Seventh Grade Math Overview

	First Semester	Second Semester
Math	Order of operations Factors and prime numbers Simple and compound interest Equations with missing numbers Metric units of measure Signed numbers Rules of equations Probability and probability in a series Using a calculator	Circumference and area of a circle Constructing triangles and calculating area Applying and transforming formulas Applying functions to find unknown values Ratios and proportions Bisecting lines and angles Volume of geometric solids Roots and exponents of fractions and negative numbers Scientific notation Graphing a line for an equation

Grade 7
Math
Coursebook

Oak Meadow

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Table of Contents

Introduction

Welcome to Grade 7 Math!

Math skills are essential for real-world problem-solving. Performing calculations and working with mathematical concepts also helps you develop logical thought, accurately interpret data, and manage finances—all real-world skills that'll help you be successful in the future.

Before you begin, please read this introduction so you know what you'll need and how to get the most out of this course.

Course Materials

This course includes the following materials:

Oak Meadow Grade 7 Math Coursebook

Oak Meadow Grade 7 Math Workbook and Answer Key

The coursebook has complete instructions for each lesson. The workbook includes practice worksheets for each lesson, lesson tests, and the answer key for each worksheet and test. It also includes extra practice worksheets that can be used whenever you need more practice with a specific skill.

After you complete each practice worksheet, use the answer key to check your answers. Circle any incorrect answers, and then redo those problems. If you still have trouble getting the correct answer, ask someone for help. This is the best way for you to gain mastery and progress smoothly through the course.

After you complete each lesson test, your parent or tutor will use the answer key to check your answers and circle any incorrect answers. Make sure to redo any incorrect problems—this is an important part of the learning process.

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

- Calculator
- Mathematical (drawing) compass
- Protractor

For the purposes of this course, you only need a calculator that can perform the four basic processes of arithmetic (addition, subtraction, multiplication, and division), calculate square roots, and perform percentage calculations. Student-quality compasses and protractors are available in the school supplies department of variety stores or drug stores.

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 before moving on to new material. Again, don't skip these—math skills build on one another, so it's essential to continually practice previous skills.

New Skills: Each new skill is explained fully with examples that show you the step-by-step process.

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: Every test includes a Learning Checklist at the end. This checklist lets you and your parent or teacher keep track of your progress.

For Enrolled Students: This section is for students 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. **Keep a list of rules and formulas.** Write them down and keep them nearby so you don't have to hunt back through the lessons to find each one.
3. 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.
4. 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.
5. 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.
6. 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.
7. 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.
8. 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 tutor 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.

Embrace the Challenge

Learning new skills requires patience and perseverance. Hard work pays off, so don't give up or try to ignore something that doesn't make sense. Ask for help when you need it, and practice as much as necessary to achieve mastery. Remember to take the time to enjoy the feeling of accomplishment when you master a new skill or gain new understanding. We hope the year ahead brings you educational success and satisfaction.

For the Parent

Seventh graders are often eager to take charge of their learning and work independently. However, success in math depends on immediate feedback and prompt attention to areas of confusion.

Students are encouraged to self-check their work and make corrections when doing practice worksheets. Your support in reviewing and helping them correct mistakes on tests is vital. Math skills are cumulative and a clear understanding of each concept or skill is necessary. By keeping track of your student's progress through the weekly test, you can identify areas that need work and provide support right away.

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.

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. Periodic lessons to review skills are built into the course. These provide extra time to solidify skills. Encourage your student to take the full week for these review lessons rather than hurrying through them. Taking a break from new information will help students gain confidence in what they've learned and stay motivated.

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 Students Enrolled in Oak Meadow School

At the end of most lessons, you will find a "For Enrolled Students" 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 anytime 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 7 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 7 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 them fix it. If you are unsure of how to help, let your teacher know.
- Do not include any practice worksheets (Skills Check, New Skills Practice, or Extra Practice Worksheets) when you submit work to your Oak Meadow teacher. **Only the lesson tests and Assessment Tests 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.

Work can be submitted to your teacher 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. **Always keep a copy of what you are sending**. If you have any questions, please contact your teacher.

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

Lesson

1

Mean, Median, Mode, and Range; Exponents; and Order of Operations

Mental Math

Mental math games are like gymnastics for your brain. They help your brain warm up and develop a flexibility of thinking that will benefit you in all areas of life. There's only one rule for mental math: do all the calculations in your head.

You'll find two variations of each mental math game, but you are highly encouraged to make up your own variations and to involve friends and family members. Feel free to repeat games you like or change ones that don't work well for you. Spend a few minutes doing mental math games before each math session and you will find your brain limber and ready to learn.

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.

Version 1: Count to 100 by 2s, and then count back down to 0. Next, count by 3s, ending on the number right before or right after 100 (you can "turn back" at either 99 or 102). Next, count up and down by 4s, then 5s, and so on, all the way up to 10s. Some of the numbers will feel very easy, like counting by 2s, 5s, and 10s, but others will be more challenging, especially going backward. Like most mental math games, this is a very simple exercise that really makes you think.

Version 2: Count to 100 by 2s, then count back down from 100 to 0 by 3s—this is harder because you are counting backward by 3s but not by multiples of 3, because 100 isn't a multiple of 3 (99 is). Whatever number you land on closest to 0, you'll begin counting forward again from that number, this time counting by 4s; then you'll count down by 5s from whatever number you end on that is closest to 100. You'll continue counting up and down, ending and beginning on different numbers each time rather than starting at 0 and ending at 100 like the first game. For instance, after counting forward to 100 by 2s, you'll count down from there by 3s: 100, 97, 94, 91, 88, etc., all the way down to 1, and then begin counting forward by 4s from 1: 1, 5, 9, 13, 17, etc. up to 101, then count by 5s down from there: 101, 96, 91, 86, 81, etc.

See if you can keep it going all the way up to counting by 10s—and notice what patterns might emerge along the way.

Skills Check

Complete the following worksheet to brush up on skills you already know. Take note of any that you are having trouble with, and spend more time working on them so you feel confident moving forward.

- Lesson 1 Skills Check

New Skills

We'll begin this course by reviewing skills you probably already know. You'll find a lot of information in the first few lessons, but don't let that worry you since it covers things you should already know. Hopefully, you'll find this review helps you to refresh your skills and gain more confidence with them.

Because they've been covered before, we'll move pretty quickly, but if you come to a skill that you find confusing or one that is new to you, slow down and take your time learning it. Practice as much as you need to in order to feel confident with that skill before moving to the next lesson.

We'll begin by looking at the following topics:

- Finding Mean, Median, Mode, and Range
- Exponents
- Order of Operations

Finding Mean, Median, Mode, and Range

We'll begin the year reviewing some concepts you probably remember. Let's first look at four ways to understand information about sets of numbers:

> **Mean:** Also called the average, the mean calculates what the amount would be if there were an equal number of items in each group.
>
> **Median:** When the numbers are arranged in order from lowest to highest, the number at the midpoint of the set is called the median.
>
> **Mode:** The number that occurs most frequently in any set of numbers is the mode.
>
> **Range:** The difference between the lowest and the highest number in the set.

