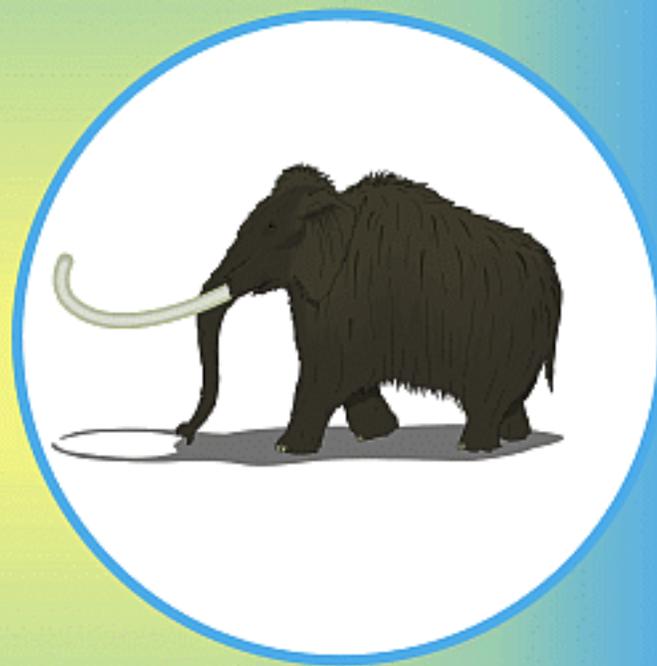


MATH MAMMOTH

Grade 5-A

Complete Worktext

- The four operations
- Problem solving
- Large numbers and the calculator
- Decimals
- Graphing and statistics



By Maria Miller

www.MathMammoth.com

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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. It contains eight main chapters. Each chapter has an introduction, which contains notes to the teacher. Then follow the actual lessons with problems. Each chapter ends in a review lesson. The chapter tests are found in a separate folder and are printed separately. This product also includes an HTML page that you can use to make extra practice worksheets for computation.

The fifth grade is time for fractions and decimals, in particular. We study them in depth and with substantial detail. Students also deepen their understanding of whole numbers, learn much more problem solving, and study geometry, graphing, and other smaller topics.

The year starts out with a study of whole numbers, their operations, and problem solving. Students get to review multi-digit multiplication and long division. Then we study equations with the help of a balance and bar models (simple diagrams). The main idea is to get students used to the idea of equation and what it means to solve an equation.

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 mentally, or with paper and pencil. I want students to learn to be critical in their use of the calculator - use it with good judgment. Every exercise where calculator use is to be allowed is marked with a little calculator symbol.

The third chapter is about decimals and their operations. It is a long chapter because now is the time to learn decimal operations well. It is assumed that the student already has a solid foundation for decimal place value, as taught in Math Mammoth 4th grade curriculum. That is the true means of preventing common misconceptions, or students resorting to rote memorization of the decimal operations.

In chapter 4, we study graphing in coordinate grid, statistical graphs, and average and mode. Today's world has become increasingly complex, with lots of data in the media, so our children need a good grasp of statistical graphs to be able to make sense of all that information.

Part B starts out with chapter 5, which is about fractions - another focus topic for 5th grade. We go through all fraction operations, and compare those with the corresponding decimal operations.

Chapter 6 takes us to geometry and measuring. There are lots of topics to study, such as classifying triangles and quadrilaterals, angle calculations, area and volume, and transformations.

Chapter 7 is a short chapter and has to do with number theory: divisibility and primes. This is also tied in with certain fraction operations, acting as a review for fraction simplification and fraction addition.

The last main chapter (chapter 8) has to do with tying together fractions, decimals, ratios, and a little bit of percent. Here will we use lots of comparisons between these concepts in word problems, and introduce students to the concept of percent.

I wish you success in your math teaching!

Maria Miller, the author

Concerning Challenging Word Problems

I would heartily recommend supplementing this program with regular practice of challenging word problems and puzzles from other sources. You could do that once a week to once every two weeks - just occasionally as it suits your schedule. The goal of challenging story problems and puzzles is to simply **develop children's logical and abstract thinking and mental discipline.**

I have made lots of word problems for the Math Mammoth curriculum. Those are for the most part multi-step word problems. I have included several lessons that utilize the bar model for solving problems and tried to vary the problems.

Even so, the problems I've created are usually tied to a specific concept or concepts. I feel children can also benefit from problem solving practice where the problems require "out of the box" thinking, or are puzzle-type in nature, or are just different from the ones I have made. Additionally, I feel others are more capable of making very different, very challenging problems.

So I'd like for you to use one or several of the resources below for some different problems and puzzles. Choose something that fits your budget (most of these are free) and that you will like using.

Math Kangaroo Problem Database

Easily made worksheets of challenging math problems based on actual past Math Kangaroo competition problems.

<http://www.kangurusa.com/clark/pdb/>

Primary Grade Challenge Math by Edward Zaccaro

The book is organized into chapters, with each chapter presenting a type of problem and the ways to think about that problem. And then there is a series of related story problems to solve, divided into 4 levels.

\$25, ISBN 978-0967991535

You can find this at Amazon.com or various other bookstores.

