Sixth Grade Math Overview

	First Semester	Second Semester
Math	Two-digit divisors Reducing fractions to lowest terms Lowest common denominator Multiplying and dividing fractions and mixed numbers Multiplying and dividing decimals Dividends of less than one Measurements of distance, weight, and volume	Calculating percentages Converting between fractions, decimals, and percentages Ratios and probability Perimeter, radius, and diameter Area of irregular shapes Equations with missing numbers Exponents Order of operations

Grade 6
Math
Coursebook

Oak Meadow

Oak Meadow, Inc.
Post Office Box 615
Putney, Vermont 05346
oakmeadow.com

Table of Contents

Introduction

Lessons

Introduction

Welcome to Grade 6 Math!

Math skills give you the tools to find real-world solutions to a variety of problems. This year, we'll continue to build on the skills you learned last year and add new ones.

Before you dive into lesson 1, please read this introduction so you have a clear idea of what to expect.

Course Materials

This course includes the following materials:

Oak Meadow Grade 6 Math Coursebook

Oak Meadow Grade 6 Math Workbook and Answer Key

Complete instructions for each lesson are found in the coursebook. In the workbook, you will find all the practice worksheets for each lesson, all the lesson tests, and the answer key for each worksheet and test. You'll also find a collection of extra practice worksheets that can be used whenever you need more practice with a particular skill.

You are expected to use the answer key to check your answers after you have completed each practice worksheet. Circle any incorrect answer, and then redo those problems. If you still have trouble getting the correct answer, ask someone for help. You will check your answers for all practice worksheets and your parent will use the answer key to check your answers after each test, circling any incorrect answers, and then giving you the opportunity to make test corrections.

Here are a few additional materials you'll need for this course:

- Deck of cards
- 4 or more dice
- Ruler marked with both inches and millimeters/centimeters
- Random collection of coins (pennies, nickels, dimes, and quarters or the local currency)

How the Course Is Organized

This course is divided into 36 lessons. Each lesson is designed to be done in one week. You can expect to spend about three to four hours on each lesson. It's best to divide up the work throughout the week rather than trying to do it all in one day. You may find that some lessons cover more material or have more practice problems than others; looking over the lesson before you begin can give you a good sense of how long it will take to complete.

Lessons will include the following:

Assignment Summary: A checklist of assignments is included at the beginning of each lesson so you can check off assignments as you complete them and see at a glance what still needs to be done.

Mental Math: Mental math games are math problems that you do in your head. You won't write anything down (or turn in anything to your teacher). These mental math exercises will get your brain all warmed up and ready to learn new material. Don't skip these! They will really help your math skills improve.

Skills Check: In each lesson, you'll have a chance to practice some of the skills you've already learned.

New Skills: Each new skill is explained fully with examples that show you the step-by-step process. Some of the "new" skills may be familiar to you—that's okay. You can still benefit from reviewing the material and looking over the examples.

New Skills Practice: Worksheets are provided to give you a chance to practice each new skill.

Lesson Test: At the end of each lesson, you will find a lesson test that gives you a chance to demonstrate your skills.

Learning Checklist: At the end of each test, you'll find a learning checklist to fill out. This checklist lets you and your parent or teacher keep track of which skills are easy for you and which need more work.

For Enrolled Families: This section is for families who are enrolled in Oak Meadow School and sending their work to an Oak Meadow teacher. It provides information and reminders about how and when to submit work.

Every few lessons, you will find a Skills Review lesson. This lesson gives you time to review all that you've learned and brush up on any skills that need more practice. You can use the extra practice worksheets (found in the back of the math workbook) to work on your skills at any time.

