

math

MAMMOTH

Grade 5-A Worktext

The four operations

Large numbers and the calculator

Problem solving

Decimals, part 1

Graphing and statistics



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Sample worksheet from

<https://www.mathmammoth.com>

By Maria Miller

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Foreword

Math Mammoth Grade 5-A and Grade 5-B worktexts comprise a complete math curriculum for the fifth grade mathematics studies that meets and exceeds the Common Core Standards.

Fifth grade is the time to focus on fractions and decimals and their operations in great detail. Students also deepen their understanding of whole numbers, get introduced to the calculator, learn more problem solving and geometry, and study statistical graphs.

The year starts out with a study of whole numbers and their operations. Students review multi-digit multiplication and learn long division with two-digit divisors. We also review divisibility and prime factorization from fourth grade.

In the second chapter, the focus is on large numbers and using a calculator. This is the first time a calculator is introduced in Math Mammoth complete curriculum—thus far, all calculations have been done with mental math or with paper and pencil. I want students to learn to be critical in their use of the calculator and use it with good judgment. Every exercise where calculator use is allowed is marked with a little picture of a calculator.

The third chapter is about equations and problem solving. We study simple equations with the help of a balance and bar models. The main goal is to get students used to the concept of an equation and what it means to solve an equation. Students also solve a fair amount of word problem with the help of the visual bar model.

The fourth chapter is about decimals and some of the operations with decimals (the rest will be studied in chapter 6). Fifth grade is the time when students learn all the basic operations with decimals. In this chapter, we focus on place value with decimals, addition and subtraction of decimals, and multiplication and division of decimals by whole numbers. Multiplying decimals by decimals and dividing decimals by decimals is covered in chapter 6.

In chapter 5 we study graphing in a coordinate grid, line and bar graphs, and average and mode. Today's world has become increasingly complex with lots of data presented in the media, so our children need a good grasp of statistical graphs to be able to make sense of all of that information.

In part 5-B, students study more about decimals, operations with fractions, and geometry.

I wish you success with teaching math!

Maria Miller, the author

Chapter 1: The Four Operations

Introduction

We start fifth grade by studying the four basic operations. This includes studying the order of operations, simple equations and expressions, long multiplication, long division, divisibility, primes, and factoring.

The main line of thought throughout this chapter is that of a mathematical *expression*. In mathematics, an expression consists of numbers, letters, and operation symbols, but does not contain an equal sign (an equation does). Students write simple expressions for problems which they solve. They study the correct order of operations in an expression. An *equation* in mathematics consists of an expression that equals another expression (expression = expression). We also study simple equations, both with and without the help of visual bar models.

Next, we review multi-digit multiplication, starting with partial products (multiplying in parts) and how that can be visualized geometrically. Then it is time for long division, especially practicing long division with two-digit divisors. We also study why long division works, in the lesson *Long Division and Repeated Subtraction*. Throughout the lessons there are also word problems to solve.

Lastly, we study the topics of divisibility, primes, and factoring. Students learn the common divisibility rules for 2, 3, 4, 5, 6, 8, 9, and 10. In prime factorization, we use factor trees.

Although the chapter is named “The Four Operations,” please notice that the idea is not to practice each of the four operations separately, but rather to see how they are used together in solving problems and in simple equations. We are trying to develop the students’ *algebraic thinking*, including the abilities to: translate problems into mathematical operations, comprehend the many operations needed to yield an answer to a problem, “undo” operations, and so on. Many of the ideas in this chapter are preparing them in advance for algebra.

The Lessons in Chapter 1

	page	span
Warm Up: Mental Math	11	2 pages
The Order of Operations and Equations	13	3 pages
Review: Addition and Subtraction	16	3 pages
Review: Multiplication and Division	19	4 pages
Multiplying in Parts	23	6 pages
The Multiplication Algorithm	29	5 pages
More Multiplication	34	5 pages
Long Division	39	4 pages
A Two-Digit Divisor 1	43	4 pages
A Two-Digit Divisor 2	47	3 pages
Long Division and Repeated Subtraction	50	5 pages
Divisibility Rules	55	5 pages
Review: Factors and Primes	60	4 pages
Prime Factorization	64	5 pages
Chapter 1 Review	69	3 pages

Helpful Resources on the Internet

MENTAL MATH

Math Mahjong

A Mahjong game where you need to match tiles with the same value.

http://www.sheppardsoftware.com/mathgames/mixed_mahjong/mahjongMath_Level_3.html

Pop the Balloons

Pop the balloons in the order of their value. You need to use all four operations.

<http://www.sheppardsoftware.com/mathgames/numberballoons/BalloonPopMixed.htm>

ORDER OF OPERATIONS

Interactive Order of Operations Practice

Click on the correct operation in the expression.

http://www.softschools.com/math/order_of_operations/games/

Order of Operations Practice

A simple online quiz of 10 questions. Uses parentheses and the four operations.

<http://www.onlinemathlearning.com/order-of-operations-practice.html>

The Order of Operations Millionaire

Answer multiple-choice questions that have to do with the order of operations, and win a million.

<http://www.math-play.com/Order-of-Operations-Millionaire/order-of-operations-millionaire.html>

Exploring the Order of Operations (Object Interactive)

Click on the correct operation to be done first in the given expression. The program then solves that operation, and you click on the *next* operation to be performed. Lastly the resource includes a game where you click on the falling blocks in the order that the order of operations would dictate.

http://www.learnalberta.ca/content/mejhm/html/object_interactives/order_of_operations/use_it.html

Choose Math Operation

Choose the mathematical operation(s) that make the equation true. Practice the role of zero and one in basic operations or operations with negative numbers. Helps develop number sense and logical thinking.

<https://www.homeschoolmath.net/operation-game.php>

Quick Calculate

Practice your arithmetic with all four operations plus the order of operations.

https://www.mathplayground.com/quick_calculate.html

Free worksheets for the order of operations

Generate printable and customizable worksheets for the order of operations. Choose from five operations and parentheses. You can choose the number range used, the number of problems, and more.

https://www.homeschoolmath.net/worksheets/order_of_operations.php

BAR MODELS

Thinking Blocks: Addition and Subtraction

Model and solve addition and subtraction word problems using this interactive math tool. This link takes you to the Thinking Blocks main page; scroll down to the section titled Addition and Subtraction.

<https://www.mathplayground.com/thinkingblocks.html>

Sample worksheet from

<https://www.mathmammoth.com>

Thinking Blocks: Multiplication and Division

Model and solve multiplication and division word problems using this interactive tool. The link takes you to the Thinking Blocks main page; scroll down to the section on multiplication and division.

<https://www.mathplayground.com/thinkingblocks.html>

FUN WITH PROBLEM SOLVING

Calculator Chaos

Most of the keys have fallen off the calculator. Make certain numbers using the keys that are left.

https://www.mathplayground.com/calculator_chaos.html

SpeedMath Deluxe

Create an equation from the four given digits using addition, subtraction, multiplication and division. Make certain that you remember the order of operations. It sometimes includes negative numbers.

<http://education.jlab.org/smdeluxe/index.html>

Random Coins

Can you make \$1.00 from Random Coins? Drag and drop the coins.

<https://www.mathsisfun.com/money/random-coins.html>

LONG DIVISION & MULTIPLICATION

Amoeba Multiplication Game

Practice partial products, or multiplication by splitting numbers. Choose “Medium Level”.

<http://downloads.bbc.co.uk/skillswise/maths/ma12pape/game/ma12pape-game-written-multiplication/multiplication.swf>

Area and the Distributive Property

Practice the idea how partial products tie in with the area of a rectangle (the distributive property).

<https://www.khanacademy.org/math/cc-third-grade-math/cc-third-grade-measurement/cc-third-grade-area-distributive-property/e/area-and-the-distributive-property>

Multiply 2-Digit Numbers with Area Model

Use an area model to decompose factors and multiply.

<https://www.khanacademy.org/math/arithmetric/multiplication-division/area-models-multiplication/e/multiplying-2-digit-numbers-with-area-models>

Estimator Quiz

Practice your estimation skills in this customizable interactive quiz. Choose “multiplication”.

<http://www.shodor.org/interactivate/activities/EstimatorQuiz/>

Interactive Multiplication Practice

Improve your multi-digit multiplication skills with this 10-question online quiz.

<https://www.thatquiz.org/tq-1/?-jg44-lf-p0>

Multiplication with Money

Spin the wheel. At the end of each spin, practice multiplying amounts of money.

<http://www.kidsmathtv.com/learn/multiplication-with-money-values-game-for-5th-grade-spin-the-wheel-team-game/>

Understanding Remainders

Use arrays and practice problems to understand remainders. Also includes a bonus game!

<https://www.khanacademy.org/math/arithmetric/arith-review-multiply-divide/arith-review-remainders/a/understanding-remainders>

Drag and Drop Math

An interactive tool to practice long division or long multiplication.