<http://www.amazon.com/dp/0967991536/?tag=homeschoolmath-20>

Problem Solving Decks from North Carolina public schools

Includes a deck of problem cards for grades 1-8, student sheets, and solutions. Many of these problems are best solved with calculators. All of these problems lend themselves to students telling and writing about their thinking.

http://community.learnnc.org/dpi/math/archives/2005/06/problem_solving.php

Math Stars Problem Solving Newsletter (grades 1-8)

These newsletters are a fantastic, printable resource for problems to solve and their solutions.

http://community.learnnc.org/dpi/math/archives/2005/06/math_stars_news.php

Mathematics Enrichment - nrich.maths.org

Open-ended, investigative math challenges for all levels from the UK. Find the past issues box down in the left sidebar. Choose Stage 2 problems for 5th grade.

<http://nrich.maths.org/public/>

<http://nrich.maths.org/public/themes.php> lets you find problems organized by mathematical themes.

Figure This! Math Challenges for Families

Word problems related to real life. They don't always have all the information but you have to estimate and think. For each problem, there is a hint, other related problems, and interesting trivia. Website supported by National Council of Teachers of Mathematics.

<http://www.figurethis.org/>

MathStories.com

Over 12,000 interactive and non-interactive NCTM compliant math word problems, available in both English and Spanish. Helps elementary and middle school children boost their math problem solving and critical-thinking skills. A membership site.

<http://www.mathstories.com/>

"Problem of the Week" (POWs)

Problem of the week contests are excellent for finding challenging problems and for motivation. There exist several:

- **Math Forum: Problem of the Week**
Five weekly problem projects for various levels of math. Mentoring available.
<http://mathforum.org/pow/>
- **Math Contest at Columbus State University**
Elementary, middle, algebra, and "general" levels.
<http://www.colstate.edu/mathcontest/>
- **Aunty Math**
Math challenges in a form of short stories for K-5 learners posted bi-weekly. Parent/Teacher Tips for the current challenge explains what kind of reasoning the problem requires and how to possibly help children solve it.
<http://www.auntymath.com/>
- **Grace Church School's ABACUS International Math Challenge**
This is open to any child in three different age groups.
<http://www.gcschool.org/pages/program/Abacus.html>
- **MathCounts Problem of the Week Archive**
Browse the archives to find problems to solve. You can find the link to the current problem on the home page.
<http://mathcounts.org/Page.aspx?pid=355>
- **Math League's Homeschool Contests**
Challenge your children with the same interesting math contests used in schools. Contests for grades 4, 5, 6, 7, 8, Algebra Course 1, and High School are available in a non-competitive format for the homeschoolers. The goal is to encourage student interest and confidence in mathematics through solving worthwhile problems and build important critical thinking skills. By subscription only.
<http://www.mathleague.com/homeschool.htm>

Chapter 1: The Four Operations

Introduction

We start out fifth grade by studying: the order of operations, multiplication, long division, equations, problem solving, and ratios.

The main line of thought throughout the chapter is that of *equations* and *problem solving*. Students encounter the exact definition of an *equation* and an *expression*. They practice the order of operations with problems that also reinforce the idea of the equal sign (“=”) as denoting equality of the right and left sides of an equation. These kind of exercises are needed because children may think that an equal sign signifies *the act of finding the answer* to a problem (as in $134 + 23 = ?$, for example), which is not so.

Students solve addition and subtraction equations both with the help of diagrams (a.k.a. bar models) and also without. Diagrams are also used for simple multiplication and division equations and for mixture equations, such as $4x + 38 = 128$.

In the middle of the chapter, we present lessons on multi-digit multiplication (multiplying in columns). These lessons go farther than just reviewing the well-known algorithm. We study in detail: multiplying in parts (partial products), how those partial products can be seen in the algorithm itself, and how multi-digit multiplication can be visualized geometrically.

Students practice long division, including two-digit divisors, as a review from 4th grade. And just in case they haven’t already learned it, this review gives them a “second chance.”

The last lessons concentrate on problem solving with the help of diagrams, including a lesson on the concept of *ratio*. Word problems involving fractional parts should now gradually become easy, routine problems.

The “Introduction to Ratios” is an important lesson. It shows the connection between fractional parts, ratios, and bar diagrams. We also study ratios further in other chapters, such as the one on fractions, so they will not be forgotten.

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 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 for algebra in advance.

The Lessons in Chapter 1

	page	span
Warm Up: Mental Math	11	2 pages
The Order of Operations and Equations	13	2 pages
Addition and Subtraction Review.....	15	3 pages
Multiplication and Division	18	3 pages
Multiplying in Parts and the Multiplication Algorithm	21	4 pages
A Three-Digit Multiplier, Plus Zeros	25	3 pages
Multiplication and Area	28	2 pages

	page	span
Long Division	30	3 pages
Long Division Practice Puzzle	33	1 page
A Two-Digit Divisor	34	4 pages
Long Division and Remainder	38	1 pages
Balance Problems and Equations	39	5 pages
More Equations	44	3 pages
Problem Solving 1: Finding a Fractional Part of the Whole	47	2 pages
Problem Solving 2: Problem Solving with Diagrams	49	2 pages
Problem Solving 3: One part is a multiple of the other	51	2 pages
Problem Solving 4	53	2 pages
Introduction to Ratios	55	4 pages
Chapter 1 Review	59	2 pages

Helpful Resources on the Internet

Rectangle Multiplication

An interactive tool that illustrates multiplying in parts using the area model. Choose the “common” option for multiplying in parts.

nlvm.usu.edu/en/nav/frames_asid_192_g_2_t_1.html

Calculator Chaos

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

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

ArithmeTiles

Use the four operations and numbers on neighboring tiles to make target numbers.

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

Choose Math Operation

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

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

MathCar Racing

Keep ahead of the computer car by thinking logically, and practice any of the four operations at the same time.