Let's look at each one separately, starting with the mean. The mean, or average, tells us what the amount would be if everything were equal. Say you have two sets of colored pencils, one with 12 pencils and one with 16. The mean gives us a way to figure out how to balance out the numbers so each group or set would have the same amount.

> **Mean is calculated by adding up all the numbers in the set of numbers and dividing the total by how many numbers there are.**

If we added up the two sets of colored pencils, we'd get the total number of pencils: $12 + 16 = 28$. By dividing that by the number of sets (2), we find the mean. $28 \div 2 = 14$, so we can say there is a mean of

14 colored pencils per set. As you can see, no set actually *has* 14 pencils; the mean just gives us a way to look at how many each set *would have* if everything were equal.

Example: The Johnson family has been collecting coins in three different jars. After one month, one jar holds $3.35, another jar holds $4.21, and the third jar holds $1.83. What is the mean amount of money in each jar?

To find the mean:

Step 1: Add the amounts in each group to get the total.

$$\begin{array}{r} \$3.35 \\ \$4.21 \\ +\ \$1.83 \\ \hline \$9.39 \end{array}$$

Step 2: Divide the total by the number of groups.

There are 3 jars in all, so we divide the total by 3 to find the mean.

$$\$9.39 \div 3 = \$3.13$$

The mean amount of money in each jar is $3.13.

Remember, whenever you are answering a word problem, first you calculate the answer mathematically, and then you report the answer in a complete sentence.

Now let's look at how to calculate median and what it shows us.

> **Median is calculated by arranging the numbers in order from lowest to highest, and identifying the number at the midpoint of the set. If there are two numbers at the midpoint, the median is found by calculating the mean (or average) of those two numbers.**

Let's look at a couple of examples to see how this works.

Example: Five homes were sold in Centerville last month for the following prices:

$102,000

$99,000

$120,000

$117,000

$115,000

What is the median price of the homes sold in Centerville last month?

To find the median:

Step 1: Write the set of numbers in order from lowest to highest.

$99,000

$102,000

$115,000

$117,000

$120,000

Step 2: The median is the number in the exact middle.

The median price of homes sold last month in Centerville is $115,000.

Finding the middle number is easy if there is an odd number of items in the set, but where is the midpoint when there is an even number of items?

Example: Jessie's baseball team scored the following number of points in games this season: 10, 7, 3, 8, 5, 2. Based on this information (or ***data***), what was the median number of points scored?

Step 1: Order the numbers in the set from lowest to highest.

2, 3, 5, 7, 8, 10

Step 2: Find the number in the middle. In this case, there are two numbers in the middle: 5 and 7. So we average those two numbers (the mean of 5 and 7 is 6) to find the median for the whole set of numbers.

The median number of points scored this season is 6. Did they ever actually score 6 points in a game? No, but the median is 6 because that's the midpoint of all their scores for the season.

You can see that we sometimes have to use mean to find the median, but the two processes are different and give us different ways of looking at data. When you calculate both mean and median for a set of numbers, you'll almost always end up with different numbers because mean and median are showing different things.

Next, let's look at mode. You can remember what mode is because it sounds like the word *most*, which is exactly what mode is: the number that appears most frequently in a set.

We calculate mode by ordering the numbers from lowest to highest, and identifying which number occurs the most. You might have more than one mode or none at all.

If a set of numbers has no repeat numbers, there is no mode because no number occurs most. On the other hand, if more than one number occurs the most number of times, you can have more than one mode. Let's look at two examples:

Example: Find the mode for the following set of numbers:

$$34, 33, 33, 36, 31, 36, 39, 33$$

To find the mode:

Step 1: Arrange the numbers in order from lowest to highest.

$$31, 33, 33, 33, 34, 36, 36, 39$$

Step 2: Identify the number that occurs the most.

The number 33 occurs more times than any other number, so the mode is 33.

Example: Find the mode for the following set of numbers:

$$2010, 2008, 2011, 2008, 2010, 2009$$

Step 1: Arrange the numbers in order from lowest to highest.

$$2008, 2008, 2009, 2010, 2010, 2011$$

Step 2: Identify the number that occurs the most.

In this set of numbers, both 2008 and 2010 appear twice, which is more than any other number. The mode for this set is 2008 and 2010.

Finally, let's calculate the range. This is simply the difference between the highest and lowest value in a set of numbers.

To calculate range, we determine the highest and lowest values in the set of numbers and then subtract the lowest number from the highest to get the range. If all the numbers are identical, the range is zero.

Example: What is the range of prices for the five houses sold in Centerville in the past month? Here is the original data set:

$102,000

$99,000

$120,000

$117, 000

$115,000

To find the range:

Step 1: Identify the lowest and highest numbers (it might help to put them in order first).

Lowest sales price: $99,000

Highest sales price: $120,000

Step 2: Subtract the lowest number from the highest.

$$\$120{,}000 - \$99{,}000 = \$21{,}000$$

The range of prices for homes sold in Centerville last month is $21,000.

Since we often find data given in several ways at once, let's look at calculating mean, median, mode, and range on one set of numbers.

Example: Find the mean, median, mode, and range for the following set of numbers:

$$127, 132, 112, 113, 139, 125, 127$$

Step 1: Arrange the numbers in order from lowest to highest.

$$112, 113, 125, 127, 127, 132, 139$$

Step 2: Find the mean by adding the numbers together and dividing by how many numbers there are.

The numbers total 875. There are 7 numbers in all, so we divide 875 by 7 to get the mean: 875 ÷ 7 = 125. The mean is 125.

Step 3: Find the median by finding the middle number. The middle number is 127, so that's the median. It doesn't matter that there are two of the same number—there is only one middle number in this set, and that's 127.

Step 4: Find the mode by identifying the number that occurs the most. In this set, 127 occurs twice, so that's the mode.

Step 5: Find the range by subtracting the lowest number from the highest.

$$139 - 112 = 27$$

The range is 27.

Here are all the answers for this problem:

Mean: 125

Median: 127

Mode: 127

Range: 27

You can see that sometimes the mean, median, mode, or range will end up being the same number even though they are all calculated differently and represent different things.

Exponents

Sometimes we need to multiply a number by itself, and an ***exponent*** can tell us how many times to do that. The exponent is written as a small number above and to the right of the base (the number that is being multiplied by itself).

$$3^2 = 3 \times 3$$
$$5^3 = 5 \times 5 \times 5$$

We read numbers with exponents in the following way:

We read 12^2 as "12 to the second power," or "12 squared."

We read 25^3 as "25 to the third power," or "25 cubed."

We read 8^4 as "8 to the fourth power."

We read 3^5 as "3 to the fifth power."

Example: What is the value of 23^3?

$$23^3 =$$
$$23 \times 23 \times 23$$
$$529 \times 23 = 12{,}167$$

Final answer: $23^3 = 12{,}167$

Order of Operations

There are four primary operations in math: addition, subtraction, multiplication, and division. You might also find elements such as parentheses and exponents in a mathematical equation. When a math problem contains several operations, it's important to complete each one in the correct order, or you will get an incorrect answer.

