worksheet to brush up on your skills and clear up any areas of confusion.

- Lesson 1 Skills Check

New Skills

We'll start the year off with a review of the skills you learned last year. Some of the skills may seem easy to you and some might need extra attention. In each lesson, read through the New Skills section and examine the examples, even if you think you already know how to do the skill perfectly. You might find yourself learning a new technique that makes it easier and quicker, or you might just increase your confidence with the skill.

Multiplication with Multi-Digit Numbers

Multiplication, especially with large numbers, often involves the process of carrying. Here's an example (sometimes talking through the process can help, so that's how we've done our example):

Example: Multiply 53 by 47.

$$\begin{array}{r} \scriptstyle 1 \\ \scriptstyle \cancel{2} \\ 53 \\ \times\ \ 47 \\ \hline 371 \\ +\ 2{,}120 \\ \hline 2{,}491 \end{array}$$

Step 1: Say to yourself, "7 times 3 is 21, so I bring down the 1 and carry the 2." Then you write a small 2 above the 5.

Step 2: Next, you say to yourself, "7 times 5 is 35, plus the carried 2 makes 37," and you write 37 next to the 1. Now the first line of your answer reads 371.

Step 3: Look at the next digit of the multiplier—the 4 in the tens column. Since you will be multiplying by the number in the tens column, you will start writing your answer in the tens column also. As a reminder not to enter your answer in the ones column, you can put a 0 below the 1 to fill the space in that column. Then say to yourself, "4 times 3 is 12, so I bring down the 2 and carry the 1." You write the 2 in the tens column of the answer, and carry the 1 by writing it above the number we previously carried (the 2). Since you don't need it any more, you can put a line through the 2 if that helps you keep things more clear.

Step 4: Then you say, "4 times 5 is 20, plus the carried 1 makes 21," and you write 21 next to the previous 2. Now the second line of your answer reads 2,120.

Step 5: Finally, you add both lines together (remember to insert a comma between the thousands and the hundreds place). The final answer is 2,491.

This process is the same no matter how many digits there are in your ***multiplier*** (the number doing the multiplying) or ***multiplicand*** (the number being multiplied). With larger numbers, however, it's easy to lose your place while computing the answer—that's why it's so important to keep all the digits lined up according to place value. To help with this, you can add zeros as a placeholder as you write the numbers in the answer (as we did in Step 3 above). You can also cross out carried numbers after you've finished using them to make sure you aren't adding the wrong numbers. Techniques like these can help you avoid multiplication errors.

As you are probably aware, knowing your multiplication tables is very important. If you find yourself having difficulty remembering your times tables as you work through these problems, practice your multiplication tables until they become automatic. You can do this with games, like jumping rope or dribbling a basketball as you recite the tables, or you can play card and dice games that require multiplication (like the one in the mental math section above). You might also want to draw or print out a copy of the multiplication table up through 12 x 12 and post it near your work space to give you something to refer to until you have learned them all by heart.

Multiplying by 10, 100, and 1,000

When multiplying by multiples of 10, 100, or 1,000, you can use the same method as we did above, or you can take this shortcut: Ignore the zeros at the end of the number, multiply the remaining digits, then add the zeros to the right of the answer. Lastly, place the comma in the correct spot.

Example:

$$\begin{array}{r} 27 \\ \times \quad 2{,}000 \\ \hline \end{array}$$

Step 1: Ignore the zeros at the end of the number. 2,000 becomes 2.

Step 2: Multiply the remaining digits. $27 \times 2 = 54$

Step 3: Add the zeros from the original number to the right of the answer, and add the comma in the correct spot.

$$\begin{array}{r} {\color{red}1} \\ 27 \\ \times \quad 2{,}000 \\ \hline 54{,}000 \end{array}$$

Make sure you ONLY ignore and then add back onto the answer the zeros that appear at the end of the numbers, not in the middle. This doesn't work for numbers like 803 or 2,003; it only works for multiples of 10 (or 100, 1,000, etc.).

You can use this technique for any numbers that end in zero—just multiply the numbers as though the ending zeros aren't there, and then add up the number of zeros in the original numbers and put them to the right of the answer.

Example:

$$\begin{array}{r} 250 \\ \times \quad 7{,}000 \\ \hline \end{array}$$

Step 1: Ignore the zeros at the ends of the numbers (there are four of them). 250 becomes 25 and 7,000 becomes 7.

