

math

MAMMOTH

Grade 5-A Worktext

The four operations

Large numbers
and the
calculator

Problem solving

Decimals



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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, aligned to the Common Core Standards.

The fifth grade is time for fractions and decimals, in particular. In part 5-A, we study decimals in depth and with substantial detail. Students also deepen their understanding of whole numbers, learn much more problem solving, and get introduced to the calculator.

The year starts out with a study of whole numbers and their operations. Students get to 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 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 equations and problem solving. We study simple equations with the help of a balance and bar models. The main idea is to get students used to the idea of an equation and what it means to solve an equation. Students also do a fair amount of problem solving using the visual bar model.

The fourth 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 part 5-B, students study graphing, fractions, and geometry.

I wish you success in your math teaching!

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 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 study simple equations, both with the help of visual bar models and also without. Bar models are also used for simple multiplication and division equations.

Next, we review multi-digit multiplication (multiplying in columns), starting with multiplying in parts (partial products) 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*. All along 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 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	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

Sample worksheet from

www.mathmammoth.com

Helpful Resources on the Internet

Long division & multiplication

Rectangle Multiplication

An interactive tool that illustrates multiplying in parts using the area model. Choose the “common” option for this grade level, to show multiplying in parts.

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

Snork’s Long Division Game

Interactive and guided long division practice that only accepts correct answers and truly guides the student step-by-step through long division problems. In the beginning, choose the highest number you want to work with (the divisor) to be a two-digit number, in order to practice with two-digit divisors.

<http://www.kidsnumbers.com/long-division.php>

Mr. Martini’s Classroom: Long Division

An interactive long division tool.

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

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>

All four operations

Math Mahjong

A Mahjong game where you need to match tiles with the same value. It uses all four operations and has three levels.

http://www.sheppardsoftware.com/mathgames/mixed_mahjong/mahjongMath_Level_1.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>

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>

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>

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. Includes negative numbers sometimes.

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

Order of operations

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>

Connect-the-Four

Solve very simple math problems about the order of operations and get to play connect-the-four game.

Requires Java.

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

Order of Operations Quiz

A 10-question online quiz that includes two different operations and possibly parentheses in each question. You can also modify the quiz parameters yourself.

<http://www.thatquiz.org/tq-1/?-j8f-la>

The Order of Operations Millionaire

Answer multiple-choice questions that have to do with the order of operations, and win a million. Can be played alone or in two teams.

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

Exploring Order of Operations (Object Interactive)

The program shows an expression, and you click on the correct operation (either +, —, ×, ÷ or exponent) to be done first. The program then solves that operation, and you click on the *next* operation to be performed, etc., until it is solved. Lastly the resource includes a game where you click on the falling blocks in the order that order of operations would dictate.

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

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>

Quick Calculate

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

<http://thematgames.com/arithmetic-games/addition-subtraction-multiplication-division/quick-calculate-game.php>

Factors and primes

Factor Game

Interactive game to practice divisibility among numbers 1-100. Play against the computer or a friend.
<http://illuminations.nctm.org/ActivityDetail.aspx?ID=12>

Factor Feeder

Eat factors of the given number, and avoid numbers that are not factors of the given number in this Pacman-style game. Use Arrow Keys to move.
<http://hoodamath.com/games/factorfeeder.php>

Primes, Factors and Divisibility - Explorer at CountOn.org

Lessons explaining divisibility tests, primes, and factors.
<http://www.counton.org/explorer/primes/>

Sliding Tile Factorization Game

Slide a number over another to capture it, if it is a factor of the other. Number 1 is only supposed to be used to capture a prime number.
http://www.visualmathlearning.com/Games/sliding_factors.html

Factors and Remainders

An interactive animation demonstrating factors and remainders. Choose a number and its possible divisor. The animation shows boxes (as given by the number) arranged into rows of (possible divisor), and you can SEE if there is any remainder.
<http://www.absorblearning.com/media/item.action?quick=ml>

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/>

Factors Millionaire Game

A millionaire game where the questions have to do with factors, prime numbers, and the greatest common factor.
<http://www.math-play.com/Factors-Millionaire/Factors-Millionaire.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

MathGoodies Interactive Factor Tree Game

Type in a missing number to the factor tree, and the program will find the other factor, and continue drawing the tree as needed.
http://www.mathgoodies.com/factors/prime_factors.html

Factors and Remainders

An interactive animation demonstrating factors and remainders. Choose a number and its possible divisor. The animation shows boxes (as given by the number) arranged into rows of (possible divisor), and you can SEE if there is any remainder.
<http://www.absorblearning.com/media/item.action?quick=ml>

Snake

Eat factors, multiples, and prime numbers in this remake of the classic game.