The ***order of operations*** provides a clear set of rules to follow when you're solving problems that have several different operations. Here is the order in which operations are done in any equation:

- Parentheses
- Exponents
- Multiplication and Division
- Addition and Subtraction

Step 1: Parentheses. If a problem contains an operation in parentheses, we always complete this operation first, no matter what else is in the equation.

$$5 + (3 \times 5) - 17 + 4^2 + 10 \div 5 \times 2 =$$
$$5 + 15 - 17 + 4^2 + 10 \div 5 \times 2 =$$

In this equation, there is one operation in parentheses: 3 × 5. First we solve that and replace the parentheses with the result.

Step 2: Exponents. After taking care of any operations in parentheses, we look for exponents, and then solve them, replacing the base and exponent with the result.

$$5 + 15 - 17 + 4^2 + 10 \div 5 \times 2 =$$
$$5 + 15 - 17 + 16 + 10 \div 5 \times 2 =$$

Since 4^2 means 4×4, which is 16, we replaced 4^2 with 16.

Step 3: Multiplication and Division. Once the elements involving parentheses and exponents are completed, we can perform any multiplication and division processes in the order they appear in the equation, from left to right.

$$5 + 15 - 17 + 16 + 10 \div 5 \times 2 =$$
$$5 + 15 - 17 + 16 + 2 \times 2 =$$

Since $10 \div 5$ came first in the equation, we perform that process first, which results in 2. Now we can move on and take care of the multiplication process, replacing 2×2 with the result (4).

$$5 + 15 - 17 + 16 + 2 \times 2 =$$
$$5 + 15 - 17 + 16 + 4 =$$

Step 4: Addition and Subtraction. Now all that's left are addition and subtraction operations, which also get done in the order they appear, from left to right.

$$5 + 15 - 17 + 16 + 4 =$$
$$20 - 17 + 16 + 4 =$$
$$3 + 16 + 4 =$$
$$19 + 4 = 23$$

It may seem very confusing at first, but just remember the order of operations and follow it step by step:

- Parentheses
- Exponents
- Multiplication and Division
- Addition and Subtraction

Remember, sometimes multiplication is indicated with parentheses, like this:

$$5(3) = 5 \times 3 = 15$$

When you see a number in parentheses without any operation inside the parentheses, you know it is treated as a multiplication element, and done at the same time you do the multiplication and division.

Example: $7(3) - 20 + 4^2 + (7 - 2)$

Step 1: Parentheses. We first perform the operation in parentheses.

$$7(3) - 20 + 4^2 + (7 - 2)$$
$$7(3) - 20 + 4^2 + 5$$

You'll notice the (3) is still there—that's because it's not an operation in parentheses; it's a way to show multiplication.

Step 2: Exponents. Next we solve exponents.

$$7(3) - 20 + 4^2 + 5$$
$$7(3) - 20 + 16 + 5$$

Step 3: Multiplication and Division. Once parentheses and exponents are taken care of, we solve multiplication and division from left to right. There is just one multiplication process in this problem.

$$7(3) - 20 + 16 + 5$$
$$21 - 20 + 16 + 5$$

Step 4: Addition and Subtraction. Finally, we can perform the addition and subtraction, from left to right.

$$21 - 20 + 16 + 5 =$$
$$1 + 16 + 5 =$$
$$17 + 5 = 22$$

Example: $16 + 9 \div (7 - 4) - 2 \bullet 3^2$

Step 1: Parentheses. We first perform the operation in parentheses.

$$16 + 9 \div (7 - 4) - 2 \bullet 3^2 =$$
$$16 + 9 \div 3 - 2 \bullet 3^2 =$$

Step 2: Exponents. Next we solve exponents.

$$16 + 9 \div 3 - 2 \cdot 3^2 =$$
$$16 + 9 \div 3 - 2 \cdot 9 =$$

Step 3: Multiplication and Division. Perform multiplication and division operations, from left to right.

$$16 + 9 \div 3 - 2 \cdot 9 =$$
$$16 + 3 - 2 \cdot 9 =$$
$$16 + 3 - 18 =$$

Step 4: Addition and Subtraction. Finally, perform the addition and subtraction, from left to right.

$$16 + 3 - 18 =$$
$$19 - 18 = 1$$

PEMDAS: The Order of Operations

In the order of operations, parentheses always come first, exponents always come second, and then multiplication and division are done in the order they appear (left to right), and finally addition and subtraction are completed from left to right.

If you find it hard to remember the order for all of these operations, you're not alone. Many mathematicians through the years have found it difficult to remember the correct order of operations. As a result, they have devised ways to remember this order, using the first letter of the operations in the proper order, as follows:

- **P**arentheses
- **E**xponents
- **M**ultiplication and **D**ivision
- **A**ddition and **S**ubtraction

The first letters of the operations in the proper order are P, E, M, D, A, and S. If you put them all together they form the word PEMDAS. This is what's called an ***acronym***—a word that's created from the first letters of several words. An acronym can be very useful for remembering information because you only have to remember the acronym and you have a clue to the words that make up each of the letters.

A phrase or sentence can also help you remember the order of operations:

Please **E**xcuse **M**y **D**ear **A**unt **S**ally

The first letter of each of the words in this phrase are P, E, M, D, A, and S, so once again you're using these letters to remind you of the order of operations. This phrase can remind you of a lovable old aunt who is constantly doing silly things, so you're always asking others to please excuse her behavior.

Whatever way you use to remember the letters P, E, M, D, A, and S, repeat it to yourself when you're solving an expression that uses all of the operations, and it will help you complete each operation in the proper order.

New Skills Practice

Complete the following worksheets in your math workbook:

- Lesson 1 New Skills Practice: Mean, Median, Mode, and Range; Exponents; and Order of Operations
- Lesson 1 Test

Remember to show all your work. Check your answers for the New Skills Practice 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 STUDENTS

You will be sending work to your Oak Meadow teacher after every two lessons. Please check the answers for the lesson 1 test 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 them 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 is an important element of this course.

One 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

Lowest Common Denominator in Fractions and Mixed Numbers

Mental Math

Many of these mental math games are very quick. Repeat each game several times so that you are warming up your brain for 2–5 minutes.

Version 1: You'll need a pair of dice for this game. Roll the dice and create a proper fraction from the two numbers (a proper fraction has the smaller number on top). For instance, if you roll a 5 and a 3, the proper fraction will be $\frac{3}{5}$. Now add that fraction to itself: $\frac{3}{5}+\frac{3}{5}=\frac{6}{5}$. Finally reduce the fraction to its lowest terms: $\frac{6}{5}=1\frac{1}{5}$. (Remember, you are doing all the calculations in your head.)

Version 2: Repeat the game above, but this time you will create a proper fraction from the two numbers, and then remember it while you roll the dice again and create a new fraction. Then you will multiply the two fractions in your head and reduce. For instance, if you roll a 2 and a 3, you will create a proper fraction $\left(\frac{2}{3}\right)$ and keep that fraction in your head while you roll the dice again. If you get a 6 and 5 on the second roll, you'll create a second proper fraction $\left(\frac{5}{6}\right)$, and then multiply the two: $\frac{2}{3}\times\frac{5}{6}=\frac{10}{18}=\frac{5}{9}$. Remember to reduce your answer to lowest terms!

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.