Step 2: Multiply the remaining digits. $25 \times 7 = 175$

Step 3: Add the zeros from the original numbers to the right of the answer, and add the commas in the correct spot.

$$\begin{array}{r} 250 \\ \times \quad 7{,}000 \\ \hline 1{,}750{,}000 \end{array}$$

Division of Whole Numbers

You had a lot of practice with division last year, but a little refresher of the terms and process might be helpful. The number on the outside of the division bracket is called the ***divisor***—this is the number you are dividing by. The number on the inside of the bracket is called the ***dividend***, which is the number being divided. The answer, which is on top of the bracket, is called the ***quotient***.

We divide whole numbers through a four-step process: divide, multiply, subtract, and bring down. To solve problems, we just continue to use these same steps over and over until the problem is complete.

Example: $3\overline{)756}$

Step 1: Divide. Begin by saying, "How many times does 3 go into 7?" Put a 2 above the 7. Be very careful to place it in the correct spot.

$$\begin{array}{r} 2 \\ 3\overline{)756} \end{array}$$

Step 2: Multiply. Next, say to yourself, "2 times 3 is 6." Put this answer below the 7.

$$\begin{array}{r} 2 \\ 3\overline{)756} \\ 6 \end{array}$$

Step 3: Subtract. Now you have to subtract the 6 from the 7, so you say, "7 minus 6 is 1" and you draw a line under the 6 and write 1 below it. Make sure to keep the numbers lined up correctly.

$$\begin{array}{r} 2 \\ 3\overline{)756} \\ \underline{6} \\ 1 \end{array}$$

Step 4: Bring down. Finally, you have to bring down the next digit of the dividend (the 5) and put it next to the 1, which makes it 15.

$$\begin{array}{r} 2 \\ 3\overline{)756} \\ \underline{6} \\ 15 \end{array}$$

Continue with the problem by repeating the four steps.

Step 1: Divide. Ask, "How many times does 3 go into 15?" Put the answer, 5, above the 5 in the dividend. Make sure to keep all the numbers carefully lined up.

Step 2: Multiply. Say, "5 times 3 is 15." Write the 15 below the other 15.

Step 3: Subtract. Say, "15 minus 15 is 0." Draw a line under the 15 and write 0.

Step 4: Bring down. Bring down the next digit in the dividend, which is a 6. The problem now looks like this:

$$\begin{array}{r} 25 \\ 3\overline{)756} \\ \underline{6} \\ 15 \\ \underline{15} \\ 06 \end{array}$$

Keep repeating the 4-step process until there are no more numbers to bring down.

Step 1: Divide 3 into 6. It goes 2 times. Write the 2 at the top above the 6.

Step 2: Multiply 2 times 3. It equals 6. Write the 6 at the bottom, below the other 6.

Step 3: Subtract 6 from 6. It equals 0, so draw a line under the 6 and write the 0 below the line.

Step 4: Since there is nothing left to bring down and no spaces at the top, the problem is finished. The final answer is 252, and the problem looks like this:

$$\begin{array}{r} 252 \\ 3\overline{)756} \\ \underline{6} \\ 15 \\ \underline{15} \\ 06 \\ \underline{6} \\ 0 \end{array}$$

Sometimes you have to look beyond the first digit of the dividend when doing the first step of a division problem. Look at the following example:

Example: $4\overline{)368}$

Since you can't divide the 4 into the 3 because 4 is larger than 3, you simply include the next digit. In this problem, you would divide 4 into 36, and then continue with the problem as usual.

$$
\begin{array}{r}
92 \\
4\overline{)368} \\
\underline{36} \\
08 \\
\underline{8} \\
0
\end{array}
$$

Creating Fractions with Remainders

In all of the problems we've presented, when the last line came out to 0 and you had no more numbers to bring down, the problem was finished. But sometimes there is a ***remainder***, as you see in the following problem:

$$
\begin{array}{r}
24 \\
2\overline{)49} \\
\underline{4} \\
9 \\
\underline{8} \\
1
\end{array}
$$

After all the steps of the division process are done, we are left with a remainder of 1. To complete the problem, we take the remainder and put it over the divisor to create a fraction that is included in the answer. For the example above, we would take the remainder of 1 and put it over the 2 (the divisor) to create the fraction $\frac{1}{2}$, giving us a final answer of $24\frac{1}{2}$:

$$
\begin{array}{r}
24\frac{1}{2} \\
2\overline{)49} \\
\underline{4} \\
9 \\
\underline{8} \\
1
\end{array}
$$

Remainders in division problems should always be written as fractions.