<https://mrnussbaum.com/drag-and-drop-math/>

Sample worksheet from

<https://www.mathmammoth.com>

Mr. Martini's Classroom: Long Division

An interactive long division tool.

<http://www.thegreatmartinicompany.com/longarithmetic/longdivision.html>

Long Division

Solve long division problems interactively. Choose the levels with 2-digit divisors.

<http://www.longdiv.co.uk/activity/>

Long Division Tic Tac Toe

Play Tic Tac Toe while solving long division problems. This exercise has multiple-choice answers.

<http://www.math-play.com/Tic-Tac-Toe-Long-Division-Game/Tic-Tac-Toe-Long-Division-Game.html>

Long Division by "Chunking"

Solve division problems by using the "chunking method" — also called division by repeated subtraction.

<http://www.chunkydivision.co.uk/activity/index.htm>

Short Division

A page that explains short division in detail. Short division is the same algorithm as long division, but some steps are only done in one's head, not written down.

<http://www.themathpage.com/ARITH/divide-whole-numbers.htm>

FACTORS AND PRIMES

Find a Factor Maze Game

Find your way through the maze by clicking on factors of a given number.

<https://www.mathmammoth.com/practice/>

Divisibility Quiz Generator

Generate customized quizzes to practice the rules of divisibility.

<http://www.mathwarehouse.com/arithmetic/numbers/divisibility-quiz.php>

Primes and Divisibility Quiz

Practice basic concepts of primes and divisibility with this interactive self-check quiz.

<http://www.phschool.com/webcodes10/index.cfm?wcprefix=ama&wcsuffix=1254>

Arrays and factors

Drag rectangles to show the factorizations of a given number on a grid.

<http://www.shodor.org/interactivate/activities/FactorizeTwo/>

Octopus Factors

Move counters up the legs of an octopus but only when the number on the circle is a multiple of the number on the card.

<http://www.counton.org/games/map-numbers/octopus/>

Factor Game

Choose a number from the game board, and your opponent gets all the numbers that are its proper factors. Adjust the number of rows and columns of the board to get a more challenging game. This game can easily be adapted to be played offline, with paper and colored pencils.

<http://illuminations.nctm.org/Activity.aspx?id=4134>

Product Game

The players choose factors and the product of those are colored in on the game board. The player who gets four products in a row wins. You can play against the computer or with a friend. This game can easily be adapted to be played offline, with paper and colored pencils.

Sample worksheet from
<https://www.mathmammoth.com>

Prime Factorization Calculator

This tool allows you to enter a composite number, and it produces a list of the prime numbers that, when multiplied, produce the original composite number.

<http://www.dadsworksheets.com/prime-factorization-calculator.html>

Sliding Tile Factorization Game

Slide a number over another to capture it. You can only do this if the number you slide is a factor of the other. Number 1 is only supposed to be used to capture prime numbers.

http://www.visualmathlearning.com/Games/sliding_factors.html

Not a Factor

Choose a number that is *not* a factor of the given number.

http://www.helpingwithmath.com/resources/games/target_factors01/not_factor.html

Factorization Forest

A fun game where for each number you factorize, you will get to grow a tree in your forest!

<https://mrnuusbaum.com/forest/>

Factoring Calculator

This tool lists all the factors of a given number and has an interesting visual that pairs the factors of the number. You can find all the factors of even very large numbers. It's fun to experiment with!

<http://www.dadsworksheets.com/factoring-calculator.html>

Factor Trees at Math Playground

Factor numbers to their prime factors using an interactive factor tree.

<https://www.mathplayground.com/factortrees.html>

MathGoodies Interactive Factor Tree Game

Type the missing number into the factor tree, and you will see the factor tree being drawn.

http://www.mathgoodies.com/factors/prime_factors.html

FOR FURTHER STUDY

Unique Prime Factorization

A video explaining the fundamental theorem of arithmetic: that each composite number has a unique prime factorization.

<https://www.youtube.com/watch?v=5kl28hnhin0>

Primes, Factors and Divisibility—Explorer at CountOn.org

Explore and learn more about divisibility tests, primes, and factors.

<http://www.counton.org/explorer/primes>

The Prime Pages

Learn about the largest known primes, how primes are found, how many there are, and more.

<http://primes.utm.edu/>

The Cryptoclub. Using Mathematics to Make and Break Secret Codes (book)

Cryptoclub kids try to break the codes of secret messages, and at the same time learn more and more about encrypting and decrypting. The book contains problems to solve at the end of each chapter, little tips, and historical information on how cryptography has been used over the centuries.

<http://www.amazon.com/gp/product/156881223X?tag=mathmammoth-20>

Primality of 1 from Wikipedia

Discussing whether 1 should or should not be counted as a prime number.

https://en.wikipedia.org/wiki/Prime_number#Primality_of_one

<http://primefan.tripod.com/Prime1ProCon.html>

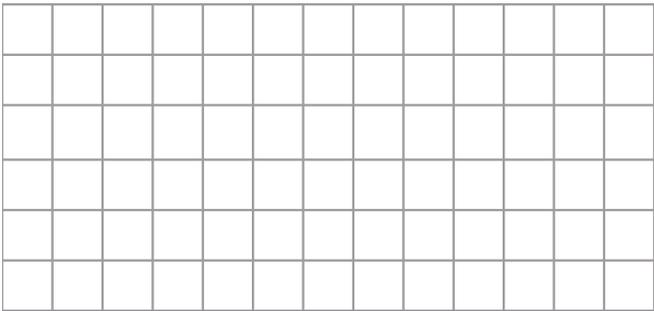
Sample worksheet from
<https://www.mathmammoth.com>

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2. Practice 4-digit by 2-digit and 5-digit by 2-digit multiplications.

<p>a.</p> $\begin{array}{r} 1491 \\ \times 27 \\ \hline \end{array}$	<p>b.</p> $\begin{array}{r} 2085 \\ \times 35 \\ \hline \end{array}$	<p>c.</p> $\begin{array}{r} 8116 \\ \times 18 \\ \hline \end{array}$
<p>d.</p> $\begin{array}{r} 20516 \\ \times 37 \\ \hline \end{array}$	<p>e.</p> $\begin{array}{r} 31447 \\ \times 29 \\ \hline \end{array}$	<p>f.</p> $\begin{array}{r} 12704 \\ \times 45 \\ \hline \end{array}$

3. Solve.

<p>A large shipping container can hold 15,000 pounds. A company packs 155 boxes of windows in it, each weighing 32 lbs. How much weight can they put in the container after that?</p>	
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4. Let's review! Multiply mentally. (Remember the shortcut? Multiply without the zeros, then tag as many zeros at the end of the answer as there are in the factors.)

a. $500 \times 200 =$	b. $30 \times 210 =$
c. $250 \times 40 =$	d. $2,000 \times 400 =$
e. $2 \times 800 \times 20 =$	f. $30 \times 40 \times 50 =$

When the factors end in zeros, we can take a shortcut! Study the examples carefully.

Example 1:

$$\begin{array}{r} 11 \\ 956 \\ \times 200 \\ \hline 191200 \end{array}$$

Here, you can first place two zeros in the ones and tens places in the answer, and then just multiply 2×956 .

Example 2:

$$\begin{array}{r} 411 \\ 950 \\ \times 820 \\ \hline 000 \\ 19000 \\ + 76000 \\ \hline 779000 \end{array}$$

Be careful... the first "line" consists totally of zeros. On the second line, first place a zero, then multiply. On the third line, first place TWO zeros, then multiply.

$$\begin{array}{r} 411 \\ 95 \\ \times 82 \\ \hline 190 \\ + 7600 \\ \hline 7790 \end{array}$$

It is easier to multiply 82×95 and tag two zeros to the final answer to get 779,000.

5. Multiply.

a. $500 \times 29 =$ _____

Simply multiply 5×29 , then tag _____ zeros to the final answer.

b. $340 \times 210 =$ _____

Multiply _____ \times _____, then tag _____ zeros to the final answer.

c. $280 \times 700 =$ _____

Multiply _____ \times _____, then tag _____ zeros to the final answer.

d. $99 \times 9,900 =$ _____

e. $500 \times 1,800 =$ _____

f. $24,500 \times 30 =$ _____

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A Two-Digit Divisor 1

It is helpful to write the multiplication table of the divisor before you divide.