Skills Check

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

- Lesson 2 Skills Check

New Skills

Identifying Common Denominators and Lowest Common Denominator (LCD)

When we are adding or subtracting fractions whose denominators are the same, we simply add or subtract the numerators, and the denominator remains the same. But when the denominators are not the same, we have to identify a common denominator before we can add or subtract. A common denominator is a number that can be divided evenly by both denominators in the problem.

There are several ways to find a common denominator:

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

We'll use each approach in the following examples. Let's start with using the largest denominator in the problem.

Example: $\frac{3}{4} + \frac{1}{12}$

Step 1: Look at the two denominators. In this example, we have denominators of 4 and 12. Since 4 goes into 12 evenly, we know we can use 12 as the common denominator.

Step 2: Convert $\frac{3}{4}$ into an equivalent fraction with 12 as the denominator by asking, "How many times does 4 go into 12?" The answer is 3, so multiply the numerator by 3 to get the equivalent fraction of $\frac{9}{12}$.

Step 3: Complete the problem as usual, and reduce the answer to lowest terms.

$$\frac{9}{12} + \frac{1}{12} = \frac{10}{12} = \frac{5}{6}$$

You should always try this approach first because it's the easiest. However, it doesn't always work, so let's try the next approach: multiply the two denominators.

Example: $\frac{6}{7} - \frac{2}{3}$

Step 1: In this problem we can't use the larger denominator because 3 won't divide evenly into 7, so we'll multiply the two denominators to find a common denominator: 7 × 3 = 21, so 21 is our new denominator.

Step 2: Convert each fraction into an equivalent fraction with a denominator of 21. First ask, "How many times does 7 go into 21?" The answer is 3 so we multiply the numerator of the first fraction by 3 to get the equivalent fraction of $\frac{18}{21}$. Then we do the same for the second fraction: "How many times does 3 go into 21?" The answer is 7 so we multiply the numerator of the second fraction by that to get the equivalent fraction of $\frac{14}{21}$.

Step 3: Complete the problem as usual, and reduce the answer to lowest terms.

$$\frac{18}{21} - \frac{14}{21} = \frac{4}{21}$$

Multiplying the two denominators will *always* give you a common denominator, but often this denominator will be quite large. To avoid this, always try to find the lowest common denominator (LCD).

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

Step 1: Look at the two denominators, and then identify the lowest common denominator by comparing the multiples of both denominators and choose the lowest multiple that both fractions have in common.

Multiples of 3:	3	6	9	**12**	15
Multiples of 4:	4	8	**12**	16	20

We can see that 12 is the lowest common denominator for the two denominators in this problem.

Step 2: Convert each fraction into an equivalent fraction using the LCD.

$$\frac{2}{3} + \frac{1}{4} = \frac{8}{12} + \frac{3}{12}$$

Step 3: Complete the problem and reduce if necessary.

LCDs in Mixed Numbers

You can follow these same procedures to find the lowest common denominator when you are adding or subtracting mixed numbers.

Example: $3\frac{1}{4} + 7\frac{5}{6}$

Step 1: Find the lowest common denominator for the fractions. The lowest common denominator is 12.

Step 2: Convert the fractions to the common denominator.

$$\begin{aligned} 3\tfrac{1}{4} &= 3\tfrac{3}{12} \\ \underline{+\ 7\tfrac{5}{6}} &= \underline{7\tfrac{10}{12}} \end{aligned}$$

Step 3: Complete the problem. When you add mixed numbers using a common denominator, you often end up with a mixed number with an improper fraction. If so, reduce as usual.

$$3\frac{1}{4} = 3\frac{3}{12}$$
$$+\ 7\frac{5}{6} = 7\frac{10}{12}$$
$$10\frac{13}{12} = 11\frac{1}{12}$$

Borrowing with Mixed Numbers and LCDs

Sometimes the top fraction in a mixed number may not be large enough to subtract the bottom fraction. When this happens, just regroup (borrow) from the whole number.

Example: $5\frac{1}{5} - 3\frac{3}{4}$

Step 1: Find the lowest common denominator. In this case, it is 20.

Step 2: Convert the fractions as usual.

$$5\frac{1}{5} = 5\frac{4}{20}$$
$$-\ 3\frac{3}{4} = 3\frac{15}{20}$$

Step 3: Since we can't subtract 15 from 4, we borrow 1 from the 5. We convert the 1 to an equivalent fraction using the common denominator: $\frac{20}{20}$. Now we can add that to $\frac{4}{20}$, and subtract as usual.

$$5\frac{1}{5} = 5\frac{4}{20} = 4\frac{24}{20}$$
$$-\ 3\frac{3}{4} = 3\frac{15}{20} = 3\frac{15}{20}$$
$$1\frac{9}{20}$$

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.

Example: $15\frac{7}{8} - 12\frac{14}{16}$

$$15\frac{7}{8} = 15\frac{14}{16}$$
$$\underline{-\ 12\frac{14}{16} = 12\frac{14}{16}}$$
$$3\frac{0}{16} = 3$$

Always remember to reduce fractions in answers to lowest terms.

New Skills Practice

Complete the following worksheets in your math workbook, showing all your work:

- Lesson 2 New Skills Practice: Lowest Common Denominator in Fractions and Mixed Numbers
- Lesson 2 Test

Check your answers for the New Skills Practice and circle any incorrect answers before reworking these problems. Use the additional practice worksheets if you need extra time to work on a skill.

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 STUDENTS

After your student completes the Skills Check and New Skills Practice for this lesson and the Lesson 2 Test (and makes any necessary corrections), please have your student complete the Lesson 2 Assessment Test. This is found in the math workbook.

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

Do not include any of the practice worksheets (Skills Check, New Skills Practice, or extra practice worksheets).

Please include any additional notes about the lesson work or anything you'd like your teacher to know. Feel free to include questions—your teacher is eager to help.

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 comments and individualized guidance. In the meantime, have your student proceed to lesson 3 and continue working.

Lesson 6

Dividing Decimals; Factors and Prime Numbers

Mental Math

As you perform your mental math, if you ever want to check your answer on paper, please do. It's not necessary, though—even if you get the answer wrong, just the act of doing calculations in your head will strengthen your math skills, even if you make a mistake now and then.

Version 1: Ask someone to give you a two-digit number. Remember this number, and then reverse the digits to create a second number. Add the two numbers together. For instance, if the original number is 83, you add 83 + 38 = 121. Do this several times. See if you notice a pattern. Then ask for a three-digit number and do the same (for instance, 168 + 861). Solve several three-digit problems. Feel free to challenge yourself with four-digit numbers too!

Version 2: Ask someone for a two-digit number. Repeat this number aloud. Then in your head, create a new number by using the same digits again to form a four-digit number. Say this number aloud, and then add the same two-digit number again to create a six-digit number, and say this number aloud. See if you can go up to a ten-digit number (billions place) or further. For instance, if the original number is 98, then the four-digit number is 9,898; the six-digit number is 989,898; and so on.

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

Dividing Decimals by Whole Numbers

When dividing decimals, the process is the same as dividing whole numbers, except we have to account for the decimal point. The only difference is an adjustment we make to put the decimal point in the correct place.