Study Tips to Help You Get the Most Out of This Course

1. **Read the math instruction in each lesson** even if it seems like something you already know. It will help to refresh your memory and perhaps give you new information or techniques that will help you in the long run.
2. In all your math work, **show your work**. This means you will show evidence of carrying, borrowing, and figuring multiplication and division step by step. Whatever process you use to solve a problem, show this in your work. Even if you can figure out the problem in your head, write down how you reached the answer. Since the answer key is provided, **simply writing down the answer is not enough**—you have to show your calculations for each step. This not only proves that you know how to do the problem, but if mistakes are occurring, it shows your parent or teacher where help is needed.
3. When you are practicing new skills, refer to the information in the coursebook if you need help. If you are still confused, **ask for help**. You can use the extra practice worksheets in the math workbook if you need more time to gain confidence with a skill.
4. After you complete each worksheet, check your answers at the back of the book and rework any incorrect problems. Get an adult to help you if necessary. **Make all the corrections before you move on to the next worksheet**—this helps you avoid making the same mistakes over and over without realizing it.
5. Make sure to **use the answer key AFTER completing each worksheet**. Copying answers from the answer key won't help you succeed. Not only is that considered cheating, but it prevents you from learning to think for yourself and persevere in your efforts to learn.
6. For the lesson tests, **solve all the problems on your own**, without looking at the coursebook or asking for help. Once you have done your best, ask a parent to check your answers in the answer key. Your parent will circle any wrong answers (and put your test score at the top of the test), and then you can **make test corrections**, using the coursebook to review any skills you need help with.
7. When you are making corrections, **talk through the problem aloud**. This helps you focus on each step of the process and lets your parent or teacher hear where you may be having trouble. Being able to explain a math process or talk your way through a math problem is an important skill and will reinforce your learning and memory.

Ready to Learn

Learning math can be challenging at times, but ultimately, very satisfying. If you find yourself struggling, take control of your learning and reach out for help. It may be that working to strengthen previous skills will help you move forward with confidence, or that having a new skill explained in a different way is all you need. Each skill forms the foundation for what comes later, so make sure you understand the material in each lesson before moving on. We wish you a great year full of mathematics learning, discovery, and satisfaction.

For the Parent

By sixth grade, many students are working well on their own, able to pace themselves and work independently. Other students, however, may need extra support, so please pay careful attention to your student's progress. Providing help or encouragement can go a long way toward preventing frustration and negative feelings about math.

It is important that you look over your child's work on lesson tests and check the answers against the answer key in the workbook. Your student can self-correct the practice worksheets using the answer key, but you should **correct all tests so that you can spot any weaknesses or confusion and help clear it up immediately**. This instant feedback is essential to student success. Circle any incorrect answers, put the test score at the top of the test, and then have your student make test corrections BEFORE moving on to the next lesson. Math skills are cumulative and a clear understanding of each concept or skill is necessary.

In the appendix of the math workbook, we have included many extra practice worksheets. These can be used if your student needs more time to work on a particular skill. The extra practice worksheets are organized by lesson, and listed in the table of contents. If you don't find what you are looking for, feel free to make up some extra practice problems of your own. There are lots of great online resources for math worksheets, as well.

Many parents remember struggling with math as a child. This curriculum is designed to guide the student through increasingly complex skills one step at a time to alleviate any frustration or struggle. The skills review lessons built into the course provide extra time to solidify skills. Hopefully this course will build confidence in your child and foster an enjoyment of mathematics. Your interest in your student's work, and your eagerness to learn and share in the discovery of new math skills, will help your child face the challenges ahead with a willing heart and an open mind.

An Important Note about Workload

This course, like all Oak Meadow courses, offers plenty of practice and review for each skill. Some students benefit from completing every practice problem, while others work better with targeted practice. You might find that your student needs to do all the practice problems for a skill that is

challenging but is able to grasp other concepts more quickly and easily, resulting in fewer practice problems needed.

Math is a subject in which repetition is extremely beneficial. That's why we have designed this course with a lot of opportunities to revisit previous skills and practice them. However, no student should be forced to do endless problem sets after they have already demonstrated mastery. **All the problems on the lesson tests must be completed;** however, you and your student can work together to determine the most useful number of problems to complete on the practice worksheets.

For Families Enrolled in Oak Meadow School

At the end of most lessons, you will find a "For Enrolled Families" section that contains information about what to send to your teacher. You are expected to submit work to your teacher after every two lessons, and communicate any time there are questions or concerns about your student's learning.

Here is a brief explanation of what you will submit:

- At the end of every two lessons, you will send two lesson tests, and one Oak Meadow Assessment Test. Lesson tests are found in the *Oak Meadow Grade 6 Math Workbook and Answer Key*. Oak Meadow Assessment Tests are in a separate booklet included with your materials.
- The lesson tests will be scored (by you) and corrected (by your student). Answers to all worksheets and tests are found in the *Oak Meadow Grade 6 Math Workbook and Answer Key*. Your Oak Meadow teacher will check and score the Assessment Tests (answers to Assessment Tests are not provided).
- To score a test, use the answer key to check each answer and circle any incorrect answers. At the top of the page write the number correct over the total number of problems. 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.
- After you score the test, have your student redo any incorrect problems (the ones that are circled). Encourage your child to talk through the problem aloud so you can see where the error occurred and help your child fix it. If you are unsure of how to help, let your teacher know.
- Do not include any practice worksheets (Skills Check and New Skills Practice) when you submit work to your Oak Meadow teacher. **Only the lesson tests and Assessment Test are sent to the teacher.** Although the practice worksheets are not being submitted, these are important elements of this course and your student will gain valuable skills and confidence from doing them.