New Skills Practice

To practice these skills, complete the following worksheets (all worksheets and tests are found in your math workbook):

- Lesson 1 New Skills Practice: Multiplication and Division of Whole Numbers
- Lesson 1 Test

Remember to **show all your work**. After completing the New Skills Practice, check your answers using the answer key in the appendix of the math workbook. Circle any incorrect answers and then rework these problems. Ask for help if you need it. You will also find additional practice worksheets in the workbook that you can use any time you need more practice with a particular skill.

Once you understand the material, complete the lesson 1 test. Your parent will check your answers, score the test, and then have you redo any incorrect problems.

Redoing any problems that you answered incorrectly may seem like a waste of time, but it's really important! Making corrections helps you figure out where you made a mistake, clear up any confusion in the process, and ensure that you are doing the skills correctly as you move forward. This will save you a lot of time in the long run. Be patient, take your time, and make sure you understand things before moving on to the next lesson.

Make the following procedures a habit with all your work:

- Show all of the calculations and processes in your work. Write down each step of a process, even if you can work out the solution in your head.
- Double check your answers using the opposite (or inverse) operation. When you are solving an addition problem, check your answer by using subtraction, and vice versa. When you are solving a division problem, check your answer by using multiplication, and vice versa. If you do not know how to do this, ask a parent or tutor, or refer to *Oak Meadow Grade 5 Math*.
- When answering word problems, use complete sentences and include the unit label for what you are measuring (for example, cards, inches, pizzas, etc.)

FOR ENROLLED FAMILIES

You will be sending the lesson 1 test to your Oak Meadow teacher at the end of the next lesson. Please check the answers using the answer key in the appendix of the math workbook. Circle any incorrect problems. Score the test, and write the number correct over the total number at the top of the page. For instance, if there are 25 problems in the test and your student gets two wrong, you would write $\frac{23}{25}$ at the top. Have your student redo any incorrect problems. Encourage your child to talk through the problem aloud so you can see where the error occurred and help your child fix it.

All math work must be checked and corrected so that your student learns how to perform each skill accurately and consistently. Students should check the answers on all worksheets themselves (anything other than tests), and make corrections. These practice worksheets won't be sent to your teacher, but completing them will help strengthen your student's skills.

Once this lesson is complete, move on to lesson 2. Feel free to contact your teacher if you have any questions about the assignments or the learning process.

Lesson

2

Two-Digit Divisors

Mental Math

Do the following mental math games as a warm-up to your math lesson. Remember, do all the math in your head. Feel free to make up games of your own and get others involved.

Version 1: Ask someone to give you three numbers between 1 and 10. Double each number and then add them together. Do this several times.

Version 2: Ask someone to give you three two-digit numbers. Add them up in your head. For an extra challenge, double each one before adding it to the total.

Skills Check

Complete the following worksheet to keep your skills sharp and clear up any areas of confusion.

- Lesson 2 Skills Check

New Skills

Two-Digit Divisors

When we divide by two-digit divisors, we follow the same four-step process we use for one-digit divisors, but we just use the entire two-digit divisor for each step.

Example: $12\overline{)493}$

Step 1: Divide. Ask yourself, "How many times does 12 go into 4?" Since 12 doesn't go into 4, ask "How many times does 12 go into 49?" 12 × 4 = 48, so 12 goes into 49 4 times. Write 4 as the quotient above the bracket, directly above the 9 in the dividend.

Step 2: Multiply. Say, "12 times 4 is 48." Write 48 under the 49. Make sure to keep things lined up carefully.

ASSIGNMENT SUMMARY

- ☐ Play mental math games.
- ☐ Complete the Skills Check worksheet.
- ☐ Read New Skills instruction.
- ☐ Complete New Skills Practice.
- ☐ Complete Lesson 2 Test and Learning Checklist.

Step 3: Subtract. Say, "49 minus 48 equals 1." Draw a line under the 48 and write 1 underneath the line.

Step 4: Bring down. Bring down the next digit in the dividend, the 3, to make 13. When you've completed this last step in the four-step process, the problem looks like this:

$$\begin{array}{r} 4 \\ 12\,\overline{)\,493} \\ \underline{48} \\ 13 \end{array}$$

Continue by repeating the four-step process:

Step 1: Divide. Ask, "How many times does 12 go into 13?" Since the correct answer is 1, write a 1 in the quotient, next to the 4.

Step 2: Multiply. Say "12 times 1 is 12," and write the number 12 underneath the 13.

Step 3: Subtract. Next, draw a line under the 12, subtract 12 from 13, and write 1 underneath.