Example: $42.93 \div 3$

Step 1: Rewrite the problem using the division bracket. Remember that the number being divided (which goes inside the bracket) is the dividend; the number doing the dividing (which goes outside the bracket) is the divisor; and the answer is the quotient.

$$3\overline{)42.96}$$

Step 2: Divide as usual, keeping the digits in the correct columns. Ignore the decimal point for now.

Step 3: To create the final answer, place the decimal point in the answer directly above where it is in the dividend.

$$\begin{array}{r} 14.31 \\ 3\overline{)42.96} \\ \underline{3} \\ 12 \\ \underline{12} \\ 09 \\ \underline{9} \\ 03 \\ \underline{3} \\ 0 \end{array}$$

You use this same process no matter how many decimal places there are in the dividend.

Dividing with Dividends Less Than 1

When you divide a whole number into a dividend that is less than 1, you have to pay attention to where the zeros are, and make sure the zeros are placed correctly in the quotient.

Example: $0.25 \div 5$

$$5\overline{)0.25}$$

Step 1: Treat the 0 just like any other number. Say to yourself, "How many times does 5 go into 0?" Since 5 doesn't go into 0, the answer is 0, so you write that in the quotient, then multiply, subtract, and bring down the next digit (the 2) as usual. Repeat the long division process of divide, multiply, subtract, and bring down until you have solved the problem.

Step 2: Place the decimal point in the answer so that it directly lines up with the decimal point in the dividend.

$$
\begin{array}{r}
0.05 \\
5\overline{)0.25} \\
\underline{0} \\
02 \\
\underline{0} \\
25 \\
\underline{25} \\
0
\end{array}
$$

Dividing Decimals with Remainders

When you have a remainder in a decimal division problem, you continue to add zeros to the end of the dividend until there is no remainder. Adding zeros to the end of the dividend doesn't change the value of the dividend, it just renames it, which allows you to complete the problem.

Example: $8\overline{)7.31}$

Divide as usual, keeping the digits in the correct columns. When you end up with a remainder (3), add a zero to the dividend, bring it down, and continue dividing as usual. Continue dividing, adding zeros to the dividend and bringing them down until the answer comes out evenly and there is no remainder left. When you finish dividing, bring the decimal point directly up into the quotient for the final answer.

$$
\begin{array}{r}
0.91375 \\
8\overline{)7.31000} \\
\underline{0} \\
73 \\
\underline{72} \\
11 \\
\underline{8} \\
30 \\
\underline{24} \\
60 \\
\underline{56} \\
40 \\
\underline{40} \\
0
\end{array}
$$

Rounding Decimals

Some decimal problems end up with answers that involve many decimal places. Since an answer in hundredths (two decimal places) is sufficient for most problems, the best solution is to round off the answer to two decimal places. In order to do that, you have to solve the problem through the thousandths place, and if there is still a remainder, follow the basic rules of rounding:

1. **If the digit in the thousandths place is 5 or greater, drop it and increase the digit in the hundredths place by 1**
2. **If the digit in the thousandths place is less than 5, drop it and keep the digit in the hundredths place as it is.**

Examples of rounding decimals to the hundredths place:

3.486 rounds to 3.49

0.0231 rounds to 0.02

12.9057 rounds to 12.91

72.302 rounds to 72.3

Repeating Decimals

Sometimes you'll encounter a problem that results in a repeating decimal—decimal numbers that continue to repeat in a certain pattern, no matter how many zeros you add to the dividend.

Example: $6\overline{)0.2}$

You begin to solve the problem as usual, until you quickly realize the problem will continue to result in a remainder of 2 no matter how many zeros you bring down. This will result in a repeat of the number 3 in the quotient.

If you see that this is what the remainder will continue to be, you can either round off the answer or you can place a bar above the two repeating digits to indicate that these digits will continue to repeat indefinitely (drop any extra repeating digits after the two barred digits). Either solution—rounding off or using a bar to indicate repeating decimals—is acceptable.

$$
\begin{array}{r}
0.0\overline{33} \\
6\overline{)0.200} \\
\underline{0} \\
02 \\
\underline{0} \\
20 \\
\underline{18} \\
20 \\
\underline{18} \\
2
\end{array}
$$

Dividing Decimals by Decimals

When dividing using two decimal fractions, the division process is the same as usual, but the placement of the decimal point is different.

Example: $1.2\overline{)20.46}$

Step 1: Move the decimal point in the divisor to the right until it is at the end of the number. That means instead of the divisor being 1.2, it's now 12. Since the divisor is now a whole number, it no longer needs a decimal point.

Step 2: Next, move the decimal point in the dividend the same number of spaces to the right that you moved it in the divisor. Since you moved it one place to the right in the divisor, you'll move it one place to the right in the dividend. That means the dividend will changes from 20.46 to 204.6.

$$12\overline{)204.6}$$

Step 3: Divide as usual, and then bring the decimal directly up into the quotient.

$$
\begin{array}{r}
17.05 \\
12\overline{)204.60} \\
\underline{12} \\
84 \\
\underline{84} \\
06 \\
\underline{0} \\
60 \\
\underline{60} \\
0
\end{array}
$$

Because we've moved the decimal point the same number of places in both the divisor and the dividend, we haven't changed the relationship between the two numbers. When we move the decimal point one place to the right in any number, we're actually multiplying the number by 10. Since we're multiplying both the divisor and the dividend by the same amount, then the relative value of the two numbers remains the same. Always remember to move the decimal points in both the divisor and the dividend by the same number of places.

Sometimes we'll see a problem where both the divisor and the dividend are less than 1. You might see a 0 in front of the decimal but usually decimals less than 1 are written without the "leading" zeros in front; either way, the value is the same.

Example: $.03\overline{).46}$

Step 1: Turn the divisor into a whole number by moving the decimal in the divisor to the right until it's at the end of the number (.03 becomes 3). Next, move the decimal point the same number of places in the dividend (.46 becomes 46).

$$3\overline{)46}$$

Step 2: Divide as usual, and bring the decimal point up into the quotient. In this problem, you'll quickly discover that there is a repeating decimal, so you can either round the answer to 15.33 or place a bar over the .33 to show it is a repeating decimal.

$$\begin{array}{r} 15.\overline{33} \\ 3\overline{)46.00} \\ \underline{3} \\ 16 \\ \underline{15} \\ 10 \\ \underline{9} \\ 10 \\ \underline{9} \\ 1 \end{array}$$

Dividing Whole Numbers by Decimals

Finally, let's look at dividing whole numbers by decimals. Keep in mind that everything to the left of a decimal point is a whole number, and everything to the right of a decimal is a fraction. Whole numbers don't need a decimal point, but we can add one and place as many zeros after it as we like without changing the value of the whole number. All of these numbers have the same value:

32 32.0 32.00 32.000

When we divide a whole number by a fraction, simply add a decimal point and zeros in order to help us solve the problem.