<http://www.funbrain.com/osa/index.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.

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

Fill and Pour

Fill and pour liquid with two containers until you get the target amount. A logical thinking puzzle.

http://nlvm.usu.edu/en/nav/frames_asid_273_g_2_t_4.html

Thinking Blocks

An interactive math tool developed to help students learn how to solve multistep word problems. Using brightly colored blocks, students model the relationships among the components of each word problem. The website has addition/subtraction problems, multiplication/division problems, and ratio problems. This block model corresponds to the bar model used in this book.

<http://www.thinkingblocks.com/>

Algebraic Reasoning

Find the value of an object based on two scales.

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

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.

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

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Order of Operations and Equations

Solve multiplications and divisions before additions and subtractions.

Solve multiplications and divisions “on the same level,” from left to right.

Solve additions and subtractions “on the same level,” from left to right.

Parentheses () change the order. *First* solve whatever is inside parentheses.

1. Solve in the right order!

a. $12 \times 5 + 8 = \underline{\quad}$	b. $10 \times 2 + 9 \times 8 = \underline{\quad}$	c. $(8 + 16) \div 3 = \underline{\quad}$
$45 + 5 \times 7 = \underline{\quad}$	$10 + 2 \times 9 + 8 = \underline{\quad}$	$120 - 2 \times 11 = \underline{\quad}$
$8 \times 5 \div 2 = \underline{\quad}$	$10 + 2 \times (9 + 8) = \underline{\quad}$	$2 \times (100 - 80 + 20) = \underline{\quad}$

Which expression(s) match each problem?

2. Mark bought three light bulbs for \$8 each, and paid with \$50. What was his change?

a. $3 \times \$8 - \50

b. $\$50 - \$8 + \$8 + \8

c. $\$50 - 3 \times \8

d. $\$50 - (\$8 - \$8 - \$8)$

3. Andy buys a salad for \$8 and a pizza for \$13, and shares them evenly with his friend. How many dollars is Andy's share of the cost?

a. $\$8 + \$13 \div 2$

b. $\$2 \div (\$8 + \$13)$

c. $2 \times \$8 + 2 \times \13

d. $(\$8 + \$13) \div 2$

4. Melissa shares equally the cost of a new fence with three other neighbors and the cost of road repair with two other neighbors. The fence cost \$600 and the road repair cost \$1,200. What is Melissa's share of the costs?

a. $\$600 \div 4 + \$1,200 \div 3$

b. $(\$600 + \$1,200) \div 3 \div 2$

c. $\$600 \div 3 + \$1,200 \div 2$

d. $(\$600 + \$1,200) \div 5$

5. Division can also be written with a line. Solve in the right order.

a. $6 + \frac{24}{2} =$

b. $\frac{32}{2} - 6 =$

c. $\frac{54}{6} - 6 - 2 =$

In this case, what we do first is the operation that is *above* the line, as though it were written in parentheses:

d. $\frac{6 + 24}{2} =$

e. $\frac{32 - 6}{2} =$

f. $\frac{54 - 6}{6} - 2 =$

An **equation** has numbers, letters, operation symbols, and one equal sign, “=”. It's called an *equation* because it contains an *equal* sign.

An **expression** only has numbers, letters, and operation symbols—but no equal sign. For example, “ $40 \times 2 + 6 \times 5$ ” is an expression.

6. Equation or expression? (You do not have to solve these.)

a. $4t = 180$

b. $2 + 60 \times 345 \div 9$

c. $15 = x + y$

d. $\frac{5.4 - 2.12}{0.4} = 8.2$

e. $1,000 = 1,000$

f. $12 - \frac{24 \div 0.8}{189}$

<p>$120 - 75 = 3 \times 15$</p> <p>This is the left side of the equation. This is the right side of the equation.</p> <p>Do the left and right sides have the same value? Just calculate $120 - 75$, then calculate 3×15, and check.</p> <p>If yes, it's a true equation. If not, it's a false equation.</p>	<p>$2 = 5$</p> <p>left side right side</p> <p>This is a very simple equation - but it's false!</p> <p>$4 + 5 = 21 - 3$</p> <p>left side right side</p> <p>This is also a false equation!</p>	<p>$18 = x - 3$</p> <p>left side right side</p> <p>Solving the equation means finding the value of x (the unknown) that makes it true.</p> <p>The value $x = 21$ makes this equation true, so we say $x = 21$ is the solution.</p>
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7. Place parenthesis into these equations to make them true.

a. $10 + 40 + 40 \times 2 = 180$

b. $144 = 3 \times 2 + 4 \times 8$

c. $40 \times 3 = 80 - 50 \times 4$

8. Find a number to fit in the box so the equation is true.

a. $40 = (\square + 9) \times 2$

b. $4 \times 8 = 5 \times 6 + \square$

c. $4 + 5 = (20 - \square) \div 2$

d. $81 = 9 \times (2 + \square)$

e. $\square \times 11 = 12 + 20 \times 6$

f. $(4 + 5) \times 3 = \square \div 2$

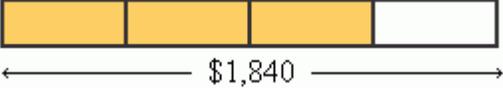
9. Build at least three true equations using (only) the symbols and numbers given. You may use the same number or symbol many times.