<p>Example 1. This division is by 16. See below the multiplication table of 16:</p> <p> $3 \times 16 = 48$ $4 \times 16 = 64$ $5 \times 16 = 80$ $6 \times 16 = 96$ $7 \times 16 = 112$ $8 \times 16 = 128$ $9 \times 16 = 144$ </p>	$\begin{array}{r} 0 \ 3 \\ 16 \overline{) 5568} \end{array}$ <p>16 goes into 5 zero times, so we look at 55.</p> <p>How many times does 16 go into 55?</p> <p>Check in the table on the left. We see it goes into 55 three times.</p>	$\begin{array}{r} 0 \ 3 \ 4 \\ 16 \overline{) 5568} \\ \underline{-48} \\ 76 \end{array}$ <p>Now, how many times does 16 go into 76?</p> <p>From the table we can see that it is four times.</p>	$\begin{array}{r} 0 \ 3 \ 4 \ 8 \\ 16 \overline{) 5568} \\ \underline{-48} \\ 76 \\ \underline{-64} \\ 128 \\ \underline{-128} \\ 0 \end{array}$ <p>Lastly, 16 goes into 128 exactly 8 times, and the division is over.</p>
<p>Example 2. We are dividing by 32. Below is the multiplication table of 32:</p> <p> $3 \times 32 = 96$ $4 \times 32 = 128$ $5 \times 32 = 160$ $6 \times 32 = 192$ $7 \times 32 = 224$ $8 \times 32 = 256$ $9 \times 32 = 288$ </p>	$\begin{array}{r} 0 \ 1 \\ 32 \overline{) 4707} \\ \underline{-32} \\ 15 \end{array}$ <p>32 goes into 47 once.</p>	$\begin{array}{r} 0 \ 1 \ 4 \\ 32 \overline{) 4707} \\ \underline{-32} \\ 150 \\ \underline{-128} \\ 22 \end{array}$ <p>32 goes into 150 four times.</p>	$\begin{array}{r} 0 \ 1 \ 4 \ 7 \\ 32 \overline{) 4707} \\ \underline{-32} \\ 150 \\ \underline{-128} \\ 227 \\ \underline{-224} \\ 3 \end{array}$ <p>32 goes into 224 seven times. Notice there is a remainder.</p>

1. Divide. First write a multiplication table for the divisor. Check each answer by multiplying.

Table of 21:

- $2 \times 21 =$
- $3 \times 21 =$
- $4 \times 21 =$
- $5 \times 21 =$
- $6 \times 21 =$
- $7 \times 21 =$
- $8 \times 21 =$
- $9 \times 21 =$

$$\begin{array}{r} 2 \ 1 \ 3 \ 8 \ 2 \ 2 \\ 21 \overline{) 3822} \end{array}$$

2. Divide. First write a multiplication table for the divisor. Check each answer by multiplying.

a.

Table of 15:

$2 \times 15 =$

$3 \times 15 =$

$4 \times 15 =$

$5 \times 15 =$

$6 \times 15 =$

$7 \times 15 =$

$8 \times 15 =$

$9 \times 15 =$

15)	4815			

b.

Table of 12:

$2 \times 12 =$

$3 \times 12 =$

$4 \times 12 =$

$5 \times 12 =$

$6 \times 12 =$

$7 \times 12 =$

$8 \times 12 =$

$9 \times 12 =$

12)	5148			

c.

Table of 25:

$2 \times 25 =$

$3 \times 25 =$

$4 \times 25 =$

$5 \times 25 =$

$6 \times 25 =$

$7 \times 25 =$

$8 \times 25 =$

$9 \times 25 =$

25)	6275			

d.

Table of 16:

$2 \times 16 =$

$3 \times 16 =$

$4 \times 16 =$

$5 \times 16 =$

$6 \times 16 =$

$7 \times 16 =$

$8 \times 16 =$

$9 \times 16 =$

16)	1504			

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Chapter 2: Large Numbers and the Calculator

Introduction

In this chapter, we study large numbers and place value up to billions—that is, up to 12-digit numbers. Students will also add, subtract, and round large numbers, and learn about exponents and powers. Concerning exponents and powers, the focus is on powers of ten (such as 10^2 , 10^5 , 10^8 , and so on), which is what the student should master in this grade level. If your student has difficulties with exponents in general, there is no need to worry. Exponents and powers are taught from scratch again in Math Mammoth grade 6.

In this chapter, students will be introduced to the calculator for the first time, and therefore they will need a simple calculator (preferably a physical one, not one on a computer or other device) about half-way through this chapter.

I have delayed the use of a calculator (as compared to many other math curricula) for good reasons. I have received numerous comments on the harm that indiscriminate calculator usage can cause. If children are allowed to use calculators freely, their minds get “lazy,” and they will start relying on calculators even for simple things such as 6×7 or $320 + 50$. It is just human nature!

As a result, students may enter college without even knowing their multiplication tables by heart. Then they have trouble if they are required to use mental math to solve simple problems.

Therefore, we educators need to *limit* calculator usage until the students are much older. Children *cannot* decide this for themselves, and definitely not in fifth grade.

However, I realize that the calculator is extremely useful, and students do need to learn how to use it. In this curriculum, I try to not only show the students how to use a calculator, but also *when* to use it and when *not* to use it.

This chapter includes many problems where calculator usage is appropriate. We also practice estimating the result before using a calculator to find the exact answer, and choosing whether mental math or a calculator is the best “tool” for the calculation.

The Lessons in Chapter 2

	page	span
A Little Bit of Millions	75	3 pages
Place Value Up to Billions	78	5 pages
Exponents and Powers	83	3 pages
Adding and Subtracting Large Numbers	86	3 pages
Rounding	88	4 pages
The Calculator	92	3 pages
When to Use the Calculator	95	2 pages
Mixed Review Chapter 2	97	2 pages
Chapter 2 Review	99	3 pages

Helpful Resources on the Internet

Online Place Value Practice

Practice writing numbers that are given in expanded form.

<https://www.mathmammoth.com/practice/place-value#mode=write-number&max-digits=12&question-number=10>

Expanded Form Quiz

Practice addition in expanded form with this 10-question quiz.

<https://www.thatquiz.org/tq-c/?-j28-19-p0>

Can you say really big numbers?

Enter a really big number, try to say it out loud, and see it written.

<http://www.mathcats.com/explore/reallybignumbers.html>

Fruit Splat Compare Numbers

Compare numbers by choosing $<$, $>$, or $=$. Choose level six.

<http://www.sheppardsoftware.com/mathgames/placevalue/FSCmpareNumbers.htm>

Place Value Quiz

Practice identifying the place values of the digits in large numbers with this 10-question quiz.

<https://www.thatquiz.org/tq-c/?-j21-19-p0>

Quiz on Large Numbers

Test your knowledge about numbers with this 10-question multiple choice quiz.

<http://www.proprofs.com/quiz-school/story.php?title=NTczNDc3>

Megapenny Project

This page visualizes big numbers with pictures of pennies.

http://nanospace.molecularium.com/attractions/mega_penny/

Powers of Ten

A 9-minute movie that illustrates the dramatic changes of scale when zooming in or out by powers of ten (40 powers of ten), starting from a picnic blanket and ending in the universe, and then starting from a hand, all the way to a proton inside an atom.

<https://www.youtube.com/watch?v=0fKBhvDjuy0>

Free Exponent Worksheets

Create a variety of customizable and printable worksheets to practice exponents.

<https://www.homeschoolmath.net/worksheets/exponents.php>

Exponents Quiz from ThatQuiz.org

A 10-question quiz, fairly easy, and not timed. You can change the parameters as you like.

<http://www.thatquiz.org/tq-2/?-j1-14-p0>

Pyramid Math

Choose "POW" to practice exponents. Drag the triangle with the right answer to the vase.

<http://www.mathnook.com/math/pyramidmath.html>

Picture Matching - Exponent Values

Match the powers with their values and reveal a pretty picture.

<http://www.studystack.com/picmatch-275044>

Sample worksheet from
<https://www.mathmammoth.com>

Exponent Game

A card game to practice exponents. Limit the cards to small numbers, instead of using the whole deck.

<http://www.learn-with-math-games.com/exponent-game.html>

Otter Rush

Choose the correct value for “x” in exponent expressions (such as $2^x = 16$) in this racing game.

https://www.mathplayground.com/ASB_Otter_Rush.html

Adding and Subtracting Powers of Ten

This interactive quiz practices adding and subtracting powers of ten with numbers up to 1,000,000.

<http://snappymaths.com/addsub/addsubp10/interactive/addsubpowers10/addsubpowers10.htm>

ROUNDING AND ESTIMATING

Rounding Quiz

Practice rounding large numbers in this interactive 10-question quiz.

<http://www.softschools.com/quizzes/math/rounding/quiz837.html>

Online Rounding Practice

Practice your rounding skills with this interactive exercise.

<https://www.mathmammoth.com/practice/rounding#number-range=0to100000000&round-to=any-place>

Alice's Cross-Number Puzzle

Respond correctly to the clues and when you finish, your answers will form upside-down calculator words.

<http://www.dr-mikes-math-games-for-kids.com/alices-cross-number-puzzle.html>

Estimation Valley Game

Practice estimation with this math golf game. The better you estimate, the more accurate your shot!

<https://mrnuessbaum.com/estimationvalley/>

Estimation at AAA Math

Exercises about rounding whole numbers and decimals, front-end estimation, estimating sums and differences. Each page has an explanation, interactive practice, and games.

<http://www.aaamath.com/B/est.htm>

CALCULATOR

Using a Calculator

Practice your calculator skills with this challenging quiz! Note: Some of the questions use concepts not studied in this grade.

http://www.transum.org/software/SW/Starter_of_the_day/Students/Using_A_Calculator.asp?Level=1

Powers Puzzle

This exploratory math exercise will get students to exploring numbers with the use of a calculator.