<http://www.pompuzzle.com/Snake>

Product game

For two players; each selects a factor, computer colors the product - who gets four in row wins.

<http://illuminations.nctm.org/ActivityDetail.aspx?ID=29>

Primes, Factors and Divisibility—Explorer at CountOn.org

Lessons explaining divisibility tests, primes, and factors.

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

Prime Number Calculator

This calculator tests if a number is a prime, and tells you its smallest divisor if it is not prime.

<http://www.basic-mathematics.com/prime-number-calculator.html>

The Prime Pages

Learn more about primes on this site: the largest known primes, finding primes, how many are there, and more.

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

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

Cryptoclub kids strive 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 how cryptography has been used over the centuries. By solving the problems you can actually learn to do all of it yourself.

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

Primality of 1 from Wikipedia

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

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

Arguments for and Against the Primality of 1

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

Unique Prime Factorization

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

<http://www.youtube.com/watch?v=5kl28hmhin0>

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Order of Operations and Equations

- *First* solve whatever is inside parentheses.
- *Next*, solve multiplications and divisions “on the same level,” from left to right.
- *Last*, solve additions and subtractions “on the same level,” from left to right.

1. Solve what is within parenthesis first. You can enclose the operation to be done first in a “bubble.”

$\begin{array}{l} (36 + 4) \div (5 + 5) \\ \quad \backslash \quad / \quad \quad \backslash \quad / \\ = 40 \quad \div \quad 10 \\ \\ = 4 \end{array}$	<p>a. $(50 - 2) \div (3 + 5)$</p>	<p>b. $20 \times (1 + 7 + 5)$</p>
	<p>c. $2 \times (600 \div 60) + (19 - 8)$</p>	<p>d. $180 \div (13 - 7 + 3)$</p>

2. Solve. When there are many multiplications and divisions, do them from left to right.

$\begin{array}{l} 24 \div 3 \times 2 \div 4 \\ \quad \backslash \quad / \\ = 8 \times 2 \div 4 \\ \quad \quad \backslash \quad / \\ = 16 \div 4 = 4 \end{array}$	<p>a. $36 \div 4 \div 3$</p>	<p>b. $1,200 \div 4 \times 5 \div 3$</p>
	<p>c. $7 \times 90 \div 2 \times 2 \div 10$</p>	<p>d. $5 \times 6 \div 3 \div 2 \times 20$</p>

3. Solve in the right order. You can enclose the operation to be done first in a “bubble” or a “cloud.”

<p>a. $12 \times 5 + 8 = \underline{\hspace{2cm}}$</p>	<p>b. $10 + 2 \times 9 + 8 = \underline{\hspace{2cm}}$</p>
<p>c. $45 + 5 \times 7 = \underline{\hspace{2cm}}$</p>	<p>d. $10 + 2 \times (9 + 8) = \underline{\hspace{2cm}}$</p>
<p>e. $(8 + 16) \div 3 \div 2 = \underline{\hspace{2cm}}$</p>	<p>f. $2 \times (100 - 80 + 20) = \underline{\hspace{2cm}}$</p>
<p>g. $120 - 2 \times (11 - 5) = \underline{\hspace{2cm}}$</p>	<p>h. $25 + 8 \times 5 \div 2 = \underline{\hspace{2cm}}$</p>

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

<p>a. $6 + \frac{24}{2} = \underline{\hspace{2cm}}$</p>	<p>b. $\frac{32}{2} - 6 = \underline{\hspace{2cm}}$</p>	<p>c. $\frac{54}{6} - 6 - 2 = \underline{\hspace{2cm}}$</p>
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An **equation** has numbers, letters, operation symbols, and one equal sign, “=”. It’s called an *equation* because it contains an *equal* sign. For example, “ $5 = 1 + 4$ ” is an equation.