11, 3, 1, -, +, ×, (), =

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Problem Solving with Diagrams, Part 1

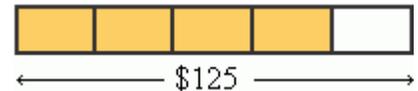
Finding a Fractional Part of the Whole

Problem	Solution
<p>Jackie earns \$1,840 monthly and Jessie earns $\frac{3}{4}$ as much. How much does Jessie earn?</p> 	<p>In the diagram, Jackie's salary is divided into four equal parts. To find $\frac{3}{4}$ of it, <u>first find $\frac{1}{4}$ of it</u>, and then multiply that by 3.</p> <p>$\\$1,840 \div 4 = \\$460.$</p> <p>$3 \times \\$460 = \\$1,380.$ Jessie earns \$1,380.</p>

Solve the problems. You may draw a diagram to help.

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

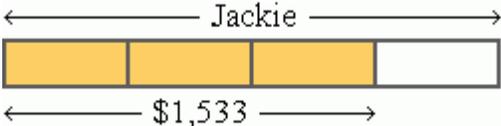
2. A \$125 camera was discounted by $\frac{1}{5}$ of its price.
What is its new price?



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

4. A T-shirt is discounted by $\frac{2}{5}$ of its price. The original price is \$10.50.
How much would ten shirts cost with the discounted price?

Notice carefully what happens if we turn the earlier problem (about Jackie and Jessie) around so that we know how much *Jessie* earns and are asked how much Jackie earns.

Problem	Solution
<p>Jessie earns $\frac{3}{4}$ as much as Jackie. Jessie earns \$1,533. How much does Jackie earn?</p> 	<p>1) First we divide Jessie's earnings by 3. $\\$1,533 \div 3 = \\511. That gives us $\frac{1}{4}$ of Jackie's salary.</p> <p>2) Then we multiply that number by 4: $4 \times \\$511 = \\$2,044$, which is Jackie's salary.</p>

Solve the problems. Drawing a bar diagram can help.

5. Mark's car weighs 840 lb, which is $\frac{2}{3}$ of what Jake's car weighs. How much does Jake's car weigh?

6. Henry is $\frac{5}{6}$ as tall as Mike, and Mike is 6 ft 6 in tall. How tall is Henry?

7. Jack is $\frac{5}{8}$ as tall as his dad.
 If Jack is 120 cm tall, then how tall is his dad?

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

9. Six-month subscriptions to an online math-practice website are discounted to $\frac{3}{4}$ of the normal month-by-month price.
 The discounted price for 6 months is \$54.

 Find the cost of an undiscounted one-month subscription.

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Chapter 2: Large Numbers and the Calculator

Introduction

In this chapter we study place value up to the billions—that is, numbers of up to 12-digits, rounding them and using a calculator.

This is the first time the calculator is introduced in the Math Mammoth Light Blue Series books. I have delayed introducing the use of a calculator (as compared to most math curricula) for good reasons. On my HomeschoolMath.net web site I have received numerous comments on the harm that indiscriminate calculator usage can cause. In a nutshell, if children are allowed to use calculators freely, their minds get “lazy,” and they will start relying on calculators even for simple things. It’s just human nature!

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

So we educators need to *limit* calculator usage until the students are much older. Children can *not* 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 to use it. In this curriculum, I strive to show the students not only *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 calculating it with calculator. In the last lesson, students need to choose whether mental math or a calculator is the best “tool” for the calculation.

The Lessons in Chapter 2

	page	span
Place Value Up to Billions	63	3 pages
Counting and Adding Large Numbers	66	3 pages
Rounding	69	3 pages
Calculator	72	3 pages
Multiples, Estimation and Calculator	75	3 pages
Review	78	2 pages

Helpful Resources on the Internet

Naming Numbers

These pages teach number naming skills covered in K8 math courses. Each page has an explanation, interactive practice and challenge games about naming numbers.

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

Megapenny project

Visualizes big numbers with pictures of pennies.

<http://www.kokogiak.com/megapenny/default.asp>

Powers of ten

Illustrates the dramatic changes of scale when zooming in or out is by powers of ten.

<http://microcosm.web.cern.ch/Microcosm/P10/english/welcome.html>

Cookie dough

Practices naming big numbers.

www.funbrain.com/numwords/index.html

Keep My place

Fill in the big numbers to this cross-number puzzle.

<http://www.mathsyear2000.org/magnet/kaleidoscope2/Crossnumber/index.html>

Estimation

Exercises about rounding whole numbers and decimals, front-end estimation, estimating sums and differences.

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

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>

Place Value Game

Create the largest possible number from the digits the computer gives you.

Unfortunately, the computer will give you each digit one at a time and you won't know what the next number will be.

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

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Add and Subtract Decimals

This “trick” will help you a lot in adding or subtracting decimals:

“Tag” zeros to the end of the decimal numbers so that all addends have the same amount of digits after the decimal. Then the answer will also have that same number of digits.

Look how the problem $0.2 + 0.05$ is done (on the right). We “tag” a zero onto the end of 0.2 to make it have *two* digits after the decimal point! That way *both* addends have hundredths. Notice how it’s just like adding fractions using a common denominator.

Note that $0.2 + 0.05$ is *not* 0.7 or 0.07!

