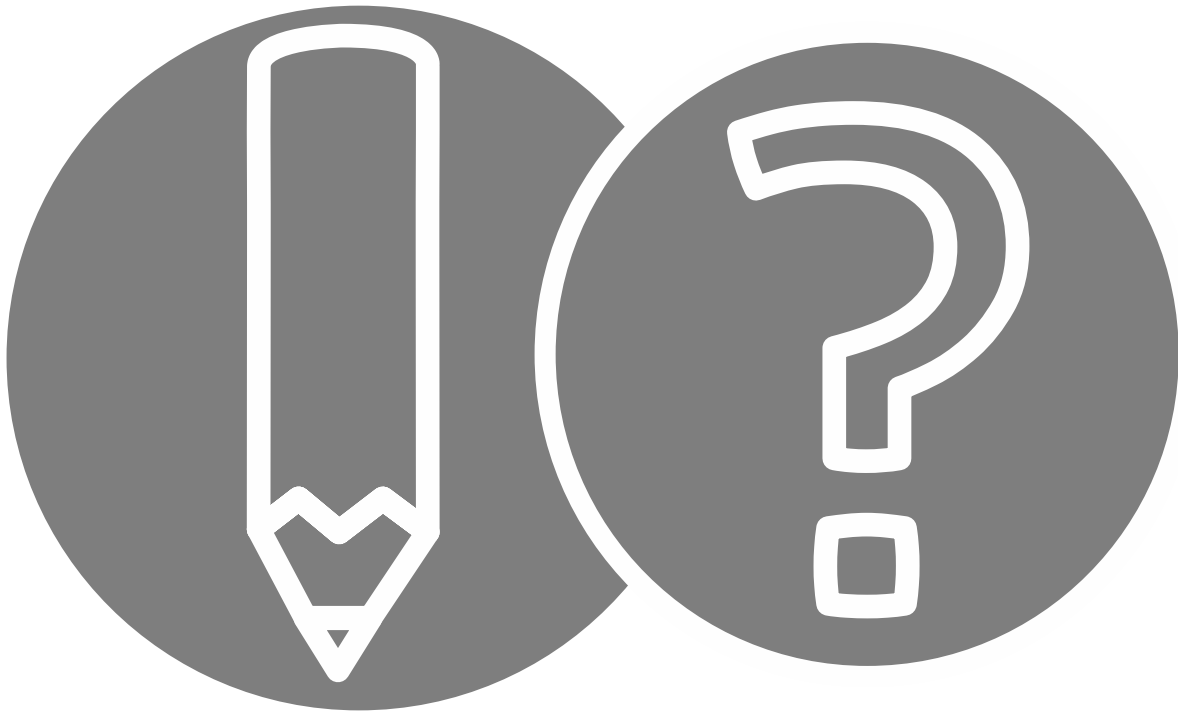


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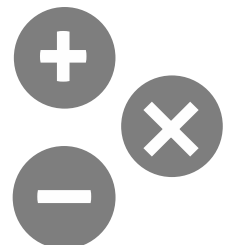
Draw & Solve

Word Problems



Rob Madell and Laura Zoe Dombrowski

Modeling Word Problems for
**Addition, Subtraction, and
Multiplication**



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Introduction

The ability to model word problems is the basis of all of whole number arithmetic. The Math Standards define 13 different types of word problems that children are expected to be able to model by the end of Grade 2. Those 13 types include examples of addition, subtraction, and multiplication.

Addition and Subtraction

The Math Standards define four types of addition word problems and seven types of subtraction word problems. By the end of Grade 1 children are expected to be able to model all of these different types of problems with small numbers.

Now, in the second grade, the Math Standards expect that children will learn to “use addition and subtraction within 100” to solve all of these different types of problems. You can use this book to help children make the transition from modeling word problems with small numbers to solving word problems with larger numbers by using strategies based on place value.

Multiplication

The Math Standards also expect children in the second grade to “gain foundations for multiplication.” Those foundations involve two types of multiplication word problems. Here is an example of one of those types.

Equal Groups/Unknown Product

A farmer has 4 chickens. One day, each of those chickens laid 2 eggs. How many eggs did the chickens lay altogether?

We might teach children to model this problem with counters:

1. Show me the 4 counters that will be the 4 chickens.
2. For each chicken, show me the 2 counters that will be the eggs that that chicken laid.
3. Count how many eggs there are altogether.

We might also teach children to model this problem with paper and pencil:

1. Draw 4 small squares that will be the chickens.
2. For each chicken, draw 2 small circles that will be the eggs that that chicken laid.
3. Count how many eggs there are altogether.

This book, together with the others in the series, is primarily intended to help children model the Math Standards problem types with paper and pencil. Work that began in Kindergarten and Grade 1 with models for addition and subtraction continues here. Models for multiplication are first introduced here in this volume for Grade 2.

How to Use This Book

Start by reminding yourself of all the different problem types that children in Grade 2 are expected to be able to model. The Introduction to Addition has examples of the four different types of addition word problems. The Introduction to Subtraction has examples of the seven types of subtraction problems. The Introduction to Multiplication discusses the two types of multiplication problems.