Step 4: Since there is nothing left in the dividend to bring down, we put the remainder over the divisor to create the fraction $\frac{1}{12}$, and the problem is finished.

$$\begin{array}{r} 41\tfrac{1}{12} \\ 12\,\overline{)\,493} \\ \underline{48} \\ 13 \\ \underline{12} \\ 1 \end{array}$$

You can divide by numbers of any size using these same four steps, but with larger numbers you have to remember to keep each digit in a straight line above and below the others, so that you bring down the correct digit.

Estimating with Large Divisors

When you are working with large divisors, one approach that can help you solve the problem more quickly is to **estimate the quotient** before you divide. Consider the following example:

Example: $21\,\overline{)\,4943}$

Step 1: Start with the divide step, but instead of trying to determine how many times 21 goes into 49, estimate the quotient by asking yourself how many times the first digit of the divisor goes into the first digit of the dividend. Ask yourself, "How many times does 2 go into 4?" Since 2×2 is 4, try 2 as the quotient. Write 2 in the quotient directly above the 9 in the dividend.

Step 2: Continue with the multiply step, by saying, "2 times 21 is 42." Write 42 under the 49. Here is where you find out if your estimate was correct. If you discovered that your estimate was too large (your answer in the multiply step is larger than the number you are subtracting from), then you would decrease the estimate in the quotient by 1 and multiply again. If it was too small, then increase it by 1 and multiply again.

Step 3: Next, proceed with the subtract step by saying, "49 minus 42 equals 7." Draw a line under the 42 and write 7 underneath the line.

Step 4: The final step in the four-step process is bring down, so bring down the next digit in the dividend, the 4, to make 74. When you've completed this fourth step in the four-step process, the problem looks like this:

$$\begin{array}{r} 2 \\ 21\overline{)4943} \\ \underline{42} \\ 74 \end{array}$$

Step 1: Now start the four-step process over again with the divide step by estimating the quotient again. Ask yourself, "How many times does 2 go into 7?" Since the correct answer is 3, write a 3 in the quotient, next to the 2.

Step 2: Then go to the multiply step again, say "3 times 21 is 63," and write the number 63 underneath the 74. Once again, if your estimate was either too high or too low, you would correct it at this point.

Step 3: Next, draw a line under the 63, subtract 63 from 74, and write 11 underneath.

Step 4: Finally, bring down the next digit in the dividend, the 3, and put it next to the 11 so it makes 113. At this point, the problem looks like this:

$$\begin{array}{r} 2 \\ 21\overline{)4943} \\ \underline{42} \\ 74 \\ \underline{63} \\ 113 \end{array}$$

Step 1: Now start the four-step process again with the divide step by estimating the quotient again. Ask yourself, "How many times does 2 go into 1?" 2 doesn't go into 1, so include the next digit and ask yourself "How many times does 2 go into 11?" The answer is 5, so write 5 in the quotient next to the 23, to make 235.

Step 2: Then multiply 5 times 21 and get 105. Write it underneath the 113. Again, here is where you can correct your estimate, if necessary.

Step 3: Next, draw a line under the 105 and subtract 105 from 113. Write the answer, 8, under the line.

Step 4: Now we are at the final step of the four-step process, but since there is nothing left in the dividend to bring down, we put the remainder 8 over the divisor 21 to make the fraction $\frac{8}{21}$. We add this next to the whole numbers in the quotient, and the problem is finished.

$$\begin{array}{r@{}l} & \;\;235\frac{8}{21} \\ 21 & \overline{)4943} \\ & \underline{42} \\ & 74 \\ & \underline{63} \\ & 113 \\ & \underline{105} \\ & 8 \end{array}$$

Estimating quotients using the first digit of the divisor will work fairly well in many cases. But for greater accuracy in estimating two-digit divisors, it's best to **round the divisor to the nearest ten before estimating**. To do this, follow the standard rule for rounding: Look one place to the right of the place you want to round to. If the digit in that place is 5 or more, round up, if it's less than 5, round down. So if the divisor is 18, you would round it to 20 and use 2 to estimate the quotient. Likewise, if the divisor is 35, you would round it to 40 and use 4 to estimate the quotient. But if the divisor is 53, you would round it to 50 and use 5 to estimate the quotient.

Even if you round divisors before estimating, you will still find some problems in which this gives you an estimate that is not correct. In this case, just adjust the estimate in the multiply step of the four-step process.