When adding in columns, write the numbers under each other and align the decimal points. You can write a zero in the empty “spot.” Then add.

$$\begin{array}{r}
 0.2 + 0.05 \\
 \downarrow \quad \downarrow \\
 0.20 + 0.05 = 0.25 \\
 \\
 \frac{2}{10} + \frac{5}{100} \\
 \downarrow \quad \downarrow \\
 \frac{20}{100} + \frac{5}{100} = \frac{25}{100} \\
 \\
 \begin{array}{r}
 0.20 \\
 + 0.05 \\
 \hline
 0.25
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 0.09 + 0.5 \\
 = 0.09 + 0.50 = 0.59 \\
 \begin{array}{r}
 0.09 \\
 + 0.50 \\
 \hline
 0.59
 \end{array}
 \end{array}$$

Both addends have hundredths, and so does the answer.

$$\begin{array}{r}
 1.007 + 2.02 \\
 = 1.007 + 2.020 = 3.027 \\
 \begin{array}{r}
 1.007 \\
 + 2.020 \\
 \hline
 3.027
 \end{array}
 \end{array}$$

Both addends have thousandths, and so does the answer.

1. Write the decimal that is one tenth, one hundredth, or one thousandth more than the given decimal.

a.

O	t	h	th
0	.	2	8 5

- 1 tenth more: _____
 1 hundredth more: _____
 1 thousandth more: _____

b.

O	t	h	th
0	.	0	1 6

- 2 tenths more: _____
 2 hundredths more: _____
 2 thousandths more: _____

c.

O	t	h	th
1	.	0	7

- 5 tenths more: _____
 2 hundredths more: _____
 6 thousandths more: _____

2. Add.

- | | | |
|--------------------|------------------|--------------------|
| a. $0.009 + 0.006$ | d. $0.8 + 0.6$ | g. $0.5 + 0.7$ |
| b. $0.009 + 0.06$ | e. $0.8 + 0.06$ | h. $0.05 + 0.07$ |
| c. $0.009 + 0.6$ | f. $0.8 + 0.006$ | i. $0.005 + 0.007$ |

3. a. Write a number that is 5 thousandths, 2 tenths, and 8 hundredths more than 1.004.

b. Write a number that is 3 thousandths and 3 tenths less than 3.411.

4. Add hundredths so that the next *whole tenth* is filled.

a. $0.47 + \underline{0.03} = \underline{0.5}$	d. $0.06 +$	l. $3.99 +$
b. $0.55 +$	f. $0.97 +$	i. $2.13 +$

5. These kids have some misconceptions. Correct their answers. And learn from these!

<p>a. Laura thinks: Both of these have two zeros after the decimal point so I'll put the same two zeros in the answer.</p> <p>$0.008 + 0.003 = 0.0011$</p>	<p>b. Jessie reasons: Just add the decimal part separately from the whole number part:</p> <p>$0.7 + 0.7 = 0.14$</p>
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<p><i>10 tenths makes 1.</i></p> <p><i>100 hundredths makes 1.</i></p> <p><i>1000 thousandths makes 1.</i></p>	<p>Solve $0.42 + \underline{\hspace{2cm}} = 1.$</p> <p>42 hundredths and 58 hundredths makes 100 hundredths, so</p> <p>$0.42 + 0.58 = 1$</p>	<p>Solve $0.219 + \underline{\hspace{2cm}} = 1.$</p> <p>219 thousandths and 781 thousandths makes 1000 thousandths, so</p> <p>$0.219 + 0.781 = 1$</p>
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6. Complete the addition so the sum is 1.

- | | | |
|---|---|--|
| a. $0.6 + \underline{\hspace{2cm}} = 1$ | d. $0.99 + \underline{\hspace{2cm}} = 1$ | g. $0.999 + \underline{\hspace{2cm}} = 1$ |
| b. $0.60 + \underline{\hspace{2cm}} = 1$ | e. $0.87 + \underline{\hspace{2cm}} = 1$ | h. $0.002 + \underline{\hspace{2cm}} = 1$ |
| c. $0.61 + \underline{\hspace{2cm}} = 1$ | f. $0.22 + \underline{\hspace{2cm}} = 1$ | i. $0.304 + \underline{\hspace{2cm}} = 1$ |

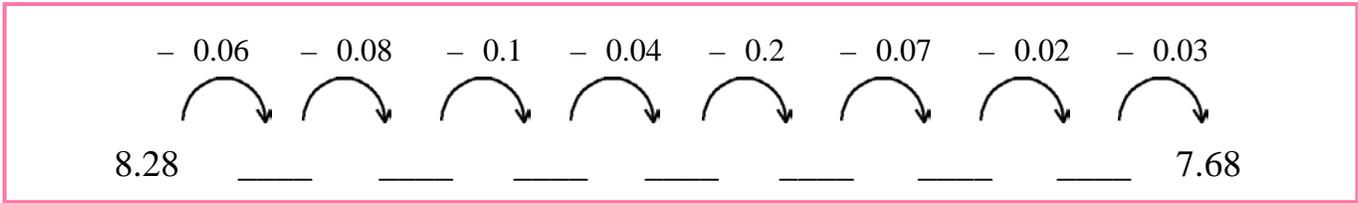
7. Subtract from 1.