Example: $.4\overline{)29}$

Step 1: Change the whole number in the dividend into a decimal fraction by adding a decimal and zeros. You may want to add more zeros later, but start with two zeros.

$$.4\overline{)29.0}$$

Step 2: Continue as you would to divide a decimal into a decimal. Move the decimal in the divisor and the dividend the same number of spaces.

$$4.\overline{)290.}$$

Step 3: Divide as usual. Remember that when you are dividing with decimals, you continue to add zeros until the problem comes out evenly with no remainders. Finally, place the decimal point in the answer, directly above where it now is in the dividend.

$$\begin{array}{r} 72.5 \\ 4.\overline{)290.0} \\ \underline{28} \\ 10 \\ \underline{8} \\ 20 \\ \underline{20} \\ 0 \end{array}$$

Factors of Whole Numbers

Every whole number greater than 1 has at least two ***factors***—1 and the number itself—and many whole numbers have more than two factors. Factors are all the whole numbers that can divide evenly into a number.

An easy way to determine the factors of a number, after writing down 1 and the number, is to start with 2 and work your way up through the numbers. If the number is even, 2 and another number will be factors. For instance, if we are looking for the factors of 12, we know $2 \times 6 = 12$, so 2 and 6 are factors. Next, see if 3 goes into the number evenly; if so, write down 3 and the number it is paired with. We know $3 \times 4 = 12$ so 3 and 4 are factors. Continue working up through the numbers (does 4 go into the number evenly? Does 5?). In this way, you can quickly determine the factors of a number.

Example: What are the factors of 24?

Does 1 go into 24? Yes, so 1 and 24 are factors.

Does 2 go into 24? Yes, so 2 and 12 are factors.

Does 3 go into 24? Yes, so 3 and 8 are factors.

Does 4 go into 24? Yes, so 4 and 6 are factors.

Does 5 go into 24. No.

Does 6 go into 24? Yes, but we've already written that down. Once you get to a repeat factor, you know we've found all the factors.

The factors of 24 are 1, 2, 3, 4, 6, 8, 12, and 24.

Example: Write the factors of 60.

Does 1 go into 60? Yes, so 1 and 60 are factors.

Does 2 go into 60? Yes, so 2 and 30 are factors.

Does 3 go into 60? Yes, so 3 and 20 are factors.

Does 4 go into 60? Yes, so 4 and 15 are factors.

Does 5 go into 60. Yes, so 5 and 12 are factors.

Does 6 go into 60? Yes, so 6 and 10 are factors.

Does 7 go into 60? No.

Does 8 go into 60? No.

Does 9 go into 60? No.

Does 10 go into 60? Yes, but we've already written that down so we know we're done.

The factors of 60 are 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, and 60.

Prime Numbers

While some numbers have several factors, others have just two factors: 1 and the number itself. These numbers are called ***prime numbers***. A prime number cannot be divided evenly by any number except itself and 1.

Example: What are the factors of 13?

Applying the same technique we used above, see how many numbers will divide evenly into 13.

Does 1 go into 13? Yes, so 1 and 13 are factors.

Does 2 go into 13? No.

Does 3 go into 13? No.

Does 4 go into 13? No.

Does 5 go into 13. No.

Does 6 go into 13? No.

Does 7 go into 13? No.

Once you get past the halfway point, you don't have to go any further because any factors would have already been discovered—we already know 2 doesn't divide evenly into the number.

Since 13 has exactly two factors (1 and 13), it is a prime number.

New Skills Practice

Complete the following worksheets in your math workbook:

- Lesson 6 New Skills Practice: Dividing Decimals; Factors and Prime Numbers
- Lesson 6 Test

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

FOR ENROLLED STUDENTS

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

Using a Calculator; Third and Fourth Roots

Mental Math

Version 1: Add up all the ages of the people in your family (feel free to include pets too). Once you have your total, try to find one or more numbers that will divide into it evenly. If it's an even number, you know 2 will go into it evenly, so start with that. Then try 3, 4, and 5. Is the total evenly divisible by one of these numbers?

Version 2: Write down a list of the birth years of each member of the family and then add the total in your head. Try to find one or more numbers that will divide into it evenly. You might need to write down the total first so you can look at it while dividing it by different numbers.

ASSIGNMENT SUMMARY

- ☐ Play mental math games.
- ☐ Complete the Skills Check worksheet.
- ☐ Read New Skills instruction.
- ☐ Complete New Skills Practice.
- ☐ Complete Lesson 17 Test and Learning Checklist.

Skills Check

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

- Lesson 17 Skills Check

New Skills

Using a Calculator

As we begin to explore some concepts that require extensive calculation, sometimes using a calculator can come in handy. A calculator can do amazing things, but it's not intelligent. If you give a calculator correct information, it will give you correct answers, but it doesn't have any way of knowing if the information you've given it is correct. So if you enter the wrong information, it will give you the wrong answers.

To avoid that, follow this basic rule: review every answer you get and consider if it makes sense. This is a good rule to follow all the time but especially when you are using a calculator. For example, if you're adding 48.9 and 8.4, you can see that the answer should certainly be less than 100. So if you forget to input the decimal in 48.9 and come up with an answer of 497.4, you know that the answer is wrong.

When that happens, enter the information again more carefully. If you follow this rule, your calculator will be a valuable tool for you in math.

Since there are a wide variety of calculators available, and variations in the way that calculators operate, we will only provide general guidelines for using a calculator to perform various operations. You might want to study the instructions included with your calculator to learn the specifics.

Using a Calculator to Perform Basic Operations with Decimals

You've already learned how to perform the four basic operations (addition, subtraction, multiplication, and division) with decimals. Now let's try them with a calculator.

Example: $14.7 + 5.94$

Step 1: Clear the calculator to make sure no previous numbers are entered. Most calculators use a "C" key for this. You will see a 0 when it is cleared.

Step 2: Enter 14.7 by pressing the 1, the 4, the decimal point, then the 7.

Step 3: Press the + key to indicate addition.

Step 4: Enter 5.94 by pressing the 5, the decimal point, the 9, and the 4.

Step 5: Press the = key to show the answer, which is 20.64.

To subtract one number from another, we follow the same process, using the subtraction key.

Example: $25.3 - 6.45$

Step 1: Clear the calculator to make sure no previous numbers are entered.

Step 2: Enter 25.3 by pressing the 2, the 5, the decimal point, then the 3.

Step 3: Press the – key to indicate subtraction.

Step 4: Enter 6.45 by pressing the 6, the decimal point, the 4, and the 5.

Step 5: Press the = key to show the answer, which is 18.85.

Multiplication problems can be solved the same way, using the multiplication key on your calculator.

Example: 5.6×8.43

Step 1: Clear the calculator.

Step 2: Enter 5.6.

Step 3: Press the × key to indicate multiplication.

Step 4: Enter 8.43.

Step 5: Press the = key to show the answer, which is 47.208.

Answers to multiplication problems can sometimes be quite long. When this happens, you should round off the answers to two decimal places, unless the problems require more decimal places. To round off an answer, follow the basic rule of rounding:

1. Look at the next digit after the number of decimal places you need.
2. If that digit is 5 or greater, drop it and increase the previous digit by 1.
3. If that digit is less than 5, drop it and keep the previous digit as it is.

Using the rule of rounding, 47.208 would round off to 47.21.

We can solve division problems with a calculator in the same way, using the division key. Remember that there are three common ways to indicate division, by using the division sign (÷), the long division bracket, or a fraction.