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

5. Equation or expression? (Do not 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. $12 - \frac{24 \div 0.8}{189}$

6. Which expression matches each problem? Also, solve the problems.

<p>a. Mark bought three light bulbs for \$8 each, and paid with \$50. What was his change?</p>	<p>(1) $3 \times \\$8 - \\50 (3) $\\$50 - 3 \times \\8</p>	<p>(2) $\\$50 - \\$8 + \\$8 + \\8 (4) $\\$50 - (\\$8 - \\$8 - \\$8)$</p>
<p>b. Shirts costing \$16 each are discounted by \$5, so mom buys six of them. What is her total cost?</p>	<p>(1) $\\$16 - \\5×6 (3) $\\$16 \times 6 - \\5</p>	<p>(2) $6 \times (\\$16 - \\$5)$ (4) $(\\$16 - 6) \times 5$</p>
<p>c. Andy buys a salad for \$8 and a pizza for \$13, and shares the cost evenly with his friend. How many dollars is Andy’s share of the cost?</p>	<p>(1) $\\$8 + \\$13 \div 2$ (3) $2 \times \\$8 + 2 \times \\13</p>	<p>(2) $\\$2 \div (\\$8 + \\$13)$ (4) $(\\$8 + \\$13) \div 2$</p>
<p>d. Melissa shares equally the cost of a meal with three other people and the cost of a taxi with two other people. The meal costs \$48 and the taxi costs \$30. How much does Melissa pay?</p>	<p>(1) $\\$48 \div 4 + \\$30 \div 3$ (3) $\\$48 \div 3 + \\$30 \div 2$</p>	<p>(2) $(\\$48 + \\$30) \div 3 \div 2$ (4) $(\\$48 + \\$30) \div 5$</p>

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

a. $6 + \frac{32}{8} = 5$	b. $(6 - 2) \times 3 = 5 + 5$	c. $5 \times 2 = 16 \div 2 + 2$
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8. 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. $40 \times 3 = 80 - 50 \times 4$
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9. 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. $(4 + 5) \times 3 = \square \div 2$

10. Solve these simple equations.

a. $s \times 2 = 660$ $s = \underline{\hspace{2cm}}$	b. $\frac{x}{2} = 5$ $x = \underline{\hspace{2cm}}$	c. $200 - y = 60$ $y = \underline{\hspace{2cm}}$
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11. 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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A Two-Digit Divisor 1

Often, it is helpful to write the multiplication table of the divisor before you divide.

Example 1. The division is by 16. Here is the multiplication table of 16:

- $3 \times 16 = 48$
- $4 \times 16 = 64$
- $5 \times 16 = 80$
- $6 \times 16 = 96$
- $7 \times 16 = 112$
- $8 \times 16 = 128$
- $9 \times 16 = 144$

$$\begin{array}{r} 0 \ 3 \\ 16 \overline{) 5568} \end{array}$$

16 goes into 5 zero times, so we look at 55.

How many times does 16 go into 55?

Check in the table on the left. We see it goes into 55 three times.

$$\begin{array}{r} 0 \ 3 \ 4 \\ 16 \overline{) 5568} \\ \underline{-48} \\ 76 \end{array}$$

Now, how many times does 16 go into 76?

From the table we can see that it is four times.

$$\begin{array}{r} 0 \ 3 \ 4 \ 8 \\ 16 \overline{) 5568} \\ \underline{-48} \\ 76 \\ \underline{-64} \\ 128 \\ \underline{-128} \\ 0 \end{array}$$

Lastly, 16 goes into 128 exactly 8 times, and the division is over.

Example 2. We are dividing by 32. Here is the multiplication table of 32:

- $3 \times 32 = 96$
- $4 \times 32 = 128$
- $5 \times 32 = 160$
- $6 \times 32 = 192$
- $7 \times 32 = 224$
- $8 \times 32 = 256$
- $9 \times 32 = 288$

$$\begin{array}{r} 0 \ 1 \\ 32 \overline{) 4707} \\ \underline{-32} \\ 15 \end{array}$$

32 goes into 47 once.

$$\begin{array}{r} 0 \ 1 \ 4 \\ 32 \overline{) 4707} \\ \underline{-32} \\ 150 \\ \underline{-128} \\ 22 \end{array}$$

32 goes into 150 four times.

$$\begin{array}{r} 0 \ 1 \ 4 \ 7 \\ 32 \overline{) 4707} \\ \underline{-32} \\ 150 \\ \underline{-128} \\ 227 \\ \underline{-224} \\ 3 \end{array}$$

32 goes into 224 seven times. Notice there is a remainder.

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

Table of 21:

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

2	1	)	3	8	2	2

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	)	48	15		

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	)	51	48		

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	)	62	75		

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	)	15	04		

3. Divide. Check each answer by multiplying.

a.