- | | | |
|---|--|--|
| a. $1 - 0.01 = \underline{\hspace{2cm}}$ | d. $1 - 0.001 = \underline{\hspace{2cm}}$ | g. $1 - 0.506 = \underline{\hspace{2cm}}$ |
| b. $1 - 0.04 = \underline{\hspace{2cm}}$ | e. $1 - 0.008 = \underline{\hspace{2cm}}$ | h. $1 - 0.56 = \underline{\hspace{2cm}}$ |
| c. $1 - 0.51 = \underline{\hspace{2cm}}$ | f. $1 - 0.021 = \underline{\hspace{2cm}}$ | i. $1 - 0.411 = \underline{\hspace{2cm}}$ |

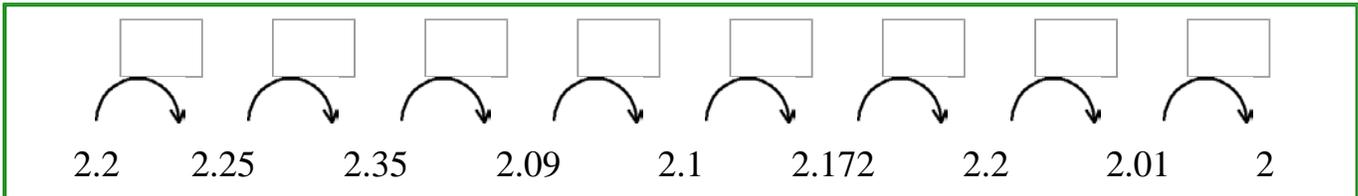
8. Solve the equations. Mental math should be enough!

a. $0.50 + x = 0.677$	b. $x + 1.52 = 2$	c. $1 - x = 0.378$	d. $x - 0.5 = 1.27$
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9. Find the missing numbers.



10. Figure out what was done in each step - either addition or subtraction!



11. Add or subtract. Remember to line up the decimal points.

a. $145.5 - 24.93$

b. $190 + 342.25 + 45.808$

c. $2,530 - 451.55 + 231.2$

12. Mrs. Wood’s precious puppy weighed 0.236 kg when it was born. At the next checkup it weighed 0.37 kg. How much weight had it gained?

13. Dad caught some fish that weighed 1.19 kg, 1.565 kg, 2.1 kg and 1.47 kg.

a. What was the total weight of the catch?

b. How much short of 7 kg was his catch?

14. Allison checked some distances using an online map service. Find the total distance for these routes:

a. From Allison’s home to the library, then to the store, then home again.

b. From the library to Sheila’s house, to the store, then home.

From	To	Distance (miles)
My home	library	2.3
home	store	0.67
library	store	1.055
home	Sheila’s	1.08
store	Sheila’s	1.508
library	Sheila’s	1.25

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Long Division with Decimals

<p>It is very easy to use long division to divide a decimal by a whole number.</p> <p>During the division process, divide as if there were no decimal point.</p> <p>Then, simply put the decimal point in the quotient <i>in the same place</i> as it was in the dividend.</p>	$ \begin{array}{r} 05\overline{)41.51} \\ \underline{35} \\ 65 \\ \underline{-63} \\ 21 \\ \underline{-21} \\ 0 \end{array} $	<p>Check:</p> $ \begin{array}{r} 5.93 \\ \times 7 \\ \hline \end{array} $
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1. Divide. Check each division result with multiplication.

a. $5 \overline{)5.30}$

b. $3 \overline{)0.72}$

c. $7 \overline{)6.23}$

d. $6 \overline{)2.388}$

e. $19 \overline{)23.94}$

f. $23 \overline{)57.638}$

<p>You are used to dividing <i>whole numbers</i> with long division, and sometimes getting a remainder. For example, $24 \div 5 = 4 \text{ R}4$.</p> <p>If we add decimal zeros (.0 or .00 or .000) to the dividend, we don't change its value, but sometimes the quotient comes out even!</p> <p>For example, if we use long division to divide 24.0 by 5, the quotient is exactly 4.8! Multiplying $5 \times 4.8 = 24$ verifies this.</p>	$\begin{array}{r} 04.8 \\ 5 \overline{)24.0} \\ \underline{20} \\ 40 \\ \underline{-40} \\ 0 \end{array}$	<p>Check:</p> $\begin{array}{r} 4 \\ 4.8 \\ \times 5 \\ \hline 24.0 \end{array}$
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2. Divide in two ways: first by indicating a remainder, then by long division.
Check your result with multiplication.

<p>a. $31 \div 4 = \underline{\quad} \text{ R} \underline{\quad}$</p> <p>$31.00 \div 4 = \underline{\hspace{2cm}}$</p> $\begin{array}{r} \\ 4 \overline{)31.00} \end{array}$ <p>Check:</p>	<p>b. $56 \div 5 = \underline{\quad} \text{ R} \underline{\quad}$</p> <p>$56.0 \div 5 = \underline{\hspace{2cm}}$</p> <p>Check:</p>	<p>c. $15 \div 8 = \underline{\quad} \text{ R} \underline{\quad}$</p> <p>$15.000 \div 8 = \underline{\hspace{2cm}}$</p> <p>Check:</p>
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3. Now you need both division and multiplication. Find the given parts of these quantities.

a. Find $\frac{3}{4}$ of 0.130 kg.

b. Find $\frac{3}{5}$ of 23 seconds.

Sometimes decimal division is not even. In that case, stop the division at some point, and *give the answer as a rounded decimal number*. Round to the place value just before the last decimal digit you found for the quotient. That way, the last digit will tell you whether to round up or down.

Example: Find $2 \div 7$ to two decimal digits.

$$\begin{array}{r} 0.285 \\ 7 \overline{)2.000} \\ \underline{14} \\ 60 \\ \underline{-56} \\ 40 \\ \underline{-35} \\ 5 \end{array}$$

It is enough to find three decimal digits for the quotient, and then we can round to two decimal digits. The third decimal digit is 5, so we round up and $2 \div 7 \approx 0.29$.

Example: Find $8 \div 9$ to three decimal digits.

$$\begin{array}{r} 0.8888 \\ 9 \overline{)8.0000} \\ \underline{72} \\ 80 \\ \underline{-72} \\ 80 \\ \underline{-72} \\ 80 \\ \underline{-72} \\ 8 \end{array}$$

We need to find *four* decimal digits for the quotient before we can round it to three decimal digits: $8 \div 9 \approx 0.889$.