<http://www.dr-mikes-math-games-for-kids.com/powers-puzzle.html>

Magical Calculator Birthday Math Trick

Have fun with this amazing calculating trick!

<http://www.dr-mikes-math-games-for-kids.com/magical-calculator-birthday-math-trick.html>

Calc-a-hundred

In this game for two players, take turns multiplying numbers on a calculator to see who can be the first one to make the total equal one hundred point something.

https://www.transum.org/Software/SW/Starter_of_the_day/starter_October5.ASP

Sample worksheet from

<https://www.mathmammoth.com>

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Adding and Subtracting Large Numbers

Just like $25 \text{ marbles} + 54 \text{ marbles} = 79 \text{ marbles}$, so will $25 \text{ million} + 54 \text{ million} = 79 \text{ million}$.

Just keep in mind:

A thousand thousands makes a million, and a thousand millions makes a billion.

<p style="text-align: center;">800,000 + 200,000</p> <p>Think of it as 800 thousand + 200 thousand. The answer is 1,000 thousand or 1,000,000.</p>	<p style="text-align: center;">Half a million</p> <p>Think of it as half of a thousand thousands, or 500 thousands = 500,000.</p>
<p style="text-align: center;">34,999,000 + 1,000</p> <p>This is 34 million 999 thousand + 1 thousand, making 34 million 1000 thousand or 35 million.</p>	<p style="text-align: center;">2 billion – 300 million</p> <p>Think of it as 2,000 million – 300 million, which makes 1,700 million or 1,700,000,000.</p>

1. Add.

	a. 90,000	b. 99,000,000	c. 999,000
+ 1,000			
+ 10,000			
+ 100,000			
+ 1,000,000			

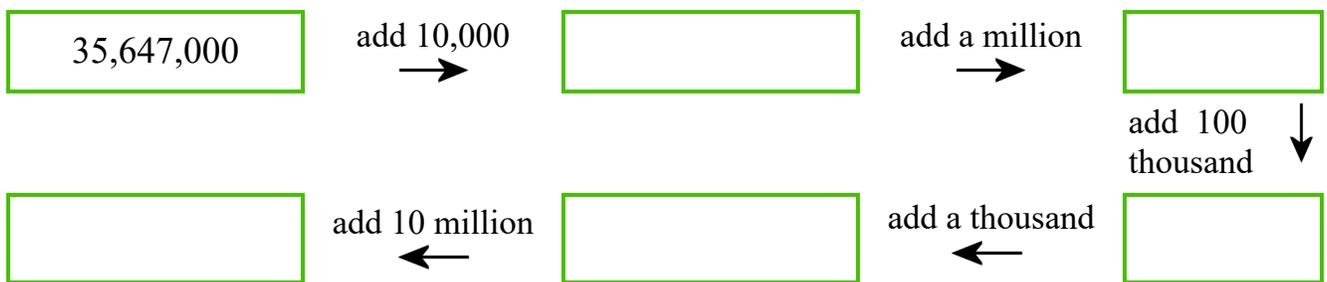
2. Match.

	a.		b.
1/2 million	750,000		1 million – 50,000
a hundred hundreds	100,000		100,000,000
1/10 million	10^6		1 million – 500,000
1/4 million	500,000		10^8
3/4 million	10^4		950,000,000
a thousand thousands	200,000		1 billion – 500 million
2 1/10 million	250,000		1 billion – 50 million
			1 billion – 50 million
			1 million – 5,000
			995,000
			1 billion – 5 million
			995,000,000

5. Continue counting for seven more numbers in each set:

a.	b.	c.
458,000,000	79,650,000	450,996,000
468,000,000	79,800,000	450,997,000
478,000,000	79,950,000	450,998,000
Each difference is _____	Each difference is _____	Each difference is _____

6. Complete the addition path.



Puzzle Corner

Solve for the unknown x or N .

a. $x + 400,000 = 4,000,000$

$x =$ _____

b. $x - 350,000 = 2,000,000$

$x =$ _____

c. $200,000 + N + 600,000 = 7,000,000$

d. $2 \times N = 3,000,000$

$N =$ _____

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Chapter 3: Problem Solving

Introduction

We start out this chapter by studying simple equations, presented as pan balance puzzles. The pan balance works very well for modeling the process of solving equations. In the second lesson, students use the bar model to help them solve equations. The equations on this level are very simple. More complex equations are presented in grades 6 and especially in grade 7 (pre-algebra).

The bulk of this chapter is then spent on the topic of problem solving, focusing on problems that involve a fractional part of a whole in some manner.

Encourage the student to draw a bar model for the problems, as it is such a helpful tool. Some of the problems here could even be found in regular Algebra 1 textbooks where they would naturally be solved with algebra. However, the bar model enables us to solve them without algebra; yet, it helps the students' algebraic thinking. Essentially, one block in the bar model corresponds to the unknown x in an equation.

The Lessons in Chapter 3

	page	span
Balance Problems and Equations, Part 1	104	3 pages
Balance Problems and Equations, Part 2	107	3 pages
More Equations	110	3 pages
Problem Solving with Bar Models 1	113	3 pages
Problem Solving with Bar Models 2	116	2 pages
Problem Solving with Bar Models 3	118	2 pages
Problem Solving with Bar Models 4	120	4 pages
Mixed Review Chapter 3	124	2 pages
Chapter 3 Review	126	3 pages

Helpful Resources on the Internet

Pan Balance - Numbers

Enter a numerical expression in one pan and then in the other. The pans will raise or lower depending on which expression is “heavier” (has a greater value). When the expressions are equivalent, the pans will balance and the full equation will be entered into the *Balanced Equations* table. This tool strengthens students' understanding of EQUALITY as a relationship, not as an operation. Many students view the equals sign as an operation of “find the answer,” which is incorrect. These students find it difficult to understand equations such as $11 = 4 + 7$ or $3 \times 5 = 17 - 2$.

<https://www.nctm.org/Classroom-Resources/Illuminations/Interactives/Pan-Balance----Numbers/>

Pan Balance - Shapes

This interactive balance builds algebraic thinking. Find the weight of each shape by placing shapes on the two pans. Try to find situations where the weights are equal. One square always weighs 1 unit.

Sample worksheet from <https://www.mathmammoth.com/activities/pan-balance-activity.aspx?id=3531>

<https://www.mathmammoth.com>

Balance Scale Activity

Use your intuition about balance to help solve the problems in this interactive online exercise. If you need help there is a video to watch for instruction.

http://www.learner.org/courses/learningmath/algebra/session6/part_c/index.html

Algebra Balance Equations

Replicate the given equation by moving the blocks of X and 1 to the sides of the balance scale. Then use addition, subtraction, multiplication, and division to each side to solve for x .

<http://www.hoodamath.com/mobile/games/algebrabalanceequations.html>

Thinking Blocks

An interactive math tool developed to help students learn how to solve multi-step word problems with the help of bar models. Choose “Find a Fraction of a Number” to practice the topic of the lesson *Problem Solving with Bar Models 1*.

https://www.mathplayground.com/tb_fractions/index.html

Thinking Blocks

An interactive math tool developed to help students learn how to solve multi-step word problems with the help of bar models. Choose “Compare Quantities” to practice the topic of the lesson *Problem Solving with Bar Models 3*.

https://www.mathplayground.com/tb_multiplication/index.html

Thinking Blocks

Choose “Find the Total or Part” to practice topics of the lesson *Problem Solving with Bar Problems 4*.

https://www.mathplayground.com/tb_fractions/index.html

Stable Scales Quiz

In each picture, the scales are balanced. Can you find the weight of the items on the scales?

https://www.transum.org/Software/SW/Starter_of_the_day/Students/Stable_Scales_Quiz.asp

Algebra Puzzle

Find the value of each of the three objects presented in the puzzle. The numbers given represent the sum of the objects in each row or column.

https://www.mathplayground.com/algebra_puzzle.html

Calculator Chaos

Most of the keys have fallen off the calculator and you have to make certain numbers using the keys that are left.

https://www.mathplayground.com/calculator_chaos.html

ArithmeTiles

Use the four operations and numbers on neighboring tiles to make the target numbers. This game uses Shockwave.

<http://www.primarygames.com/math/arithmetiles/>

SpeedMath Deluxe

Create an equation from the four given digits using addition, subtraction, multiplication and division. Make sure that you remember the order of operations. It includes negative numbers sometimes.

<http://education.jlab.org/smdeluxe/>

Sample worksheet from

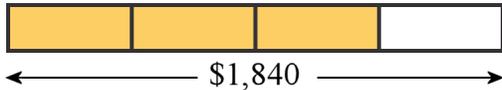
<https://www.mathmammoth.com>

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Problem Solving with Bar Models 1

A fractional part of a whole

Problem. Jackie earns \$1,840 monthly and Jessie earns $\frac{3}{4}$ as much. How much does Jessie earn?