Table of 12:

$2 \times 12 =$

$3 \times 12 =$

$4 \times 12 =$

$5 \times 12 =$

$6 \times 12 =$

$7 \times 12 =$

$8 \times 12 =$

$9 \times 12 =$

1	2	)	8	8	8		

b.

Table of 22:

$2 \times 22 =$

$3 \times 22 =$

$4 \times 22 =$

$5 \times 22 =$

$6 \times 22 =$

$7 \times 22 =$

$8 \times 22 =$

$9 \times 22 =$

2	2	)	6	7	1	0	

c.

Table of 14:

$2 \times 14 =$

$3 \times 14 =$

$4 \times 14 =$

$5 \times 14 =$

$6 \times 14 =$

$7 \times 14 =$

$8 \times 14 =$

$9 \times 14 =$

1	4	)	1	7	3	6	

d.

Table of 51:

$2 \times 51 =$

$3 \times 51 =$

$4 \times 51 =$

$5 \times 51 =$

$6 \times 51 =$

$7 \times 51 =$

$8 \times 51 =$

$9 \times 51 =$

5	1	)	7	5	4	8	

4. Mental math! If 20 goes into 800 forty times, then 20 goes into 820 one time more, or 41 times.
 In each box, use the top problem to help you solve the bottom problem.

a. $800 \div 20 =$ $820 \div 20 =$	b. $700 \div 50 =$ $750 \div 50 =$	c. $150 \div 15 =$ $300 \div 15 =$
d. $480 \div 40 =$ $520 \div 40 =$	e. $600 \div 30 =$ $690 \div 30 =$	f. $1,200 \div 60 =$ $1,320 \div 60 =$

5. **a.** How many inches are in one foot?

b. Convert 245 inches into feet and inches.

c. Convert 387 inches into feet and inches.

6. **a.** How many ounces are in one pound?

b. Convert 163 ounces into pounds and ounces.

c. Convert 473 ounces into pounds and ounces.

7. A newborn baby gains weight at approximately one ounce per day. Suppose that the baby gained weight at that rate for a FULL YEAR. (In reality, babies don't; their growth rate slows down.) How many pounds and ounces would the baby gain in a year?

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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. We study adding, subtracting, rounding, exponents, and using a calculator.

This is the first time the calculator is introduced in Math Mammoth complete curriculum. I have delayed introducing the use of a calculator (as compared to many math curricula) for good reasons. 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 such as 6×7 or $320 + 50$. It is 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.

Therefore, 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 a 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
A Little Bit of Millions	75	3 pages
Place Value Up to Billions	78	3 pages
Exponents and Powers	81	3 pages
Adding and Subtracting Large Numbers	84	3 pages
Rounding	87	3 pages
The Calculator and Estimating	90	3 pages
When to Use the Calculator	93	2 pages
Mixed Review	95	2 pages
Review	97	3 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

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 to the proton inside an atom.

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

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.counton.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>

Free Exponent Worksheets

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

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

Baseball Exponents

Choose the right answer from three possibilities before the pitched ball comes.

<http://www.xpmath.com/forums/arcade.php?do=play&gameid=95>

Exponents Quiz from ThatQuiz.org

Ten questions, fairly easy, and not timed. You can change the parameters as you like to include negative bases, square roots, and even logarithms.

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

Exponents Jeopardy

The question categories include evaluating exponents, equations with exponents, and exponents with fractional bases.

<http://www.math-play.com/Exponents-Jeopardy/Exponents-Jeopardy.html>

Pyramid Math

Simple practice of either exponents, roots, LCM, or GCF. Drag the triangle with the right answer to the vase.

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

Exponents Battleship

A regular battleship game against the computer. Each time you "hit", you need to answer a math problem involving exponents (and multiplication).

<http://www.quia.com/ba/1000.html>

Exponent Battle

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

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

Pirates Board Game

Steer your boat in pirate waters in this online board game, and evaluate powers.