4. Find

a. $2 \div 9$ to two decimal digits;

b. $1 \div 3$ to three decimal digits;

c. $1 \div 6$ to three decimal digits.

Fractions and division

Remember that the fraction line is *also* a division symbol. So $\frac{1}{8}$ can mean both one-eighth (a fraction), and a division problem $1 \div 8$. This gives us a means of converting fractions to decimals!

5. Convert the following fractions into decimals using long division (use a notebook). If needed, round the decimal to three decimal digits.

a. $\frac{5}{8} =$

b. $\frac{6}{7} =$

c. $\frac{7}{20} =$

6. a. Fill in the explanation on how to solve the problem, and find the price of one roll.

24 rolls and one loaf of rye bread cost \$10.70. If the bread costs \$2.30, find the cost of one roll.

First subtract \$_____ from \$_____. Then _____ that result by _____. One roll costs \$_____.

b. Write a *single* expression to match the explanation above.

7. Seven muffins and one drink cost \$7.11. If the drink costs \$1.23, find the cost of one muffin.

8. Three packs of transistors and seven packs of capacitors cost a total of \$8.70. What is the price of one transistor pack, if one capacitor pack costs \$0.60?

9. Solve in the right order: $2 \times (68.43 \div 3 + 2.9)$.

10. Write a word problem that is solved by the calculations below.

a. $(\$50 - \$26) \div 3 = \$8$

b. $(\$100 - 25 \times \$1.40) \div 2 = \$32.50$

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Chapter 4: Statistics and Graphing

Introduction

The fourth chapter starts out with a study of the coordinate grid, but only the first quadrant. I have also included a very gentle *Introduction to Functions* lesson, where students plot ordered pairs from number rules.

Practicing the use of the coordinate grid is a natural “prelude” to the study of line graphs, which follow 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.

To achieve these goals I have provided plenty of exercises, with a lot of variety in topics.

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, including 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. 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 the mean and the 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 still plenty of time to learn that concept in 6th, 7th, and 8th grades. Introducing all three concepts at the same time tends to jumble the concepts together and confuse them—and all that many students are able to grasp out of that jumble is often just fairly meaningless calculation procedures. I feel it is better to introduce and contrast initially just the two concepts, the mean and the mode, in order to give the student a solid foundation to study them later in more depth when the median is introduced and compared and contrasted with them.

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

The Lessons in Chapter 4

	page	span
Coordinate Grid	141	3 pages
Introduction to Functions	144	4 pages
Lines Graphs	148	4 pages
Reading Line Graphs	152	2 pages
Double and Triple Line Graphs	154	2 pages
Making Bar Graphs	156	2 pages
Making Histograms	158	2 pages

Double Bar Graphs	160	2 pages
Average (Mean)	162	3 pages
Mean, Mode and Bar Graphs	165	2 pages
Statistics Project (optional)	167	1 page
Review	168	2 pages

Helpful Resources on the Internet

Bar Chart Virtual Manipulative

Build your bar chart online using this interactive tool:

nlvm.usu.edu/en/nav/frames_asid_190_g_1_t_1.html?from=category_g_1_t_1.html

An Interactive Bar Grapher

Graph data sets in bar graphs. The color, thickness, and scale of the graph are adjustable. You can input your own data, or you can use or alter pre-made data sets.

illuminations.nctm.org/ActivityDetail.aspx?ID=63

Create a Graph

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

nces.ed.gov/nceskids/createagraph/default.aspx

Mode of a Set of Data

This is a very simple and clear lesson with examples and interactive quiz questions.

www.mathgoodies.com/lessons/vol8/mode.html

Using and Handling Data

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

www.mathsisfun.com/probability

Finding the Mean, Median, and Mode

This is a great lesson, with interactive quiz questions at the end. It also explains briefly the different uses for mean, median, and mode. After all, why do we have three different numbers to describe the central tendency of a data set?

www.algebra.org/lessons/lesson.aspx?file=Algebra_StatMeanMedianMode.xml

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.

www.cimt.plymouth.ac.uk/projects/mepres/book8/bk8i5/bk8_5i2.htm

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Reading Line Graphs

The graph shows how many people were living on farms in the United States during 1900-1990. You can see how dramatically the number has dropped!

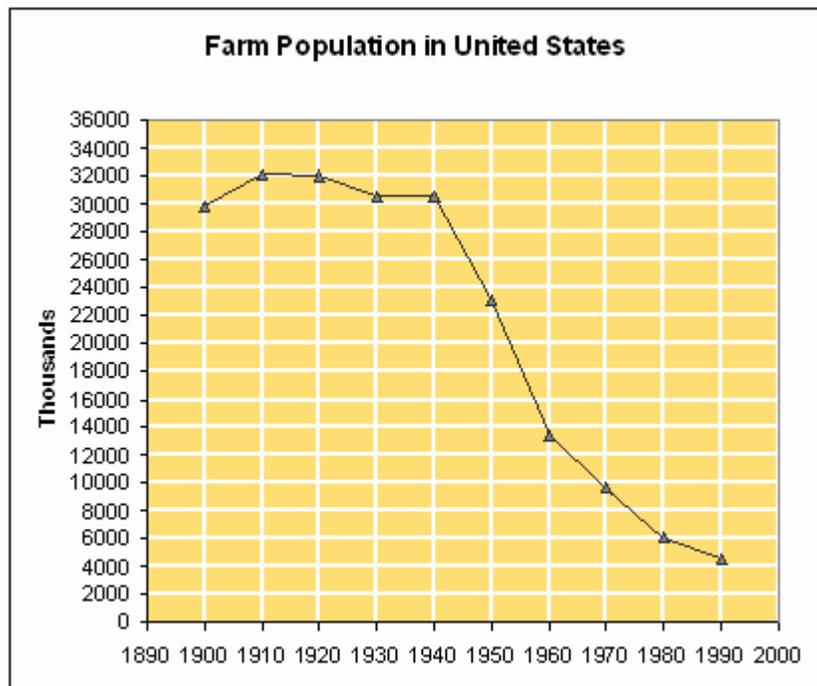
The question (a) in exercise 1 asks you to *estimate* the farm population in year 2000. Do it by tracing over the graph and continuing the graph in a natural way till the year 2000. The plain numbers listed in the table do not really help with estimation (without further mathematical tools).