Solution. In the model, Jackie's salary is divided into four equal parts (blocks). To find $\frac{3}{4}$ of it, first find $\frac{1}{4}$ of it, which is **one block** in the model.

$$\$1,840 \div 4 = \$460$$

Then multiply that result by three:

$$3 \times \$460 = \$1,380.$$

So, Jessie earns \$1,380.

Solve. Draw a bar model. Write an expression (number sentence) for each calculation you do.

1. A camera that cost \$125 was discounted by $\frac{1}{5}$ of its price. What is the new price?



$$\underline{\hspace{2cm}} \div \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

2. A pizza that weighs 680 g is divided into five equal pieces. How much do two pieces weigh?

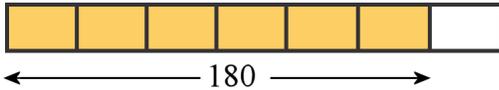
$$\underline{\hspace{2cm}} \div \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

$$\underline{\hspace{2cm}} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

3. A bottle of water costs $\frac{2}{3}$ as much as a bottle of juice that costs \$1.50. How much do *two* bottles of water and *two* bottles of juice cost?

A Fractional Part More

Problem. The school year in country A is 180 days long. In country B it is $\frac{1}{6}$ part longer than that. How long is the school year in country B?



Solution. First, we divide the 180-day school year into 6 parts, to find how much one “block” is in the model:

$180 \div 6 = 30$. So, one block is 30 days.

Then we *add* one-sixth more to the whole bar model, and that is how long the school year is in country B.

$$180 + 30 = 210$$

So, the school year in country B is 210 days long.

Solve. Draw a bar model. Write an expression (number sentence) for each calculation you do.

4. The price of a train ride is \$12. It went up by $\frac{1}{6}$.
What is the new price?

$$\underline{\hspace{2cm}} \div \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

$$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

5. A cafeteria lunch used to cost \$4.50 but the price was increased by $\frac{1}{5}$. What is the price now?

6. A one-way bus ride from Helen’s home to town costs \$1.
The bus company will raise the price by $\frac{1}{10}$ in June.

a. How much will a one-way ride cost in June?

b. How much more will a two-way ride (home to town to home) cost Helen in June than in May?

7. A T-shirt cost \$10.50, but now it is discounted by $\frac{2}{5}$ of its price. Annie bought *ten* shirts with the discounted price. What is the total cost?

8. Duckville has 3,687 inhabitants, which is $\frac{3}{5}$ of the number of inhabitants in Eagleby. How many people *in total* live in Eagleby and Duckville?

A package of 10 small envelopes costs \$2.50, and a package of 10 large ones costs $\frac{2}{5}$ more. Find the total cost of buying 50 envelopes of each kind.

Puzzle Corner

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Chapter 4: Decimals, Part 1

Introduction

In this first chapter about decimal arithmetic, students study place value with decimals, add and subtract decimals, and learn to multiply and divide decimals by whole numbers. We study more about decimal multiplication and division in chapter 6, along with conversions between measurement units. Some of the decimal lessons can appear boring, plus there are quite a few of them, so I hope that by breaking up the decimal topics into two chapters, students will not get “bogged down” by the number of topics to study. It can also help them retain the concepts, because we review some topics from this chapter in chapter 6.

The first two lessons deal with place value, first with tenths and hundredths (up to two decimal digits), and then with thousandths (three decimal digits). Then we briefly look at decimals on a number line. These first lessons are very important, since understanding decimal place value is the foundation for understanding other operations with decimals.

We start building on this foundation in the lesson *Add and Subtract Decimals — Mental Math*. Students solve sums such as $0.8 + 0.06$ based on their knowledge of place value. The value of that sum is 0.86, not 0.14, like students with a misconception could answer.

Adding and subtracting decimals in columns comes next. This is the common algorithm where the decimal points (or all places) need to be lined up before adding or subtracting. Students also learn to compare and round decimals.

Then lastly for this chapter, we study multiplying and dividing decimals by whole numbers, both using mental math, and using column-multiplication and long division. The mental math strategies are based on understanding decimal place value. One reason I include so many mental calculations is because they help students understand the concepts of decimal arithmetic and of place value.

You might wonder why *Math Mammoth Grade 5* presents decimals before fractions. The traditional way is to teach fractions first because then we can show that decimals are simply fractions of a specific type — namely, they are fractions with denominators that are powers of ten (for example, 0.45 is simply the fraction $45/100$).

There are several reasons I present decimals before fractions. First, students have studied some about both decimals and fractions in earlier grades, so they should have the necessary background to comprehend that the decimals we are studying here *are* fractions. Therefore, I see no need to study all fraction arithmetic in 5th grade before decimal arithmetic.

Secondly, I feel that decimal arithmetic is somewhat easier than fraction arithmetic, and students already know more about it than they know about all the fraction arithmetic that is studied in 5th grade (in 5-B). Thus, studying decimal arithmetic first may be easier for some students.

The Lessons in Chapter 4

	page	span
Review: Tenths and Hundredths.....	134	3 pages
More Decimals: Thousandths	137	5 pages
Decimals on a Number Line	142	2 pages
Add and Subtract Decimals—Mental Math	144	4 pages
Add and Subtract Decimals in Columns	148	2 pages

Comparing Decimals	150	2 pages
Rounding Decimals	152	2 pages
Multiply a Decimal by a Whole Number	154	4 pages
More on Multiplying Decimals	158	2 pages
More Practice and Review	160	2 pages
Divide Decimals by Whole Numbers, Part 1.....	162	4 pages
Divide Decimals by Whole Numbers, Part 2.....	166	2 pages
Mixed Review Chapter 4	168	2 pages
Chapter 4 Review	170	3 pages

Helpful Resources on the Internet

Decimal Arithmetic - Videos by Maria

These are my videos where I explain all about decimal arithmetic: adding, subtracting, multiplying, dividing, comparing and rounding decimals, plus some problem solving. Suitable for grades 5-6.

https://www.mathmammoth.com/videos/grade_5/5th-grade-videos.php#decimals

CONCEPT OF DECIMAL

Decimal Demonstrator

An interactive visual model that uses cups to demonstrate decimal numbers up to two decimal digits.

<http://www.ictgames.com/decimalDemonstrator/index.html>

Zoomable Decimal Number Line

Click on this interactive number line to zoom in more and more and explore decimal numbers.

<https://www.mathsisfun.com/numbers/number-line-zoom.html>

Decimals Number Line White Board

An illustrative tool that demonstrates decimals on a number line.

http://www.active-maths.co.uk/fractions/whiteboard/dec_no_line1.html

Scales

Move the pointer on the scale to match the decimal number given to you. Refresh the page from your browser to get another problem to solve.

<http://www.interactivestuff.org/sums4fun/scales.html>

Puppy Pull Game: Fractions to Decimals

Help your team win the tug contest by converting fraction words to decimal numbers!

http://www.mathplayground.com/ASB_Puppy_Pull_Decimals.html

Fractions & Decimals Matching Mystery Picture Game

Find matching pairs of fractions and decimals while uncovering a hidden picture.

<https://www.mathmammoth.com/practice/fractions-decimals>

Fraction Decimal Pairs

Choose from five different Fraction Decimal Pair activities that practice matching fractions with their equivalent decimal numbers.

Sample worksheet from
http://www.transum.org/software/SW/Starter_of_the_day/Students/Pairs.asp?Topic=15
<https://www.mathmammoth.com>

PLACE VALUE

Decimals in Expanded Form

Practice converting decimals between standard form and expanded form in this interactive exercise.

<https://www.khanacademy.org/math/arithmetic/decimals/decimal-place-value/e/writing-and-interpreting-decimals>

Place Value Strategy

Organize the digits given by the spinner to make the largest number possible.

<http://www.decimalsquares.com/dsGames/games/placevalue.html>

Decimal Place Value Card Game

Try to form the highest decimal number using playing cards in this quick and easy card game for 2-4 players.

<http://games4gains.com/blogs/teaching-ideas/41379652-decimal-place-value-with-playing-cards>

Decimal Darts

Practice estimation and decimal numbers while trying to pop balloons with darts. Requires Shockwave.

<http://www.decimalsquares.com/dsGames/games/darts.html>

Decimal Challenge

Guess a secret decimal number between 0 and 10. Each time the computer tells you whether your guess was too high or too low.

<http://www.interactivestuff.org/sums4fun/decchall.html>

Decimal Detective

Identify the decimal numbers digit-by-digit with the help of given hints. Choose Sergeant Level.

<http://flash.topmarks.co.uk/3286>

COMPARING AND ORDERING

Switch

Put the sequence of decimal numbers in ascending order by switching them around. Refresh the page from your browser to get another problem to solve.

<http://www.interactivestuff.org/sums4fun/switch.html>

Smaller and Smaller Maze

Practice ordering decimal numbers to find your way through the maze.