New Skills Practice

Complete the following worksheets in your math workbook:

- Lesson 2 New Skills Practice: Two-Digit Divisors, and Estimating with Large Divisors
- Lesson 2 Test

Remember to show all your work. Check your answers using the answer key, and circle any incorrect answers before reworking these problems. Ask for help or use the additional practice worksheets if you need to.

Once you understand the material, complete the lesson test. Your parent will check your answers for the test and have you redo any incorrect problems.

FOR ENROLLED FAMILIES

After your student completes the Skills Check, New Skills Practice, and Lesson 2 Test for this lesson, please have your student complete the Lesson 2 Assessment Test. Make sure the skills worksheets and the lesson 2 test have been corrected and your student has fixed any errors BEFORE taking the Assessment Test. All lesson tests should be scored (by you) and corrected (by your student) before being submitted to the teacher along with the Assessment Test. If you have any questions about this, please let your teacher know.

At the end of this lesson, submit the following three items to your Oak Meadow teacher:

- Lesson 1 Test
- Lesson 2 Test
- Lesson 2 Assessment Test

Please include any additional notes about the lesson work or anything you'd like your teacher to know. Feel free to include questions with your documentation—your teacher is eager to help. Do not include any of the practice worksheets (Skills Check, New Skills Practice, or extra practice worksheets).

If you have any questions about what to send or how to send it, please refer to your Parent Handbook and your teacher's welcome letter. Your teacher will respond to each submission of student work with detailed comments and individualized guidance. In the meantime, have your student proceed to lesson 3 and continue working.

Lesson 6

Lowest Common Denominator

Mental Math

Version 1: Try reducing fractions in your head. Start with a few easy ones (like $\frac{9}{12}$ or $\frac{3}{15}$) and then pose some harder ones for yourself. It might work better if you write down four or five fractions ahead of time, and then reduce them in your head one at a time. Or you can ask someone else to name a few fractions for you to reduce.

Version 2: Here's a different way to do the fraction mental math game above. Start with a fraction and then rename it by expanding it. For instance, if you start with $\frac{3}{5}$, you can expand it to $\frac{6}{10}$ and then $\frac{9}{15}$. First, expand it by $\frac{2}{2}$, and then by $\frac{3}{3}$. See how far you can go with it.

ASSIGNMENT SUMMARY

- ☐ Play mental math games.
- ☐ Complete the Skills Check worksheet.
- ☐ Read New Skills instruction.
- ☐ Complete New Skills Practice.
- ☐ Complete Lesson 6 Test and Learning Checklist.

Skills Check

Complete the following worksheet to practice some of the skills you have learned.

- Lesson 6 Skills Check

New Skills

Common Denominators

Adding or subtracting fractions that have the same denominators is easy—we only need to add or subtract the numerators. But in many problems involving fractions, the denominators are not the same so we can't just add or subtract the numerators; we have to rename one or both of the fractions by finding a ***common denominator***. This is a number that can be divided evenly by both denominators in the problem.

There are several ways to find a common denominator for two fractions:

1. Use the largest denominator in the problem.
2. Multiply the two denominators.
3. Compare the multiples of both denominators and choose the lowest multiple that both fractions have in common.

The first approach doesn't always work but it's a good place to start. The other two techniques will always work.

Let's look at the first approach:

1. **Use the largest denominator in the problem.**

Example: $\frac{3}{8} - \frac{1}{4}$

Step 1: Using the largest denominator in the problem is the easiest thing to do, but it doesn't always work. In this example, the largest denominator is 8 and the smallest denominator is 4. Does 4 go into 8 evenly? Yes, $4 \times 2 = 8$, so 8 will be our common denominator.

Step 2: Write the equation in vertical format and then add the equal sign and the common denominator. Since the top fraction isn't changing, write that as is:

$$\begin{array}{r} \frac{3}{8} = \frac{3}{8} \\ -\frac{1}{4} = \frac{}{8} \\ \hline \end{array}$$

Step 3: Look at the denominator in the bottom fraction. Say to yourself, "4 goes into 8 2 times." Look at the numerator in the bottom fraction and say, "2 times 1 is 2." The number 2 is your new numerator, and the fraction $\frac{1}{4}$ is renamed as $\frac{2}{8}$. You've expanded $\frac{1}{4}$ by multiplying it by $\frac{2}{2}$. Remember, expanding doesn't change its value, only renames it.

Step 4: Now you can subtract as usual:

$$\begin{array}{r} \frac{3}{8} = \frac{3}{8} \\ -\frac{1}{4} = \frac{2}{8} \\ \hline \frac{1}{8} \end{array}$$

Let's look at the next approach:

2. **Multiply the two denominators.**

Example: $\frac{2}{3} + \frac{3}{4}$

Step 1: In this problem we can't use the largest denominator, because 3 won't divide evenly into 4, so we'll multiply the two denominators. In this example, we would multiply 3 by 4 and get 12.