Since the numbers in a division problem appear in different positions, it's important to remember to enter the numbers in the proper order if you're using a calculator. When you use a calculator to solve a division problem, first enter the dividend, then the division sign, and finally the divisor (and then press the equals sign to get the answer).

Example: $16.42 \div 3.5$

Step 1: Clear the calculator.

Step 2: Enter the dividend: 16.42.

Step 3: Press the ÷ key to indicate division.

Step 4: Enter the divisor: 3.5.

Step 5: Press the = key to show the answer, which is 4.6914286.

As we found with multiplication, division answers can sometimes be quite long. When this happens, round off the answer to two decimal places, as before: 4.6914286 rounds to 4.69.

Converting Common Fractions to Decimals with a Calculator

The line that separates the numerator from the denominator in a common fraction has the same meaning as a division sign; we know that $\frac{5}{8}$ means 5 divided by 8, and that $\frac{2}{3}$ is 2 divided by 3. In this way, all common fractions can be easily converted to decimal fractions by simply dividing the numerator by the denominator.

Example: Use your calculator to convert $\frac{5}{8}$ into a decimal.

Step 1: Clear the calculator.

Step 2: Press the 5 key for the numerator (this is the dividend).

Step 3: Press the ÷ key to indicate division.

Step 4: Press the 8 key for the denominator (this is the divisor).

Step 5: Press the = key to show the answer, which is 0.625.

Not all fractions convert to decimals evenly. Sometimes the decimal may extend into several decimal places, or it may even continue indefinitely, sometimes as a repeating decimal. When this happens, round the answer to two decimal places, unless the problem you are solving requires additional decimal places. Using this rule, we would round off the answer in this example to 0.63.

We can convert mixed numbers to decimals in two ways: we can first convert it to an improper fraction or we can first convert the fraction and then add the whole number.

Example: Convert $2\frac{3}{4}$ into a decimal.

Step 1: Clear the calculator.

Step 2: Press the 3 key for the numerator.

Step 3: Press the ÷ key to indicate division.

Step 4: Press the 4 key for the denominator.

Step 5: Press the = key to show the fraction, which is 0.75.

Step 6: Add the whole number to the fraction, for a final answer of 2.75.

Alternately, we can change the mixed number to an improper fraction and then convert that into a decimal.

Step 1: Convert $2\frac{3}{4}$ to an improper fraction by multiplying the whole number by the denominator, and then add it to the numerator: $2\frac{3}{4} = \frac{11}{4}$.

Step 2: Divide the numerator by the denominator by entering 11 ÷ 4. (Make sure to clear the calculator before you begin!)

Step 3: Press the equals sign for the answer: 2.75.

Calculating Percentages Using a Calculator

Some problems involving percentages require multiplying a number by a percent.

Example: In the fall election, 5,600 people voted, and 53% voted for Cheryl Beamer. How many people voted for Cheryl Beamer in the election?

This question asks, "What is 53% of 5,600?" To determine this without a calculator, we need to convert the percentage into a decimal, and then multiply it by the total number.

Using a calculator, you can solve the problem like this.

Step 1: Clear the calculator to make sure no previous numbers are entered.

Step 2: Enter 5,600. This is the total amount.

Step 3: Press the × key to indicate multiplication.

Step 4: Enter 53. This is the percentage we are trying to calculate.

Step 5: Press the % key to show the answer (some calculators may require you to press the = key after the % key to display the answer). The answer is 2,968.

If your calculator doesn't have a percent key, you can just multiply 5,600 by .53 for the same answer.

In the election, 2,968 people voted for Cheryl Beamer.

Example: At Lakeside Summer Camp, 87% of the campers take sailing lessons. If there are 323 campers, how many take sailing lessons?

Step 1: Clear the calculator.

Step 2: Enter total number (323).

Step 3: Press the × key to indicate multiplication.

Step 4: Enter the percentage (87).

Step 5: Press the % key to show the answer, which is 281.01. (Alternately, you can enter 323 × .87 to arrive at the same answer.)

Since we're talking about people, and you can't have a fraction of a person, we round this to the nearest whole number: 281.

At Lakeside Summer Camp, 281 campers take sailing lessons.

Some problems involving percentages give the amount of the part and the whole, and require us to calculate the percentage.

Example: There are 44 Farm Club members, and 32 of them are exhibiting at the county fair. What percent of the members are exhibiting?

To determine the percentage, we form a fraction, with the part over the whole, and divide the numerator (the part becomes the dividend) by the denominator (the whole becomes the divisor) to create a decimal. Then we convert the decimal to a percentage by moving the decimal point. Here's how to do that with a calculator.

Step 1: In your head, form a fraction from the two known numbers, with the part over the whole: $\frac{32}{45}$.

Step 2: Clear the calculator.

Step 3: Enter the numerator, which is the dividend: 32.

Step 4: Press the ÷ key to indicate division.

Step 5: Enter the denominator, which is the divisor: 44.

Step 6: Press the = key to show the decimal, which is 0.7272727[repeating].

Step 7: Change the decimal to a percent by moving the decimal point two places to the right, and round it to the nearest whole number.

Seventy-three percent of the Farm Club members exhibited at the county fair. (If we wanted to round it to two decimal places, the answer would be 72.73%. Unless otherwise specified, always round decimals to two places.)

Example: There are 5 barn cats living on the farm. Two are black and 3 are orange and white. What percentage of the cats are black? What percentage are orange and white?

Step 1: Create a fraction representing the black cats. Two out of 5 are black, so the fraction is $\frac{2}{5}$.

Step 2: Clear the calculator.

Step 3: Enter the numerator/dividend: 2.

Step 4: Press the division key.

Step 5: Enter the denominator/divisor: 5.

Step 6: Press the equals key: 0.4.

Step 7: Convert the decimal to a percentage by moving the decimal point: 0.4 = 40%.

Now follow the same steps to find out the percentage of orange and white cats.

Step 1: Create a fraction representing the orange and white cats: $\frac{3}{5}$.

Step 2: Clear the calculator.

Step 3: Enter the numerator/dividend: 3.

Step 4: Press the division key.

Step 5: Enter the denominator/divisor: 5.

Step 6: Press the equals key: 0.6.

Step 7: Convert the decimal to a percentage by moving the decimal point: 0.6 = 60%.

Of the 5 barn cats, 40% are black and 60% are orange and white. Notice that the two percentages equal 100%, which represents the whole group of cats.

Using a Calculator with Signed Numbers

When you use a calculator to perform multiplication or division of signed numbers, don't enter any positive or negative values into your calculator. Perform the indicated operation using the absolute value of the numbers (the numbers without any signs). Then use the rules to determine what the sign of the answer should be and add that to the answer.

Rules for adding signed numbers:

- **If two numbers have the same sign, add their absolute values and give the sum the sign of the original numbers.**
- **If two numbers have different signs, subtract the smaller absolute value from the larger and give the result the sign of the number with the larger absolute value.**

Rule for subtracting signed numbers:

- **To subtract signed numbers, change the minus sign to a plus sign and add the opposite of the number being subtracted.**

Rules for multiplying and dividing signed numbers:

- **When two numbers with the same sign are multiplied or divided, the result is positive.**
- **When two numbers with different signs are multiplied or divided, the result is negative.**

Let's try a few problems using the calculator.