<http://www.counton.org/magnet/kaleidoscope/smaller/>

Decimals in Space

An Asteroids-style game where you first answer a question about the smallest decimal and then get to shoot asteroids, earning points based on the numbers on them.

<http://www.mathwarehouse.com/games/our-games/decimal-games/decimal-place-value-math-game>

Order Decimals Quiz

Place the decimal numbers in the correct order in this 10-question online quiz.

<https://www.thatquiz.org/tq-6/?-j20-lc-p0>

Compare Decimals Quiz

Practice comparing decimal numbers in this 10-question online quiz.

<https://www.thatquiz.org/tq-B/?-jk-la-p0>

Sample worksheet from

<https://www.mathmammoth.com>

ROUNDING

Round Decimals Using the Number Line

Practice using the number line to round decimals in this interactive online activity.

<https://www.khanacademy.org/math/cc-fifth-grade-math/cc-5th-place-value-decimals-top/cc-5th-rounding-decimals/e/rounding-decimals-using-a-number-line>

Rounding Numbers (Choose level 3)

Practice rounding decimal numbers. Get five correct in a row to take penalty shots!

http://www.abcya.com/rounding_numbers.htm

ADDITION & SUBTRACTION

Sock

Push the green blocks into the holes, and add the numbers on them, to make the target number.

<http://www.interactivestuff.org/sums4fun/sock.html>

Number Conundrum

Can you solve the conundrum? Each number is the sum of the two numbers directly beneath it. Select “Hard” from the settings icon.

http://www.mathplayground.com/number_conundrum/number_conundrum_decimal_numbers.html

Add and Subtract Decimals Quiz

Practice adding and subtracting decimals with up to three decimal digits in this 10-question online quiz.

<https://www.thatquiz.org/tq-3/?-j123-lk-p0>

Decimal Plus

Practice mental and written methods for adding and subtracting decimal numbers in this online exercise.

<http://www.transum.org/Maths/Activity/Decimals/Add.asp?Level=2>

Decimals Workshop

Practice adding, subtracting, multiplying, or dividing decimals with this customizable interactive exercise.

<http://mrnussbaum.com/decimals-workshop/>

Decimal Squares Blackjack

Play cards with decimals, trying to get as close to 2 as possible without going over. Requires Shockwave.

<http://www.decimalsquares.com/dsGames/games/blackjack.html>

MULTIPLICATION

Decimals Workshop

Practice adding, subtracting, multiplying, or dividing decimals with this customizable interactive exercise.

<http://mrnussbaum.com/decimals-workshop/>

Multiply Decimals by Whole Numbers

Polish your decimal multiplication skills with this interactive online exercise.

<https://www.khanacademy.org/math/cc-fifth-grade-math/cc-5th-arith-operations/cc-5th-mult-decimals/e/multiplying-decimals-without-the-standard-algorithm-2>

Sample worksheet from

<https://www.mathmammoth.com>

Decimal Times - Mental Multiplication

Practice mental and written methods for multiplying and dividing decimal numbers in this interactive online exercise.

<http://www.transum.org/Maths/Activity/Decimals/>

Multiply with Decimals: Simple Word Problems

Practice multiplying decimals by whole numbers with these interactive word problems.

<https://www.studyladder.com/games/activity/multiply-decimals-by-whole-numbers-22247>

DIVISION

Long Division to Decimal Places

This is a short tutorial about dividing whole numbers to decimal digits. At the bottom of the page you will find a short online quiz.

https://www.mathsisfun.com/long_division3.html

Long Division — Choose “Decimal Division”

Enter the numbers that you want to divide and click on the button “Do division” to see a step-by-step illustration of the solution.

<http://www.mathsonline.org/pages/longdiv.html>

Decimal Long Division Worksheets

Use these randomly generated worksheets for extra practice.

https://www.homeschoolmath.net/worksheets/decimal_division.php#long

PROBLEM SOLVING

Burnside’s Billions Game

Mr. Burnside is leaving you his fortune, but under one condition... You need to buy up his 27 favorite world landmarks in the next 40 days! This game involves foreign currency, exchange rates, and large-scale calculations involving decimals.

<https://www.mrnussbaum.com/billions/>

FOR REVIEW

Decimal and Whole Number Jeopardy

Review place value, comparing, and rounding decimals. Also, practice number patterns.

<http://www.quia.com/cb/8142.html>

Fractions & Decimals Matching Game

Practice converting fractions to decimals while also uncovering a hidden picture in this fun matching game!

<https://www.mathmammoth.com/practice/fractions-decimals>

Online Decimal Rounding Practice

Improve your decimal rounding skills with this interactive exercise.

<https://www.mathmammoth.com/practice/rounding#number-range=decimals&decimal-place=3>

Sample worksheet from

<https://www.mathmammoth.com>

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Divide Decimals by Whole Numbers 1

To divide a decimal by a whole number with long division is very easy.

Simply divide normally, as if there were no decimal point. Then, **put the decimal point in the quotient in the same place** as it is in the dividend.

See the example on the right. It is your task to finish checking the division by multiplication. Verify that the multiplication gives you the original dividend, 41.51.

$$\begin{array}{r}
 05.93 \\
 7 \overline{)41.51} \\
 \underline{-35} \\
 65 \\
 \underline{-63} \\
 21 \\
 \underline{-21} \\
 0
 \end{array}$$

Check:

$$\begin{array}{r}
 5.93 \\
 \times 7 \\
 \hline
 \end{array}$$

1. Divide. Check each division result with multiplication.

<p style="text-align: right;">Check:</p> <p>a. $5 \overline{)5.30}$</p>	<p style="text-align: right;">Check:</p> <p>b. $6 \overline{)2.388}$</p>
<p style="text-align: right;">Check:</p> <p>c. $19 \overline{)23.94}$</p>	<p style="text-align: right;">Check:</p> <p>d. $23 \overline{)57.638}$</p>

You know that when dividing whole numbers, there can be a remainder. For example, $24 \div 5 = 4 \text{ R}4$.

But, we can continue such divisions into decimal digits. To do that, add decimal zeros to the dividend.

Example 1. This is the division $24 \div 5$ but with 24 written as 24.0.

It is actually an even division, with a quotient of 4.8.

$$\begin{array}{r} 04.8 \\ 5 \overline{)24.0} \\ \underline{20} \\ 40 \\ \underline{-40} \\ 0 \end{array}$$

Check:

$$\begin{array}{r} 4 \\ 4.8 \\ \times 5 \\ \hline 24.0 \end{array}$$

How do you know how many decimal zeros to add to the dividend, so the division will be even?

You cannot tell that before you divide. Just start with maybe 2-3 zeros, and see how the division goes. You can always add more zeros to the dividend if you need to. Besides, not every decimal division is even! We will see an example of that on the next page.

2. Divide in two ways: first by indicating a remainder, then by long division. Add a decimal point and decimal zeros to the dividend. Lastly, check your answer by multiplying.

a. $31 \div 4 = \underline{\quad} \text{ R } \underline{\quad}$

$$4 \overline{)31} \quad \text{Check:}$$

b. $56 \div 5 = \underline{\quad} \text{ R } \underline{\quad}$

$$5 \overline{)56} \quad \text{Check:}$$

c. $15 \div 8 = \underline{\quad} \text{ R } \underline{\quad}$

$$\overline{\quad} \quad \text{Check:}$$

d. $45 \div 20 = \underline{\quad} \text{ R } \underline{\quad}$

$$\overline{\quad} \quad \text{Check:}$$

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Chapter 5: Statistics and Graphing

Introduction

This chapter starts out with a study of the coordinate grid, but only in the first quadrant. Besides learning how to plot points, students also plot ordered pairs (points) from number patterns or rules. This is actually the beginning of the study of *functions*.

Practicing the use of the coordinate grid is a natural “prelude” to the study of line graphs, which follows next. The goals are that the student will be able to:

- read line graphs, including double line graphs, and answer questions about data already plotted;
- draw line graphs from a given set of data.

The goals for the study of bar graphs are similar to those for the study of line graphs, in that the student will need to both:

- read bar graphs and double bar graphs, and answer questions about data already plotted; and
- draw bar graphs and histograms from a given set of data.

In order to make histograms, it is necessary to understand how to group the data into categories (“bins”). The lesson *Making Histograms* explains the method we use to make categories if the numerical data is not already categorized.

Toward the end of the chapter, we study average (also called the *mean*) and mode, and how these two concepts relate to line and bar graphs. Other math curricula commonly introduce the median, too, but I decided to omit it from 5th grade. There is plenty of time to learn that concept in subsequent grades. Introducing all three concepts at the same time tends to jumble the concepts together and confuse them — and all that a lot of students are able to grasp from that is only the calculation procedures. I feel it is better to introduce and contrast initially only the two concepts, the mean and the mode, in order to give the student a solid foundation. We will introduce the median later, and then compare and contrast it with the other two.

This chapter also includes an optional statistics project, in which the student can develop investigative skills.