<http://mathgames4children.com/fun-board-games/6th-grade/pirate/exponents-pirate-waters-grade-6-game.html>

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Adding and Subtracting Large Numbers

<p>Just like 25 marbles + 54 marbles = 79 marbles, so will 25 million + 54 million = 79 million. Just keep in mind: a thousand thousands makes a million, and a thousand millions makes a billion.</p>	
<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	100,000,000
a hundred hundreds	100,000	1 million – 500,000	500,000
1/10 million	10^6	10^8	950,000,000
1/4 million	500,000	1 billion – 500 million	1/2 billion
3/4 million	10^4	1 billion – 50 million	950,000
a thousand thousands	200,000	1 million – 5,000	995,000
2/10 million	250,000	1 billion – 5 million	995,000,000

3. Add and subtract. Simply write the numbers under each other, lining up the place values. Use the usual addition or subtraction algorithm, regrouping the same way as you have learned before.

<p>a. $329,145,000 + 2,809,125,093$</p> <div style="border: 1px solid black; height: 100px; width: 100%;"></div>	<p>b. $5,049 + 45,390,000 + 5,483,700$</p> <div style="border: 1px solid black; height: 100px; width: 100%;"></div>
<p>c. $45,700 + 90,567,000 + 2,560 + 2,300,560$</p> <div style="border: 1px solid black; height: 100px; width: 100%;"></div>	<p>d. $290,800 + 254,000,230 + 56,391 + 2,381$</p> <div style="border: 1px solid black; height: 100px; width: 100%;"></div>
<p>e. $480,560,000 - 23,980,000$</p> <div style="border: 1px solid black; height: 100px; width: 100%;"></div>	<p>f. $1,000,000 - 156,990$</p> <div style="border: 1px solid black; height: 100px; width: 100%;"></div>
<p>g. $22,300,000 - 4,431,190$</p> <div style="border: 1px solid black; height: 100px; width: 100%;"></div>	<p>h. $7,014,289,000 - 3,103,559,391$</p> <div style="border: 1px solid black; height: 100px; width: 100%;"></div>

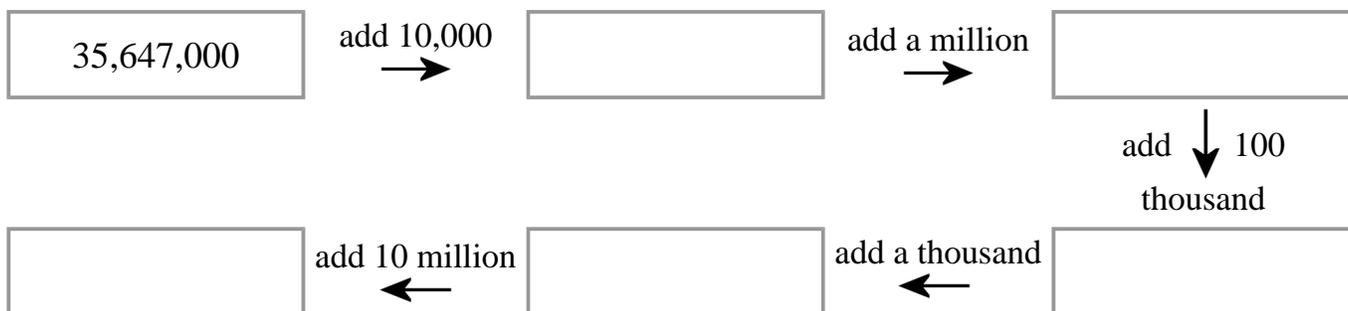
4. Subtract and compare.

<p>a. 1 million – 100 thousand =</p> <p>1 million – 10 thousand =</p> <p>1 million – 1 thousand =</p>	<p>b. 7 million – 500 thousand =</p> <p>7 million – 50 thousand =</p> <p>7 million – 5 thousand =</p>
--	--

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

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

6. Complete the addition path.



7. Solve for x .

a. $x + 400,000 = 4,000,000$ $x =$ _____	b. $x - 350,000 = 2,000,000$ $x =$ _____
c. $200,000 + x + 600,000 = 7,000,000$ $x =$ _____	d. $2x = 3,000,000$ $x =$ _____

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Chapter 3: Problem Solving

Introduction

First in this chapter, students solve some equations, presented as pan balance puzzles. Then we study mixture equations, such as $4x + 38 = 128$, once again using the bar model as a visual model.

The bulk of this chapter is spent on problem solving. We use the bar model a lot. The problems include a fractional part of a whole, a fractional part more, the total is known, one part is more than the other, and so on.

