

---

# Contents

<b>Introduction .....</b>	<b>4</b>
<b>Warmup: Mental Math .....</b>	<b>7</b>
<b>Review of the Four Operations .....</b>	<b>9</b>
<b>Mental Math Review .....</b>	<b>11</b>
<b>Addition and Subtraction Review .....</b>	<b>13</b>
<b>Multiplication and Division .....</b>	<b>16</b>
<b>Terminologies for the Four Operations .....</b>	<b>19</b>
<b>Expressions .....</b>	<b>21</b>
<b>Equations .....</b>	<b>23</b>
<b>Balance Problems and Equations .....</b>	<b>26</b>
<b>More Equations .....</b>	<b>31</b>
<b>Powers and Exponents .....</b>	<b>34</b>
<b>Order of Operations and Equations .....</b>	<b>37</b>
<b>The Order of Operations .....</b>	<b>39</b>
<b>Multiplying in Parts and the Multiplication Algorithm .....</b>	<b>41</b>
<b>A Three-Digit Multiplier, Plus Zeroes .....</b>	<b>45</b>
<b>Multiplication and Area .....</b>	<b>48</b>
<b>Multiplying and Dividing in Parts .....</b>	<b>50</b>
<b>Long Division .....</b>	<b>53</b>
<b>Long Division Practice Puzzle .....</b>	<b>56</b>
<b>A Two-Digit Divisor .....</b>	<b>57</b>
<b>Long Division and Remainder .....</b>	<b>61</b>
<b>Word Problems .....</b>	<b>62</b>
<b>Coordinate Grid 1 .....</b>	<b>63</b>
<b>Introduction to Functions .....</b>	<b>66</b>
<b>Coordinate Grid 2 .....</b>	<b>70</b>
<b>Functions Again .....</b>	<b>72</b>
<b>Using Two Variables—Functions .....</b>	<b>75</b>
<b>Review .....</b>	<b>79</b>
<b>Answers .....</b>	<b>83</b>
<b>More from Math Mammoth .....</b>	<b>104</b>

---

# 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](http://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](http://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](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>

## **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](http://nlvm.usu.edu/en/nav/frames_asid_273_g_2_t_4.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>

## **Algebraic Reasoning**

Find the value of an object based on two scales.

[http://www.mathplayground.com/algebraic\\_reasoning.html](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](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](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](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](http://nlvm.usu.edu/en/nav/frames_asid_324_g_4_t_2.html) — includes negative numbers

### **General Coordinates Game**

Either type in the coordinates of a displayed point or enter coordinates and the applet will plot the point.

<http://www.terragon.com/tkobrien/algebra/topics/orderpairs/op.html>

### **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>