The Lessons in Chapter 5

	page	span
Coordinate Grid	177	3 pages
Number Patterns in the Coordinate Grid	180	4 pages
More Number Patterns in the Coordinate Grid	184	4 pages
Line Graphs	188	4 pages
Reading Line Graphs	192	2 pages
Double and Triple Line Graphs	194	2 pages
Making Bar Graphs	196	2 pages
Making Histograms	198	2 pages
Double Bar Graphs	202	2 pages
Average (Mean)	204	3 pages

Mean, Mode, and Bar Graphs	207	2 pages
Statistics Project (optional)	209	1 page
Mixed Review Chapter 5	210	3 pages
Chapter 5 Review	213	2 pages

Helpful Resources on the Internet

COORDINATE GRID

Cali and the Coordinate System

Move Cali on the given coordinates, which are only positive numbers. How long will it take you to feed Cali 10 times?

<https://www.math10.com/en/math-games/games/geometry/games-cali-coordinate-system.html>

Soccer Coordinates Game

Plot the coordinates on the coordinate grid correctly to block the soccer ball from entering the goal.

<http://www.xpmath.com/forums/arcade.php?do=play&gameid=90>

Coordinate Grid Quiz from ThatQuiz.org

Practice plotting a point and giving the coordinates of a given point (in the first quadrant).

<https://www.thatquiz.org/tq-7/?-j48-l5-p0>

Number Pattern Tables

Apply the rule to find the missing number in the table.

<https://www.studyladder.com/games/activity/number-pattern-tables--20584>

Interpret Relationships Between Number Patterns

Generate patterns using given rules, identify relationships between terms, and graph ordered pairs consisting of corresponding terms from the patterns.

<https://www.khanacademy.org/math/pre-algebra/applying-math-reasoning-topic/number-patterns/e/visualizing-and-interpreting-relationships-between-patterns>

Graph a Two-Variable Relationship

Practice identifying relationships between variables with this interactive exercise.

<https://www.ixl.com/math/grade-5/graph-a-two-variable-relationship>

GRAPHING AND GRAPHS

Easy Practice Problems for Reading Bar Graphs

First, customize your bar chart. Then, click on the buttons on the left side to get questions to answer.

<http://www.topmarks.co.uk/Flash.aspx?f=barchartv2>

Graphs Quiz from That Quiz.org

Questions about different kinds of graphs (bar, line, circle graph, multi-bar, stem-and-leaf, box plot, scatter graph). You can modify the quiz parameters to your liking.

<http://www.thatquiz.org/tq-5/math/graphs>

Sample worksheet from
<https://www.mathmammoth.com>

Survey Game

First, ask children their favorite hobby or color. Then, make a frequency table, a bar graph, and a pictogram from the results.

<http://www.kidsmathgamesonline.com/numbers/mathdata.html>

Line Graphs Quiz

Answer the questions about the line graph in this interactive 10-question quiz.

<https://www.thatquiz.org/tq-5/?-j10f14-l5-p0>

Histograms at Maths is Fun

Learn about histograms in this short and clear tutorial. At the end of the page you will find quiz questions.

<https://www.mathsisfun.com/data/histograms.html>

Creating Histograms at Khan Academy

Use the given data to create a histogram in this interactive exercise.

<https://www.khanacademy.org/math/cc-sixth-grade-math/cc-6th-data-statistics/histograms/e/creating-histograms>

Create Double Bar Graphs Using Tables

Use the data in the table to complete the bar graph in this interactive exercise.

<http://www.mathgames.com/skill/6.96-create-double-bar-graphs-using-tables>

Interpret Double Bar Graphs

Read the double bar graphs and answer the questions in this interactive quiz.

<http://www.mathgames.com/skill/6.95-interpret-double-bar-graphs>

Statistics Interactive Activities from Shodor

A set of interactive tools for exploring and creating different kinds of graphs and plots. You can enter your own data or explore the examples.

<http://www.shodor.org/interactivate/activities/BarGraph/>

<http://www.shodor.org/interactivate/activities/Histogram/>

<http://www.shodor.org/interactivate/activities/CircleGraph/>

<http://www.shodor.org/interactivate/activities/MultiBarGraph/>

Math Goodies Interactive Data and Graphs Lessons

Clear lessons with examples and interactive quiz questions, covering the concept and construction of line graphs, bar graphs, circle graphs, comparing graphs, and exercises.

http://www.mathgoodies.com/lessons/toc_vol11.html

Interactive tool for creating graphs

Customize your own bar graph, line graph, or pie chart using this interactive tool.

<https://www.mathsisfun.com/data/data-graph.php>

Create a Graph

Create bar graphs, line graphs, pie graphs, area graphs, and xyz graphs to view, print, and save.

<http://nces.ed.gov/nceskids/createagraph/default.aspx>

Sample worksheet from

<https://www.mathmammoth.com>

Data Grapher

Use this tool to create bar graphs, line graphs, pie charts, and pictographs. You can enter multiple rows and columns of data, select which set(s) to display in a graph, and choose the type of representation.

<http://illuminations.nctm.org/Activity.aspx?id=4098>

MEAN, MEDIAN, MODE, AND RANGE

Math - Elephants - Line Graphs & Mean

Interactive exercises for interpreting a line graph, drawing a line graph, and calculating the mean.

<https://en.e-learningforkids.org/math/lesson/elephants-plant-line-graphs-mean/>

Mean/Mode Quiz

A 10-question quiz about calculating the mode and the mean.

<http://www.thatquiz.org/tq-p-z1/?-j6g00-l5-p0>

The Mean Machine

Use this interactive tool to see how average is calculated.

<http://www.mathsisfun.com/data/mean-machine.html>

Calculating the Mean

Practice calculating the mean with this interactive exercise from Khan Academy.

<https://www.khanacademy.org/math/cc-sixth-grade-math/cc-6th-data-statistics/mean-and-median/e/calculating-the-mean>

Study Jams: Mode

This site gives step-by-step illustrations of how to find the mode for a set of data.

<http://studyjams.scholastic.com/studyjams/jams/math/data-analysis/mode.htm>

Mean, Median, and Mode

How to calculate the mean, the median, and the mode for sets of data given in different ways. There are also interactive exercises.

http://www.cimt.org.uk/projects/mepres/book8/bk8i5/bk8_5i2.htm

Using and Handling Data

Simple explanations for finding the mean, median, or mode.

<http://www.mathsisfun.com/data/central-measures.html>

Measures Activity

Enter your own data and the program will calculate the mean, median, mode, range, and some other statistical measures.

<http://www.shodor.org/interactivate/activities/Measures>

Sample worksheet from

<https://www.mathmammoth.com>

Coordinate Grid

This is a **coordinate grid**.

The long black line across the bottom, with the “x” near its end, is called the **x-axis**.

The vertical line that has “y” near the top is called the **y-axis**.

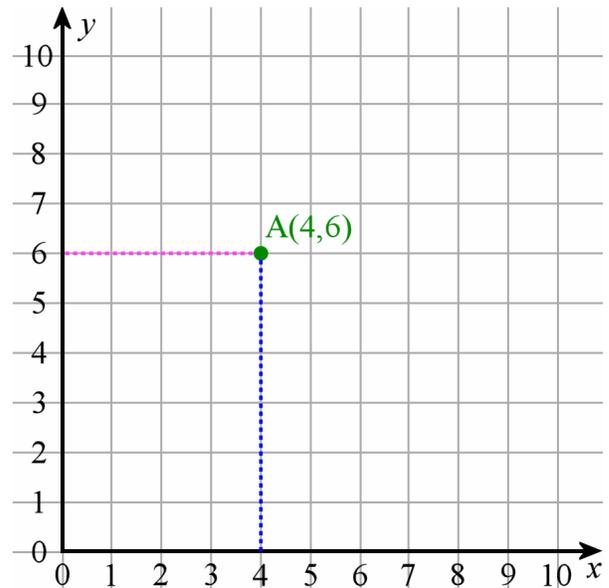
You can see one point, called “A,” that is drawn or *plotted* on the grid.

It has two numbers *associated*, or matched, with it. Those two numbers are called the **coordinates** of the point A.

The first number is called the **x-coordinate** of the point A, and the second number is called the **y-coordinate** of the point A.

The x-coordinate of the point A is 4 because if you drew a line straight down from A, it would *intersect*, or “hit,” the x-axis at 4. The y-coordinate of the point A is 6 because if you drew a line straight left from A, it would intersect the y-axis at 6.

We write the two coordinates of a point inside parentheses, separated by a comma.



Note: The order of the two coordinates matters. The *first* number is ALWAYS the x-coordinate, and the *second* number is ALWAYS the y-coordinate, not the other way around. So (5, 8) means that the x-coordinate is 5 and the y-coordinate is 8.