Encourage the student to draw the 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 be solved with algebra. However, the bar model enables us to solve them without algebra; yet, it helps 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	102	5 pages
More Equations	107	4 pages
Problem Solving with Bar Models 1	111	3 pages
Problem Solving with Bar Models 2	114	2 pages
Problem Solving with Bar Models 3	116	2 pages
Problem Solving with Bar Models 4	118	4 pages
Mixed Review	122	2 pages
Chapter 3 Review	124	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 move up and down depending on which expression is greater. When the expressions are equivalent, the pans will balance and the full equation will be entered into the *Balanced Equations* table. This tool strengthens understanding and computation of numerical expressions and equality. In understanding equality, one of the first things students must realize is that equality is a relationship, not an operation. Many students view “=” as “find the answer.” For these students, it is difficult to understand equations such as $11 = 4 + 7$ or $3 \times 5 = 17 - 2$.

<http://illuminations.nctm.org/ActivityDetail.aspx?ID=26>

Pan Balance - Shapes

An online balance that builds your algebraic thinking. Find the unknown weight of each shape by placing shapes on the two pans, and trying to find situations where the weights are equal. One square always weighs 1 unit.

<http://illuminations.nctm.org/ActivityDetail.aspx?ID=33>

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 multi-step 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

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>

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. Includes negative numbers sometimes.

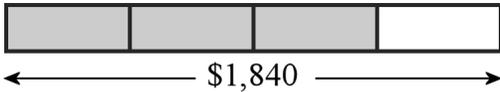
<http://education.jlab.org/smdeluxe/index.html>

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Problem Solving with Bar Models, Part 1

A fractional part of the whole

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



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



_____ \div _____ = _____

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

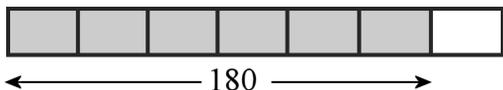
_____ \div _____ = _____

_____ \times _____ = _____

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?

A Fractional Part More

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?



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 \$12 train ride 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-town-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 buys ten shirts with the discounted price. What is her total bill?

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?

9. 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.

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Chapter 4: Decimals

Introduction

In this chapter, we study place value with decimals and learn to perform the four basic operations with decimal numbers.

The chapter starts with a short review of tenths and hundredths, after which, we study numbers with three decimal digits (thousandths). Students also compare and round numbers with up to three decimal digits.

The rest of the chapter is spent studying the four basic operations with decimals. We start with addition and subtraction, which we are familiar with from fourth grade, and then spend a considerable amount of time with multiplication and division of decimals.

I have tried to emphasize mental calculations based on the conceptual understanding of decimals. For that reason, the text often includes little “tricks” that can help with mental calculations. Along with that, the chapter has lessons on long multiplication and long division with decimals.

Problems accompanied by a small picture of a calculator are meant to be solved with the help of a calculator. Otherwise, a calculator should not be allowed.

We also study using decimal numbers in measuring units, the metric system, and conversions between the customary units of measurement. I have tried to emphasize sensible and intuitive methods for converting measuring units within the metric system, instead of relying on mechanical formulas.

You might wonder why *Math Mammoth Grade 5* presents decimals before fractions. The traditional way is to teach fractions first because fractions are more general, and then, to show that decimals are simply a specific type of fractions with denominators that are powers of ten.

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 decimals 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.....	130	3 pages
More Decimals: Thousandths	133	3 pages
Comparing Decimals	138	2 pages
Rounding	140	2 pages
Add and Subtract Decimals	142	4 pages
Multiplying Decimals by Whole Numbers	146	4 pages
Multiplying Decimals in Columns	150	2 pages
Multiplying Decimals by Decimals	152	4 pages
More Decimal Multiplication	156	3 pages
Long Multiplication	159	1 page

Dividing Decimals—Mental Math	160	5 pages
Long Division with Decimals	165	4 pages
More Long Division with Decimals	169	5 pages
Multiply and Divide by Powers of Ten	172	5 pages
Divide Decimals by Decimals 1	177	3 pages
Divide Decimals by Decimals 2	180	4 pages
Decimals in Measuring Units and More	184	4 pages
Rounding and Estimating	188	2 pages
The Metric System	190	3 pages
Converting Between Customary Units of Measurement	193	4 pages
Number Rule Puzzles	197	1 page
Problem Solving	198	4 pages
Mixed Review	202	2 pages
Review	204	5 pages

Helpful Resources on the Internet

Decimal Arithmetic

These are my videos that go through all of the important decimal arithmetic: adding, subtracting, multiplying, dividing, comparing and rounding decimals, plus some problem solving. Great for grades 5, 6, and 7.