When submitting work to your teacher, **always keep a copy of what you are sending**. Work can be submitted digitally or through the postal mail. You will find detailed instructions about how to submit your work in your teacher's welcome letter and in your Parent Handbook. If you have any questions, please contact your teacher.

We wish you and your student a satisfying and successful year of learning!

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.

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

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:

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

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

Step 2: Multiply the remaining digits. 27 × 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.

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

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:

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

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 × 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.

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

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.

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

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.

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

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 × 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:

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

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 $\frac{8}{12}$.

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

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

17

Skills Review

Cumulative Skills Review

You have two weeks to review and practice the skills you have learned. Here is the list of skills from the first semester:

Lesson 1

- Multiplication with Multi-Digit Numbers
- Multiplying by 10, 100, and 1,000
- Division of Whole Numbers
- Creating Fractions with Remainders

Lesson 2

- Two-Digit Divisors
- Estimating with Large Divisors

Lesson 3

- Common Fractions
- Adding Fractions with Common Denominators
- Subtracting Fractions with Common Denominators
- Improper Fractions and Mixed Numbers

Lesson 5

- Adding and Subtracting Mixed Numbers
- Subtraction Using Mixed Numbers and Whole Numbers
- Reducing Fractions to Lowest Terms

Lesson 6

- Common Denominators
- Finding the Lowest Common Denominator (LCD)
- Using LCDs in Mixed Number Addition
- Subtracting and Regrouping with Mixed Numbers and LCDs

Lesson 7

- Multiplying Simple Fractions
- Fractions in Word Problems
- Multiplying Fractions and Mixed Numbers

Lesson 8

- Multiplying Whole and Mixed Numbers
- Canceling Fractions

Lesson 10

- Dividing Fractions
- Dividing Whole Numbers and Fractions
- Dividing with Fractions and Mixed Numbers
- Why You Invert and Multiply to Divide

ASSIGNMENT SUMMARY

- ☐ Practice skills learned so far.
- ☐ Complete Lesson 17 Test and Learning Checklist.

Lesson 11

- Decimal Fractions
- Comparing Decimals
- Adding and Subtracting Decimals
- Adding and Subtracting Money

Lesson 12

- Measuring Distance Using the Metric System
- Metric Units of Weight
- Metric Units of Volume
- Reading an Inch Ruler
- Reading a Centimeter Ruler

Lesson 14

- Multiplying Decimals
- Multiplying Decimals and Whole Numbers
- Multiplying Decimals by 10, 100, and 1,000

Lesson 15

- Dividing Decimals by Whole Numbers
- Dividing with Dividends Less Than 1
- Dividing Decimals with Remainders

Lesson 16

- Dividing Decimals by 10, 100, and 1,000
- Dividing Decimals by Decimals
- Dividing Whole Numbers by Decimals

Use the extra practice worksheets to work on these skills. Make sure to ask for help if you need it.

When you have finished reviewing and practicing these skills, complete the Lesson 17 Test and Learning Checklist.

FOR ENROLLED FAMILIES

Help your student review any skills that need work or ask your teacher for help.

Lesson

23 Squares and Square Roots

Mental Math

Version 1: Roll two pairs of dice and add up the total. Keep this number in mind as you roll all four dice again. Add up the new numbers on the dice, and then add that to the previous total. Keep rolling the dice, adding them together, and adding it to your running total. See how quickly you can reach 100.

Version 2: Roll one pair of dice and add up the total. Roll a second pair of dice, add the total, and then multiply that by the first total. For instance, if you roll a 2 and 6 the first time, and then a 3 and a 3 the second time, you will multiply 8 by 6. You can do this with a partner, taking turns multiplying the numbers and calling them out. See how fast you can go—the goal is to become automatic with your calculations of multiplication facts.