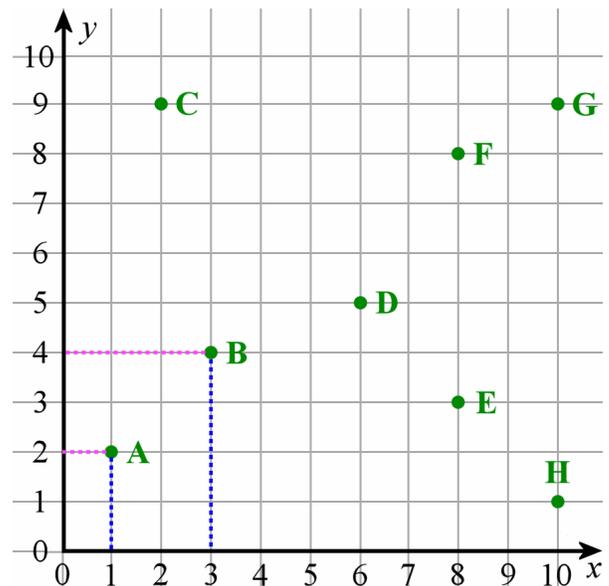
1. Write the two coordinates of the points plotted on the coordinate grid. For points A and B, the helping lines are drawn in. (The helping lines are not necessary to draw; they are just that — *helping* lines. You can draw them if they help you.)

A (___, ___) B (___, ___)

C (___, ___) D (___, ___)

E (___, ___) F (___, ___)

G (___, ___) H (___, ___)



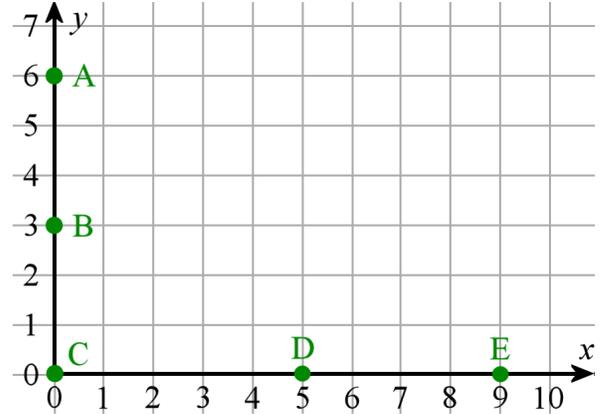
Sample worksheet from
<https://www.mathmammoth.com>

Notice especially the points that are located on the two axes.

If a point lies on the y -axis, its x -coordinate is zero.
A is $(0, 6)$ and B is $(0, 3)$.

If the point lies on the x -axis, its y -coordinate is zero.
D is $(5, 0)$ and E is $(9, 0)$.

The point C has the coordinates $(0, 0)$.
This point $(0, 0)$ is called the **origin**.

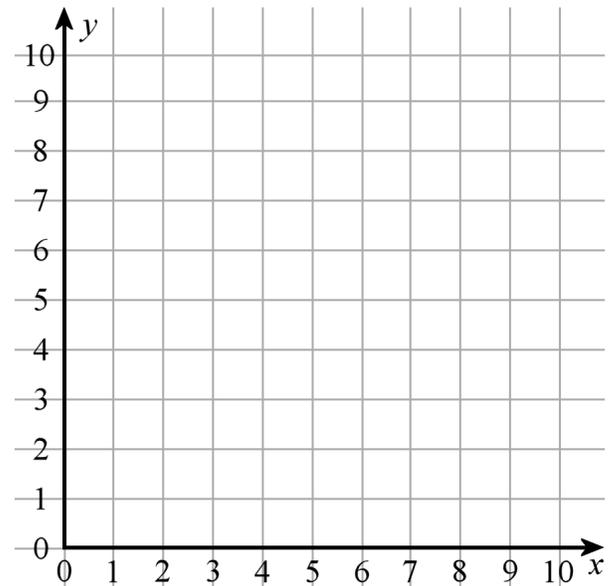


2. Plot and label the following points on the coordinate grid. (You may draw helping lines at first, but try to learn to plot the points without actually drawing them.)

A $(2, 8)$ B $(0, 5)$ C $(4, 0)$

D $(9, 10)$ E $(8, 5)$ F $(1, 4)$

G $(1, 0)$ H $(0, 8)$ I $(3, 7)$



3. The coordinate grid is very useful for many things. For example, computer drawing programs use it frequently. Let's say "LINE $(5,6) - (2,7)$ " means a straight line segment that is drawn from the point $(5, 6)$ to the point $(2, 7)$.

Draw the following line segments (joining the two given points). Use a ruler!

The first one is already done for you.

What figure is formed?

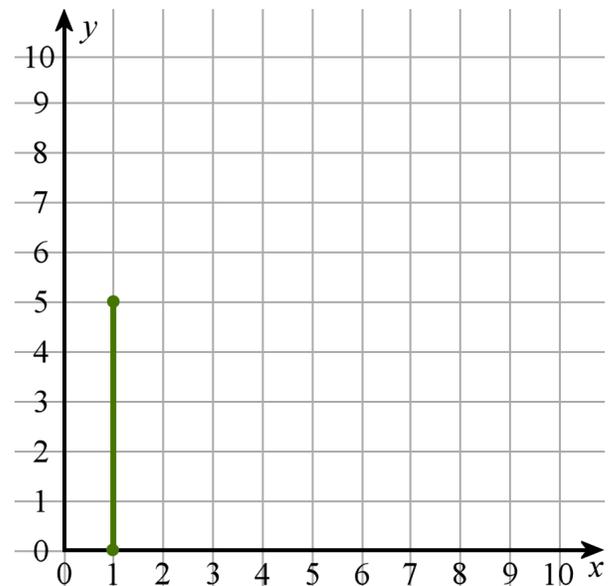
LINE $(1, 0) - (1, 5)$ LINE $(1, 5) - (0, 5)$

LINE $(0, 5) - (4, 7)$ LINE $(4, 7) - (8, 5)$

LINE $(8, 5) - (7, 5)$ LINE $(3, 0) - (3, 3)$

LINE $(5, 0) - (5, 3)$ LINE $(3, 3) - (5, 3)$

LINE $(1, 0) - (7, 0)$ LINE $(7, 0) - (7, 5)$



This example shows point A moving four units down and then two units to the right. The new location is called point A' (read "A prime").

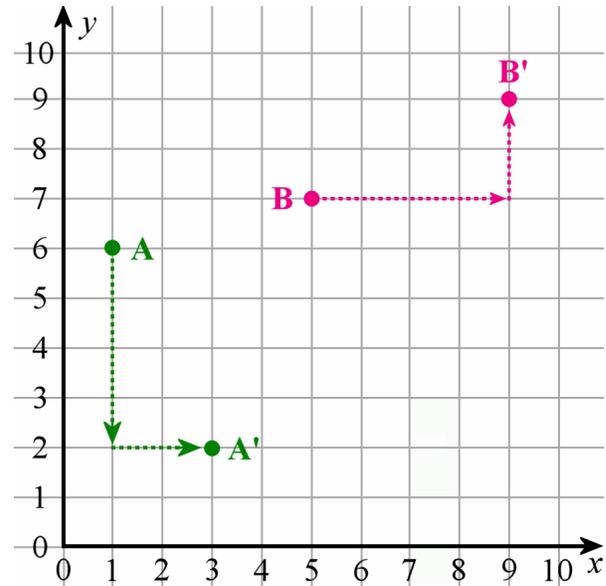
Originally A's coordinates were (1, 6).

After the movement, the coordinates are (3, 2).

Notice how you can just add two units to the x -coordinate (movement two units to the right), and subtract four units from the y -coordinate (the movement four units straight down).

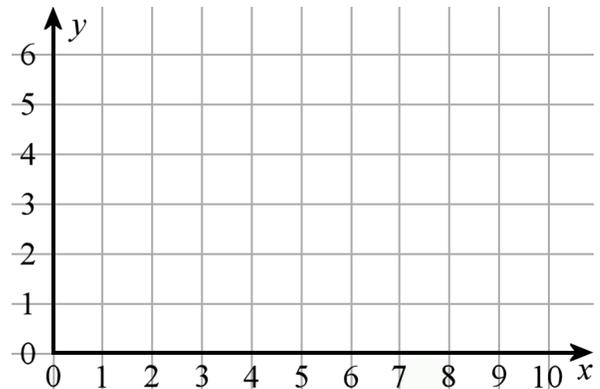
Point B is originally at (5, 7). It moves four units to the right and two up. You add four to the x -coordinate, and two to the y -coordinate. Its new coordinates are (9, 9).

- Movement right or left affects the x -coordinate.
- Movement up or down affects the y -coordinate.



4. The three vertices of a triangle are (2, 0), (5, 1) and (3, 4). The triangle is moved three units to the right and two up.

- Plot the vertices of the triangle before and after the movement. Use two different colors for the two triangles.
- Write the coordinates of the vertices after the movement.



5. Determine how the line segment has been moved:

Each point moved ____ units to the (right/left) and ____ units (up / down).

Now move the triangle ABC the same way.

Let's call the new triangle A'B'C'.

Write the coordinates of the vertices of the triangle A'B'C' after the movement.