Example: $12(-3)$

Step 1: Clear the calculator.

Step 2: Enter the first number: 12.

Step 3: Press the multiplication key.

Step 4: Enter the absolute value of the second number: 3.

Step 5: Press the equals key: 36.

Step 6: Apply the rule for multiplying signed numbers. Since the signs for the two numbers are different, the result is negative: 12 (–3) = –36.

Example: $-198 - 23$

Remember, to subtract signed numbers, we convert the problem to an addition problem and add the opposite of the number being subtracted. Our problem now looks like this: –198 + (–23)

Step 1: Clear the calculator.

Step 2: Enter the absolute value of the first number: 198.

Step 3: Press the addition key.

Step 4: Enter the absolute value of the second number: 23.

Step 5: Press the equals key: 221.

Step 6: Apply the rule for adding signed numbers. Since the signs for the two numbers are the same, the sum is given the same sign: –198 – 23 = –221.

Example: $56 + (-65)$

When adding two numbers with different signs, subtract the smaller absolute value from the larger and give the result the sign of the number with the larger absolute value.

Step 1: Clear the calculator.

Step 2: Enter the absolute value of the larger number: 65.

Step 3: Press the subtraction key.

Step 4: Enter the smaller number: 56.

Step 5: Press the equals key: 9.

Step 6: Apply the rule for adding signed numbers. Since the signs for the two numbers are different, give the result the sign of the number with the larger absolute value: 56 + (–65) = –9.

Example: $-80 \div (-16)$

Step 1: Clear the calculator.

Step 2: Enter the absolute value of the first number: 80.

Step 3: Press the division key.

Step 4: Enter the absolute value of the second number: 16.

Step 5: Press the equals key: 5.

Step 6: Apply the rule for dividing signed numbers. Since the signs for the two numbers are the same, the result is positive: –80 ÷ (–16) = 5.

Square Roots, Third Roots, and Fourth Roots of Numbers

Finding the square root of a number becomes quite simple when using a calculator with a radical (square root) sign.

Example: Calculate the square root of 169.

Step 1: Clear the calculator. (Hopefully this is becoming a habit by now!)

Step 2: Enter the number you want to find the square root of: 169.

Step 3: Press the square root key (√) for the answer: 13.

You can always check your answer by multiplying 13 by itself: 13 × 13 = 169.

Example: Calculate the square root of 529.

Step 1: Clear the calculator.

Step 2: Enter the number you want to find the square root of: 529.

Step 3: Press the square root key for the answer: 23.

Example: Calculate the square root of 2,025.

Step 1: Clear the calculator.

Step 2: Enter the number you want to find the square root of.

Step 3: Press the square root key for the answer: 45.

Just as there are square roots of numbers, there are also third and fourth (and higher) roots of numbers. The principle for third and fourth roots of numbers is the same as for square roots. For example, the third root of a number is the number that, if multiplied by itself three times, will equal the original number. The fourth root of a number is the number that, if multiplied by itself four times, will equal the original number.

$3^3 = 3 \times 3 \times 3 = 27$ so the third root of 27 is 3.

$5^4 = 5 \times 5 \times 5 \times 5 = 625$ so the fourth root of 625 is 5.

Finding the third or fourth root of a number is a complicated process, so mathematicians use calculators to find these roots. Most calculators have square root keys, but only advanced math calculators have keys for roots of higher powers. The goal in this lesson is just to help you understand the concept of third and fourth roots, so we'll just experiment with determining the value of exponents and then finding the third and fourth roots that way.

When we express higher roots of numbers, we use the familiar radical symbol, but we put a small number beside the symbol to indicate the power of the root.

Example: $\sqrt[3]{64}$

This indicates that we are looking for the third root of 64, the number that, if multiplied by itself 3 times, will equal 64.

Use your calculator to try different combinations.

Step 1: Let's start with 2. Calculate 2^3 by entering $2 \times 2 \times 2$ (remember to clear the calculator first). You'll notice that after you enter 2×2 and then press the multiplication sign again, the cumulative total shows: 4. Press 2 again, to multiply 4×2 (which is the same as $2 \times 2 \times 2$).

Step 2: Press the equals sign for the answer: 8.

That's not the answer we're looking for, so we try a higher number and repeat the steps. Let's try 3.

Step 1: Calculate 3^3 by entering $3 \times 3 \times 3$. You'll notice that after you enter 3×3 and then press the multiplication sign again, the cumulative total shows: 9. Press 3 again, to multiply by 3 a third time.

Step 2: Press the equals sign for the answer: 27.

Still not high enough, so we'll try again with 4.

Step 1: Calculate 4^3 by entering $4 \times 4 \times 4$.

Step 2: Press the equals sign for the answer: 64.

That's the number we're looking for: $4 \times 4 \times 4 = 64$, so the third root of 64 is 4.

Example: $\sqrt[4]{81}$

This time we are looking for the fourth root of 81, the number that, if multiplied by itself 4 times, will equal 81. Again, we'll use the calculator to try different combinations.

Step 1: Let's start with 2. Calculate 2^4 by entering 2 × 2 × 2 × 2. You can watch the cumulative total increase as you move through the operations. Keep careful track of how many times you enter the numbers—you will press 2 four times.

Step 2: Press the equals sign for the answer: 16.

That's not the answer we're looking for, so we try a higher number and repeat the steps.

Step 1: Calculate 3^4 by entering 3 × 3 × 3 × 3.

Step 2: Press the equals sign for the answer: 81.

That's the number we're looking for: 3 × 3 × 3 × 3 = 81, so the fourth root of 81 is 3.

New Skills Practice

Complete the following worksheets in your math workbook:

- Lesson 17 New Skills Practice: Using a Calculator; Third and Fourth Roots
- Lesson 17 Test

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

Lesson

23 Skills Review

Cumulative Skills Review

In this Skills Review lesson, you have the chance to brush up on skills that still need practice. The test is a *cumulative* test; that means that it includes a collection of all the skills you've worked on so far this year. Here is a list of the skills so far in the second semester:

Lesson 19

- Using Pi to Determine the Circumference and Area of a Circle
- Measuring and Classifying Angles
- Measuring and Classifying Triangles
- Determining the Sum of Angles in a Triangle

Lesson 20

- Using a Compass
- Constructing Triangles
- Calculating the Area of Rectangles and Triangles

Lesson 21

- Applying Formulas
- Distance, Rate, and Time
- Transforming Formulas

Lesson 22

- Determining Sequence Patterns
- Applying Functions to Find Unknown Values
- Identifying Functions

In addition to this list, you might want to check over the list of skills from the first semester (found in lesson 18). Use this week to practice any skills you still need to work on—there are lots of extra practice worksheets in the appendix of your math workbook—and ask a parent or teacher for help if you need it.

When you feel ready, complete the Lesson 23 Test and Learning Checklist.

ASSIGNMENT SUMMARY

- ☐ Practice skills learned so far.
- ☐ Complete Lesson 23 Test and Learning Checklist.