ASSIGNMENT SUMMARY

- ☐ Play mental math games.
- ☐ Complete the Skills Check worksheet.
- ☐ Read New Skills instruction.
- ☐ Complete New Skills Practice.
- ☐ Complete Lesson 23 Test and Learning Checklist.

Skills Check

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

- Lesson 23 Skills Check

New Skills

Finding the Square of a Number

When we multiply one number by the same number, we call this a ***square***. We can find the square of any number simply by multiplying that number by itself. So the square of 3 is 9 because $3 \times 3 = 9$, and 12 squared is 144 because $12 \times 12 = 144$. As you can imagine, when you square large numbers, you get very large numbers, but regardless of the size of the number, the process for finding a square is always the same.

Example: What is the square of 7?

$$7 \times 7 = 49$$

The square of 7 is 49.

We can also find the square of decimals. We just multiply and move the decimal in the answer over the appropriate number of places, as usual.

Example: What is the square of 5.6?

$$5.6 \times 5.6 = 31.36$$

The square of 5.6 is 31.36

Square Roots

When we square a number, we multiply it by itself. To find the ***square root*** of a number, we find a number that, when multiplied by itself, equals the original number. This sounds more confusing than it actually is, so look at the following example:

Example: What is the square root of 36?

The square root of 36 is 6 because 6 × 6 = 36.

Example: What is the square root of 1?

Since 1 × 1 = 1, the square root of 1 is 1.

If you know your multiplication tables well, squares and square roots are not difficult. If you haven't mastered these fundamentals of math, devote extra time to practicing your multiplication tables.

Place Value in Large Numbers

As we've mentioned, sometimes squaring numbers results in very large numbers, so this is a good time to review place value.

In any whole number, each digit occupies a certain place in the number, and this place has a certain place value. Place values extend from ones into millions, billions, trillions, quadrillions, and far beyond. For most purposes, you will only need to understand place value through trillions (13 digits). To understand the relationship of these larger places, look at the following example of the place values for the number 7,643,258,961,470:

One Trillion		**Hundred Billion**	**Ten Billion**	**One Billion**		**Hundred Million**	**Ten Million**	**One Million**		**Hundred Thousand**	**Ten Thousand**	**One Thousand**		**Hundred**	**Ten**	**One**
7	,	6	4	3	,	2	5	8	,	9	6	1	,	4	7	0

If we were to name this number aloud, we would say "seven trillion, six hundred forty-three billion, two hundred fifty-eight million, nine hundred sixty-one thousand, four hundred seventy." At first, this may just look like a lot of confusing numbers, but if you look closely, you can see there is a pattern to it.

Each major place—marked by a comma—is a thousand times as large as the last, so if we write out the major divisions, they look like this:

One	1
One thousand	1,000
One million	1,000,000
One billion	1,000,000,000
One trillion	1,000,000,000,000

There is a comma after thousands, a comma after millions, a comma after billions, and a comma after trillions. In between the commas, there are three places. Each major place is really the ones place of that value, so there is one, then one thousand, then one million, then one billion, then one trillion. The ones place is always followed by the tens place of that number then the hundreds place. For example, the one thousand place is followed by the ten thousand, then the hundred thousand. Next follows one million, then ten million, then hundred million. This same pattern is always followed.

We show this pattern when we add commas to large numbers. We start from the ones place, count 3 places and insert a comma. Then we count 3 more places and insert a comma, 3 more places and a comma, and so forth. The commas indicate the major places and make it easier to read the number.

Example: What is the value of the 4 in 3,297,548?

The 4 is in the tens place, so the value is 4 tens, or 40.

Example: What is the value of the 8 in 2,836,295,601,597?

The 8 is in the hundred billions place, so the value is 8 hundred billion, or 800,000,000,000.

Example: Write 5,200,332,507,243 in words.

Five trillion, two hundred billion, three hundred thirty-two million, five hundred seven thousand, two hundred forty-three.

Remember we only use hyphens in compound numbers (twenty-one through ninety-nine) and we only use the word *and* when there is a decimal involved (to separate the whole number from the fraction). The word *and* is not used when writing whole numbers.

Example: Using numbers, write eight trillion, four hundred seventeen billion, six million, two hundred sixty-nine thousand, five hundred one.

8,417,006,269,501

New Skills Practice

Complete the following worksheets in your math workbook:

- Lesson 23 New Skills Practice: Squares and Square Roots, Place Value to Trillions
- Lesson 23 Test

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