This is the common denominator. As before, write the problem in a vertical format and add the equal sign and a common denominator:

$$\begin{array}{r} \frac{2}{3} = \frac{}{12} \\ + \frac{3}{4} = \frac{}{12} \\ \hline \end{array}$$

Step 2: Look at the denominator in the top fraction and say, "How many times does 3 go into 12?" The answer is 4, so you multiply the numerator by 4, and end up with $\frac{8}{12}$.

$$\begin{array}{r} \frac{2}{3} = \frac{8}{12} \\ + \frac{3}{4} = \frac{}{12} \\ \hline \end{array}$$

Step 3: Look at the denominator in the bottom fraction and say, "How many times does 4 go into 12?" The answer is 3, so you multiply the numerator by 3 to make $\frac{9}{12}$.

Step 4: Then add as usual, and reduce the fraction to lowest terms by converting the improper fraction to a mixed number:

$$\begin{array}{r} \frac{2}{3} = \frac{8}{12} \\ + \frac{3}{4} = \frac{9}{12} \\ \hline \frac{17}{12} = 1\frac{5}{12} \end{array}$$

The third approach will help find the lowest common denominator.

Finding the Lowest Common Denominator (LCD)

Multiplying the two denominators will always give you a common denominator, but often this denominator will be quite large and must be reduced to lowest terms at the end of the problem. To avoid having to reduce fractions at the end of the problem, you always look for the lowest common denominator, or LCD. Sometimes, the first two approaches will give us the LCD. If not, we use a third approach:

3. **Compare the multiples of both denominators and choose the lowest multiple that both fractions have in common.**

Example: $\frac{1}{6} + \frac{1}{8}$

Step 1: As usual, we first look to see if we can use the largest denominator in the problem as a common denominator, but we find that this doesn't work because we can't divide 6 into 8 evenly. So we try the second approach: we multiply the two denominators. We can do this, but we end up with 48 for a denominator and that's a pretty big number. So we compare the multiples of the two denominators:

Multiples of 6:	6	12	18	**24**	30	36	42	**48**
Multiples of 8:	8	16	**24**	32	40	**48**	56	64

We find that 24 is a multiple of both denominators, as well as 48, but we'll want to use 24 for our lowest common denominator since it's the lowest common multiple.

Step 2: Once we've found the LCD, we complete the problem as usual:

$$\begin{array}{r} \frac{1}{6} = \frac{4}{24} \\ + \frac{1}{8} = \frac{3}{24} \\ \hline \frac{7}{24} \end{array}$$

Using LCDs in Mixed Number Addition

Finding the lowest common denominator is also helpful when you are adding or subtracting mixed numbers.

Example: $2\frac{3}{4} + 3\frac{5}{6}$

Step 1: Find the common denominator. Don't focus on the whole number right now; just look at the denominator of the two fractions. When you've decided what the LCD will be, write the fractions in vertical format, add the equal sign, and enter the common denominator.

$$\begin{array}{r} 2\frac{3}{4} = 2\frac{\quad}{12} \\ + 3\frac{5}{6} = 3\frac{\quad}{12} \\ \hline \end{array}$$

Step 2: Look at the denominator in the top fraction. Say to yourself, “4 goes into 12 (the common denominator) 3 times.” Then multiply the numerator by 3 to get $\frac{9}{12}$.

Step 3: Repeat the process for the second fraction. Say, “6 goes into 12 2 times,” and multiply the numerator by 2 to get $\frac{10}{12}$.

$$\begin{array}{r} 2\frac{3}{4} = 2\frac{9}{12} \\ + 3\frac{5}{6} = 3\frac{10}{12} \\ \hline \end{array}$$

Step 4: Complete the problem and reduce your answer to lowest terms.

$$\begin{array}{r} 2\frac{3}{4} = 2\frac{9}{12} \\ + 3\frac{5}{6} = 3\frac{10}{12} \\ \hline 5\frac{19}{12} = 6\frac{7}{12} \end{array}$$

When you add mixed numbers using a common denominator, you often end up with a mixed number and an improper fraction. If so, you reduce as usual. If the result is a mixed number with an improper fraction that equals 1, just convert the fraction to 1 and add it to the whole number. So an answer of $3\frac{8}{8}$ would reduce to 4.

