
Contents

Introduction	4
Warmup: Mental Math	8
Review of the Four Operations	10
Mental Math Review	12
Addition and Subtraction Review	14
Multiplication and Division	17
Terminologies for the Four Operations	20
Expressions	22
Equations	24
Balance Problems and Equations	27
More Equations	32
Powers and Exponents	35
Order of Operations and Equations	38
The Order of Operations	40
Multiplying in Parts and the Multiplication Algorithm	42
A Three-Digit Multiplier, Plus Zeroes	46
Multiplication and Area	49
Multiplying and Dividing in Parts	52
Long Division	55
Long Division Practice Puzzle	58
A Two-Digit Divisor	59
Long Division and Remainder	63
Word Problems	64
Coordinate Grid 1	65
Introduction to Functions	68
Coordinate Grid 2	72
Functions Again	74
Using Two Variables—Functions	77
Review	81
Answers	85
More from Math Mammoth	107

Introduction

Math Mammoth The Four Operations (with a Touch of Algebra) is a mathematics worktext meant primarily for fifth and sixth grades. Some of the lessons can also be used in seventh grade.

A worktext means that the book is a textbook and workbook together: the lessons include both the explanations of the concepts, as well as practice exercises.

The lessons in this worktext have been taken from the Math Mammoth complete curriculum for fifth and sixth grades. For this reason, they may not always flow smoothly from one lesson to the next with a perfect continuity, though I have tried to present them here in the most logical order. For example, there are two lessons for the order of operations: one is from the fifth grade curriculum, and the other is from sixth grade. There is certainly some overlap between them, and the teacher can choose to omit some exercises in one or the other.

The main topics studied in this book are simple equations, expressions that involve a variable, the order of operations, long multiplication, long division, and graphing simple linear functions.

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 $4x + 38 = 128$.

We also 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 also practice long division, including two-digit divisors, as a review from fourth grade.

Although the book 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 student's *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.

I wish you success in math teaching!

Maria Miller, the author

Helpful Resources on the Internet

*Use these free online resources to supplement the “bookwork” as you see fit.
You can access an up-to-date online version of this list at
www.mathmammoth.com/weblinks/four_operations.htm*

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>

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>

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

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>

Division and Order of operations and Division and Addition - Order of Operations

Two mystery picture games.

<http://www.dositey.com/2008/math/m/mystery2MD.htm> and

<http://www.dositey.com/2008/math/m/mystery2AD.htm>

Order of Operations Quiz

A 10-question online quiz that includes two different operations and possibly parenthesis 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>

Sample worksheet from
www.mathmammoth.com

Exploring Order of Operations (Object Interactive)

The program shows an expression, and you click on the correct operation (either +, —, \times , \div 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 parenthesis 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://themathgames.com/arithmetic-games/addition-subtraction-multiplication-division/quick-calculate-game.php>

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>

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

Equation Match

Playing on level 1, you need to match simple equations based on them having the same solution.

<http://www.bbc.co.uk/education/mathsfile/shockwave/games/equationmatch.html>

Battleship

Choose the right solution for a 1-step equation every time you hit the enemy's ship. Some of the equations involve negative solutions; however since the game is interesting, some students might be willing to play it anyway (you can always guess at the right solution since it is a multiple choice game).

<http://www.quia.com/ba/36544.html>

Algebra Meltdown

Solve simple equations using function machines to guide atoms through the reactor. But don't keep the scientists waiting too long or they blow their tops. Again, includes negative numbers.

http://www.mangahigh.com/en_gb/games/algebrameltdown

Words into Equations Battleship Game

Practice expressions such as quotient, difference, product, and sum.

<http://www.quia.com/ba/210997.html>

Balance when Adding and Subtracting Game

The interactive balance illustrates simple equations. Your task is to add or subtract x's, and add or subtract 1's until you have x alone on one side.

<http://www.mathsisfun.com/algebra/add-subtract-balance.html>

Algebra Balance Scales

Similar to the one above, but you need to first put the x's and 1's in the balance to match the given equation.

http://nlvm.usu.edu/en/nav/frames_asid_201_g_4_t_2.html — only positive numbers

http://nlvm.usu.edu/en/nav/frames_asid_324_g_4_t_2.html — includes negative numbers

Co-ordinate Game

You will see a red circle on the grid. Enter the co-ordinates and click “check.”

http://www.bgfl.org/bgfl/custom/resources_fbp/client_fbp/ks3/maths/coordinate_game/game1.htm

Graph Mole

A fun game about plotting points in the coordinate plane. Plot the points before the mole eats the vegetables.

<http://funbasedlearning.com/algebra/graphing/default.htm>

Graphit

A graphing tool that plots both functions and ordered pairs.

<http://www.shodor.org/interactivate/activities/graphit/index.html>

Algebra Puzzle

Find the value of each of the three (or four) objects presented in the puzzle. The numbers given are the sum in each row or column.

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

Algebraic Reasoning - Math Playground

Find the value of a given object based on information provided by two scales. Levels 1 and 2 contain two scales. Level 3 is more difficult and has three scales.

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

Balance Beam Activity

A virtual balance that provides balance puzzles where student is to find the weights of various figures, practicing algebraic thinking. Includes three levels.

<http://mste.illinois.edu/users/pavel/java/balance/index.html>