Notice that the table lists the farm population in *thousands of people*. For example, in year 1970 there were 9712 thousand people—or 9,712,000 people—living on farms. In other words, you need to tag three zeros onto each of those numbers.

Note also that these numbers are actually *rounded* to the nearest thousand—no population remains an exact number of so many thousand people, year after year.

Year	Farm Population (thousands of people)
1900	29875
1910	32077
1920	31974
1930	30529
1940	30547
1950	23048
1960	13445
1970	9712
1980	6051
1990	4591

Source: Census of Agriculture



- Consider the graph above. Estimate the U.S. farm population in the year 2000.
 - In which two decades were the greatest drops in farm population?
 - How many people did the farm population decrease during those two decades (separately)?
 - What was the first year when the farm population dropped below 10 million?
 - When approximately did the farm population drop below 5,000,000?

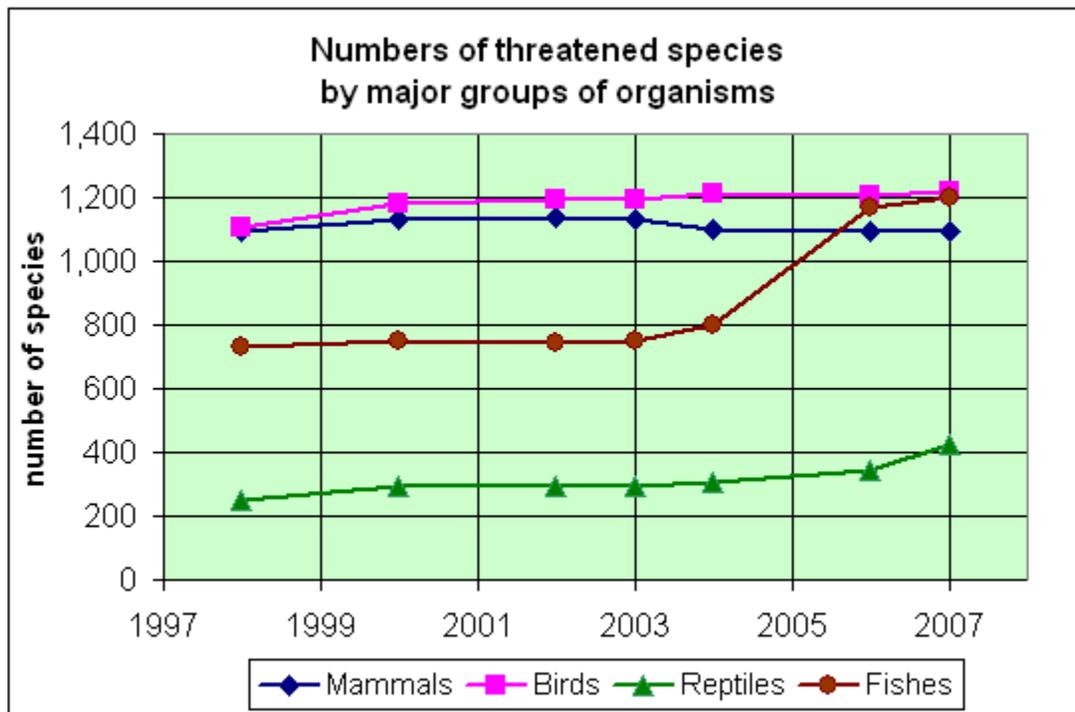
2. The International Union for Conservation of Nature (IUCN) produces a report every few years called *IUCN Red List of Threatened Species*. This report lists the number of animal and plant species that are considered endangered and extinct. The term “threatened” actually means the species can either be considered “Critically Endangered,” “Endangered,” or “Vulnerable.”

Study the data and the graph below, and answer the questions.

Table 1: Numbers of threatened species by major groups of organisms (1996–2007)

Number of threatened species →	in 1996/98	in 2000	in 2002	in 2003	in 2004	in 2006	in 2007
Mammals	1,096	1,130	1,137	1,130	1,101	1,093	1,094
Birds	1,107	1,183	1,192	1,194	1,213	1,206	1,217
Reptiles	253	296	293	293	304	341	422
Fishes	734	752	742	750	800	1,171	1,201

(Data from 2007 IUCN Red List: Table 1)



- How many reptile species were considered “threatened” in 2003? In 2007?
- How many fish species were considered “threatened” in 2003? In 2007?
- In which major animal group has the number of threatened species stayed approximately the same over this period?
- In which major animal group has the number of threatened species increased substantially over this period?
- In which major animal groups has the number of threatened species increased only slightly over this period?