Subtracting and Regrouping with Mixed Numbers and LCDs

The process for finding lowest common denominators when you’re subtracting mixed numbers is the same as that used in addition. However, sometimes the top fraction in a mixed number may not be large enough to subtract the bottom fraction. When this happens, you have to take an extra step to rename the mixed number by regrouping, as follows:

Example: $7\frac{1}{2} - 4\frac{3}{4}$

Step 1: First, find the lowest common denominator and convert the fractions as usual:

$$\begin{array}{r} 7\frac{1}{2} = 7\frac{2}{4} \\ - 4\frac{3}{4} = 4\frac{3}{4} \\ \hline \end{array}$$

Step 2: Since you can't subtract $\frac{3}{4}$ from $\frac{2}{4}$, you borrow 1 from the 7, which changes the whole number to 6. Then you rename the 1 you borrowed, using the common denominator, so the 1 becomes $\frac{4}{4}$. This does not change the value of the number; it just expresses it in another form. You add $\frac{2}{4}$ and $\frac{4}{4}$ to get $\frac{6}{4}$. Now you can solve the problem as usual:

$$\begin{array}{r} 7\frac{1}{2} = 7\frac{2}{4} = 6\frac{6}{4} \\ -\ 4\frac{3}{4} = 4\frac{3}{4} = 4\frac{3}{4} \\ \hline 2\frac{3}{4} \end{array}$$

Sometimes, the value of the fractions in the mixed number may be the same, and the fraction in the answer will equal 0. In this case, since any fraction with 0 in the numerator equals 0, you can delete the fraction and just keep the whole number, as in the following example:

Example: $12\frac{3}{5} - 10\frac{6}{10}$

$$\begin{array}{r} 12\frac{3}{5} = 12\frac{6}{10} \\ -\ 10\frac{6}{10} = 10\frac{6}{10} \\ \hline 2\,\frac{0}{10} = 2 \end{array}$$

Always remember to reduce fractions in answers to lowest terms.

New Skills Practice

Complete the following worksheets in your math workbook:

- Lesson 6 New Skills Practice: Lowest Common Denominator (LCD) in Mixed Number Addition and Subtraction
- Lesson 6 Test

Show all your work and check your answers, reworking any incorrect problems.

FOR ENROLLED FAMILIES

At the end of this lesson, submit the following three items to your Oak Meadow teacher:

- Lesson 5 Test
- Lesson 6 Test
- Lesson 6 Assessment Test

Make sure the two lesson tests have been graded (by you) and then corrected (by your child). Do not include any of the practice worksheets with your submission.

Lesson

7

Multiplying Fractions and Mixed Numbers

Mental Math

Version 1: Put a pile of pennies, nickels, dimes, and quarters into a bag. Without looking, reach in and grab a handful. Add up the total amount. Remember this number. Drop the coins back in the bag and grab another handful. Add this amount and then add it to your first number. Do this a few times.

Version 2: Using the bag of coins, reach in and grab a handful. Add them up. If the total is less than one dollar, figure out how much more money you would need to make one dollar. What are the possible coin combinations that would amount to this total? If the total is more than one dollar, figure out how much more money you would need to make five dollars. What combination of bills and coins would you need? Do this a couple of times.

ASSIGNMENT SUMMARY

- ☐ Play mental math games.
- ☐ Complete the Skills Check worksheet.
- ☐ Read New Skills instruction.
- ☐ Complete New Skills Practice.
- ☐ Complete Lesson 7 Test and Learning Checklist.

Skills Check

Complete the following worksheet to practice some of the skills you have learned.

- Lesson 7 Skills Check

New Skills

Multiplying Simple Fractions

So far we've been adding and subtracting fractions, but sometimes we need to multiply and divide fractions. To multiply simple fractions, you just multiply the numerators to get a new numerator, then multiply the denominators to get a new denominator.

Example: $\frac{3}{5} \times \frac{2}{3}$

Say to yourself, "3 times 2 is 6," and write that as the numerator in the answer. Then say, "5 times 3 is 15," and write that as the denominator. Then reduce the answer to lowest terms, if necessary.

$$\frac{3}{5} \times \frac{2}{3} = \frac{6}{15}$$

Example: $\frac{4}{10} \times \frac{5}{9}$

$$\frac{4}{10} \times \frac{5}{9} = \frac{20}{90} = \frac{2}{9}$$

When we multiply whole numbers and simple fractions, we first have to convert the whole number into a fraction. To do this, we simply put the whole number over the number 1.