<http://www.youtube.com/user/MathMammoth#grid/user/CCFD68119A0DA3E8>

Place Value Strategy

Place the 3 or 4 digits given by the spinner to make the largest number possible.

www.decimalsquares.com/dsGames/games/placevalue.html

Decimal Darts

Try to pop balloons with darts by estimating the balloons' height.

www.decimalsquares.com/dsGames/games/darts.html

Decimal Challenge

Try to guess a decimal number between 0 and 10. Each time feedback tells you whether your guess was too high or too low.

www.interactivestuff.org/sums4fun/decchall.html

Beat the Clock

Type in the decimal number for the part of a square that is shaded in this timed game.

www.decimalsquares.com/dsGames/games/beatclock.html

Scales

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

www.interactivestuff.org/sums4fun/scales.html

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.

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/index.html>

Decimal and Whole Number Jeopardy

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

www.quia.com/cb/8142.html

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://themathtgames.com/arithmetical-games/place-value/decimal-place-value-math-game.php>

Sock

Push the green blocks into the holes to make the target number.

www.interactivestuff.org/sums4fun/sock.html

Decimal Squares Blackjack

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

www.decimalsquares.com/dsGames/games/blackjack.html

A Decimal Puzzle

Make every circle add up to 3.

http://nlvm.usu.edu/en/nav/frames_asid_187_g_2_t_1.html?open=instructions&from=category_g_2_t_1.html

FunBrain Decimal Power Football

Simple games for addition, subtraction, multiplication, and division of decimals, including some with a missing factor or divisor. Solve a problem, and the football player moves down the field.

<http://www.funbrain.com>

Exploring Division of Decimals

Use a square to explore the products of two numbers with one decimal digit. The product is shown as an area.

www.hbschool.com/activity/elab2004/gr6/1.html

Decimal Speedway

Practice decimal multiplication in this fun car-racing game.

www.decimalsquares.com/dsGames/games/speedway.html

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3. a. Fill in the explanation as to how to solve the problem.

Three packs of transistors and seven packs of capacitors cost a total of \$8.70. One capacitor pack costs \$0.60. Find the cost of one transistor pack.

First _____ the cost of seven capacitor packs from _____. Then divide that result by _____.

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

c. Solve the problem.

4. Three friends equally shared the cost of a taxi fare, \$35.40, and the cost of a meal, \$128.95. How much did each person pay?

5. Write a word problem that matches each calculation below. *You do not have to calculate anything.*

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

b. $25 \times \$1.40 \div 2 = \17.50

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Converting Between Customary Units of Measurement

<u>Units of weight</u>	<u>Units of volume</u>	<u>Units of length</u>																								
<table style="margin-left: auto; margin-right: auto;"> <tr><td>(short) ton</td><td>T</td></tr> <tr><td>pound</td><td>lb</td></tr> <tr><td>ounce</td><td>oz</td></tr> </table>	(short) ton	T	pound	lb	ounce	oz	<table style="margin-left: auto; margin-right: auto;"> <tr><td>gallon</td><td>gal</td></tr> <tr><td>quart</td><td>qt</td></tr> <tr><td>pint</td><td>pt</td></tr> <tr><td>cup</td><td>C</td></tr> <tr><td>ounce</td><td>oz</td></tr> </table>	gallon	gal	quart	qt	pint	pt	cup	C	ounce	oz	<table style="margin-left: auto; margin-right: auto;"> <tr><td>mile</td><td>mi</td></tr> <tr><td>yard</td><td>yd</td></tr> <tr><td>foot</td><td>ft</td></tr> <tr><td>inch</td><td>in</td></tr> </table>	mile	mi	yard	yd	foot	ft	inch	in
(short) ton	T																									
pound	lb																									
ounce	oz																									
gallon	gal																									
quart	qt																									
pint	pt																									
cup	C																									
ounce	oz																									
mile	mi																									
yard	yd																									
foot	ft																									
inch	in																									

To convert from one neighboring unit to another, either **multiply** or **divide** by the conversion factor. If you do not know which, THINK if the result needs to be a smaller or bigger number.

Example. Convert 53 ounces into cups.

Ounces are smaller units than cups, so 53 ounces as cups will make *fewer* cups (you need fewer cups since they are the bigger units). So, we need to divide by the factor 8 (*since 8 ounces makes a cup*).