Example: $7 \times \frac{4}{5}$

First, we change the whole number 7 to the fraction $\frac{7}{1}$. Notice that this doesn't change the value of the number; $\frac{7}{1}$ is just an improper fraction, and if we reduce it we get 7 again. All we have done is to rename it as a fraction instead of a whole number.

$$7 \times \frac{4}{5} = \frac{7}{1} \times \frac{4}{5}$$

Now we can multiply the numerators and then multiply the denominators. Finally, reduce the answer to lowest terms.

$$7 \times \frac{4}{5} = \frac{7}{1} \times \frac{4}{5} = \frac{28}{5} = 5\frac{3}{5}$$

Fractions in Word Problems

In word problems, multiplication of fractions is often indicated by the word *of*. Look at the following example:

Example: What is $\frac{2}{3}$ of 20?

$$\frac{2}{3} \text{ of } 20 = \frac{2}{3} \times 20 = \frac{2}{3} \times \frac{20}{1} = \frac{40}{3} = 13\frac{1}{3}$$

Example: Rachel collected 24 colored rocks on the beach. If $\frac{1}{3}$ of the rocks are green, how many green rocks were collected?

$$\frac{1}{3} \text{ of } 24 = \frac{1}{3} \times 24 = \frac{1}{3} \times \frac{24}{1} = \frac{24}{3} = 8$$

Rachel collected 8 green rocks.

Multiplying Fractions and Mixed Numbers

To multiply a fraction and a mixed number, we first have to change the mixed number to an improper fraction. Then we multiply the fractions as usual:

Example: $\frac{3}{4} \times 2\frac{1}{2}$

The first step is to change the mixed number to an improper fraction. To do this, multiply the denominator of the fraction by the whole number, add the numerator, and put that over the denominator. Say to yourself, "2 times 2 is 4, plus 1 is 5." Put the 5 over the 2 to make $\frac{5}{2}$, then rewrite the problem using the improper fraction:

$$\frac{3}{4} \times 2\frac{1}{2} = \frac{3}{4} \times \frac{5}{2}$$

Now we can multiply the fractions as usual, then reduce.

$$\frac{3}{4} \times 2\frac{1}{2} = \frac{3}{4} \times \frac{5}{2} = \frac{15}{8} = 1\frac{7}{8}$$

Example: $4\frac{5}{6} \times \frac{1}{3}$

Change the mixed number to an improper fraction. Say to yourself, "4 times 6 is 24, plus 5 is 29." Put the 29 over the 6 to make $\frac{29}{6}$, then rewrite the problem with the improper fraction:

$$4\frac{5}{6} \times \frac{1}{3} = \frac{29}{6} \times \frac{1}{3}$$

Multiply the fractions as usual, then reduce.

$$4\frac{5}{6} \times \frac{1}{3} = \frac{29}{6} \times \frac{1}{3} = \frac{29}{18} = 1\frac{11}{18}$$

To multiply mixed numbers, we simply change both mixed numbers into improper fractions, then multiply as usual:

Example: $3\frac{1}{2} \times 2\frac{2}{3}$

Change both mixed numbers to improper fractions. $3\frac{1}{2}$ becomes $\frac{7}{2}$, and $2\frac{2}{3}$ becomes $\frac{8}{3}$. Rewrite the problem with the new fractions:

$$3\frac{1}{2} \times 2\frac{2}{3} = \frac{7}{2} \times \frac{8}{3}$$

Multiply the fractions as usual, then reduce.

$$3\frac{1}{2} \times 2\frac{2}{3} = \frac{7}{2} \times \frac{8}{3} = \frac{56}{6} = 9\frac{2}{6} = 9\frac{1}{3}$$

Example: $4\frac{4}{5} \times 7\frac{1}{3}$

Change both mixed numbers to improper fractions.

$$4\frac{4}{5} \times 7\frac{1}{3} = \frac{24}{5} \times \frac{22}{3}$$

Multiply the fractions as usual, then reduce.

$$4\frac{4}{5} \times 7\frac{1}{3} = \frac{24}{5} \times \frac{22}{3} = \frac{528}{15} = 35\frac{3}{15} = 35\frac{1}{5}$$

As you can see, it might take several steps to reduce an answer to lowest terms—just keep going until you can't reduce the number any further.

New Skills Practice

Complete the following worksheets in your math workbook:

- Lesson 7 New Skills Practice: Multiplying Using Simple Fractions and Mixed Numbers, Fractions in Word Problems
- Lesson 7 Test

Show all your work and check your answers, reworking any incorrect problems.