$53 \div 8 = 6 \text{ R}5$. The results means 54 ounces is 6 cups and 5 (leftover) ounces.

You can also think of it this way: since 8 ounces makes a cup, we need to figure how many cups or how many “8 ounces” there are in 53 ounces... or how many 8s are in 53? The answer to that is solved by division.

1. Convert.

a. 6 ft = _____ in.	b. 25 in = _____ ft _____ in	c. 13 ft 7 in = _____ in
7 ft 5 in. = _____ in.	45 in = _____ ft _____ in	71 in. = _____ ft _____ in

2. Convert.

a. 2 lb 8 oz = _____ oz	b. 8 lb = _____ oz	c. 43 oz = _____ lb _____ oz
45 oz = _____ lb _____ oz	56 oz = _____ lb _____ oz	90 oz = _____ lb _____ oz

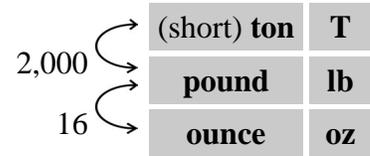
3. Convert.

a. 3 C = _____ oz	b. 4 C = _____ pt	c. 7 gal = _____ qt
55 oz = _____ C _____ oz	3 pt = _____ C	45 qt = _____ gal _____ qt

Example. Convert 4.52 lb into ounces.

We are going from bigger units (pounds) to smaller units (ounces), so there will be LOTS more of them. We need to multiply.

Using a calculator, multiply $4.52 \times 16 = 72.32$ oz.



Example. How many miles is 8,400 feet?

Since one mile is 5,280 feet, then 8,400 feet would be somewhere between 1 and 2 miles.

To find out exactly, use division, and round the answer: $8,400 \div 5,280 = 1.59090909... \approx 1.59$ miles.



5. Convert. Use a calculator. Round your answer to two decimal digits, if necessary.



a. 7.4 mi = _____ ft 16,000 ft = _____ mi	b. 1,500 ft = _____ yd 7,500 yd = _____ mi	<p>1,760 → mile 3 → yard 12 → foot 1 mile = 5,280 feet</p>
c. 900 ft = _____ mi 2.56 mi = _____ yd	d. 12.54 mi = _____ ft 82,000 ft = _____ mi	

6. Convert. Use a calculator. Round your answer to two decimal digits, if necessary.



a. 15.2 lb = _____ oz 655 oz = _____ lb	b. 4.78 T = _____ lb 7,550 lb = _____ T	c. 78 oz = _____ lb 0.702 T = _____ lb
---	---	--

7. Solve the riddle. Use the calculator for the problems that you feel cannot be solved mentally.

- | | | |
|--------------------------------|-------------------------------|-------------------------------|
| F 0.6 mi = _____ ft | G 7 C = _____ oz | I 14,256 ft = _____ mi |
| A 5,632 yd = _____ mi | R 6,200 lb = _____ T | W 6 ft 7 in = _____ in |
| O 10 qt = _____ C | S 3 lb 5 oz = _____ oz | L 732 in = _____ ft |
| H 2 lb 11 oz = _____ oz | E 5 ft 2 in = _____ in | D 42 in = _____ ft |
| L 1.3 mi = _____ yd | O 40 oz = _____ lb | P 3 gal = _____ pt |
| | | A 0.75 mi = _____ ft |

What did one potato chip say to the other?

53	43	3960	61	2288	57	62	56	40
<input type="text"/>								
3168	2.5	3.1	3.2	3.5	2.7	24		?
<input type="text"/>								

8. Solve.

- a. If you serve 1-cup servings of juice to 30 people, how many *whole* gallons of juice will you need?

- b. Mom was making applesauce in 2-gallon batches and bottling it in 1-quart jars. After 9 batches, how many jars of applesauce had she made?

- c. How many 8-inch pieces can you cut out of $9\frac{3}{4}$ ft of ribbon?

- d. A 4-ounce serving of coffee costs \$1.20. What would a 5-ounce serving cost?

- e. A bottle of shampoo weighs 13 oz, and there are 20 of them in a box. The box itself weighs 8 oz. How much does the box with the bottles of shampoo weigh in total (in pounds and ounces)?

- f. Mark drinks three 5-ounce servings of coffee a day. Find how much coffee he drinks in a month (30 days). Give your answer in units other than ounces.

- g. Erica lost 5 lb of weight over 4 weeks of time. How much weight did she lose daily, on average?

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