We suggest that students be introduced to the various types of word problems with physical models. Use counters or other manipulatives for demonstrations and discussions with the whole group, with small groups, and ideally with

individual children. In the case of addition and subtraction, this may have already happened in first grade.

At some later point you can introduce paper-and-pencil models. For children still struggling with modeling addition and subtraction, you may want to start with worksheets found in the first-grade book in this series before turning to the problems in this volume. For an introduction to multiplication, children should use the worksheets provided here. Paper-and-pencil models have at least one advantage over physical models. At the end of class you will be able to collect and review each student's work.

We have used worksheets like these with our students and are happy with the results. We hope that you have a similar experience.

A Note About Names

In writing here about the various problem types, we have used the names assigned to those types by the Math Standards. But the only names that we use with our students are *addition*, *subtraction*, *multiplication*, and *division*. We do sometimes make the distinction, for example, between “one type of addition problem” and “another type of addition problem.”

A Note About Modeling

Eventually children will learn to represent word problems with equations, and to solve those word problems, and to solve those equations, with strategies beyond counting. For example, the problem about chickens and eggs can be represented by the equation

$$4 \times 2 = \square$$

and can be solved by reasoning that “since 2 twos make 4, 4 twos must make 8.” But first children must learn what these word problems mean—in this case that the four sets of two eggs should be put together and counted one by one. These

books are about teaching children what word problems mean.


A Note About Drawing

Some children like to make elaborate drawings. They may want to give the chickens beaks and wings. They may want to draw the farmer and the hen house. But none of this detail is essential to the mathematics. Those chickens and the eggs can be represented by circles or squares or tally marks. In fact, the Standards of Mathematical Practice encourage teachers to help children to “*decontextualize*—to abstract a given situation and represent it symbolically . . .” These books support that standard. We think that you should encourage children to make very simple drawings.


Equal Groups/Unknown Product - 1

Name _____ Date _____

1. There are 2 horses on a farm. Each horse ate 4 apples.
How many apples did they eat altogether? 8



2. A boy saw 5 bird nests. There were 2 birds in each nest.
How many birds are there altogether? 10



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This second-grader knew from memory that 2 fours make 8, and she counted by twos to find that 5 twos are 10. She didn't need the pictures to solve the problems, but making the drawings is still worthwhile.

A Note About Understanding vs. Memorizing

Some children come to school understanding some types of word problems. **Add To/Result Unknown** is a good example. Other types of word problems can be difficult for children. **Take From/Start Unknown** and **Compare/Bigger Unknown** are good examples. To help them we advocate direct instruction in modeling. But to be clear, we are not arguing for mechanical, rote learning. We merely believe in putting difficult problems in front of children and helping them to understand those problems. We don't advocate having them memorize steps that they do not understand.

—Rob Madell and Laura Dombrowski

Introduction to Addition

The Math Standards expect that, by the end of second grade, students will be able to use strategies beyond counting to solve four different types of addition word problems, with numbers within 100.

Add To/Result Unknown

35 girls jumped into a swimming pool. Then 23 boys jumped into the swimming pool. How many children are in the swimming pool altogether?

Put Together/Total Unknown

There are 35 chocolate chip cookies in the window of a bakery. There are 23 oatmeal raisin cookies in the window. How many cookies are in the window altogether?

Take From/Start Unknown

Some cows are in the barn on a farm. After 35 of those cows went outside, there were still 23 cows left in the barn. How many cows were in the barn at first?

Compare/Bigger Unknown

A big family had a picnic. They ate 35 hot dogs and 23 more hamburgers than hot dogs. How many hamburgers did they eat?

It is clear that there are important differences among the four types of addition word problems. Some are a lot easier to understand than others. Nevertheless, the Math Standards expect that by the end of first grade children will have learned to model each of them and will understand that each of them involves the joining of two sets of objects. (For children who still need help with modeling addition word problems, the first-grade book in this series would be a good resource.)

Compare/Bigger Unknown - 1

Name _____ Date _____

1. There are 6 addition problems for homework. There are 9 more subtraction problems than addition problems. How many subtraction problems are there? 15

Draw a picture.

Write an equation. $6 + 9 = 15$

2. There are 26 addition problems for homework. There are 38 more subtraction problems than addition problems. How many subtraction problems are there? 64

Show your strategy.

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Notice the plus signs to represent addition problems and minus signs to represent the additional subtraction problems. And also notice the use of an open number line as this child's strategy.

The purpose of the activity pages in this section on addition is to help children make the transition from the modeling they learned in first grade to the strategies that they are learning in second grade.

Each of the addition activity pages included here is dedicated to one or the other of the four types of addition word problems. The first problem on each page requires children to model it with a simple picture. That picture should remind them that the problem involves addition—the joining of two sets. The second problem on each page is

identical to the first—but involves larger numbers. Encourage your students to solve the second problem using the strategies based on place value that they have been learning. You might also help them to see that a good strategy for understanding a difficult problem is to first try to solve it with a small-number model.

Add To/Result Unknown problems begin on page 3.

Put Together/Total Unknown problems begin on page 13.

Take From/Start Unknown problems begin on page 23.


Compare/Bigger Unknown problems begin on page 33.

Compare/Bigger Unknown - 1

Name _____ Date _____

1. There are 6 addition problems for homework. There are 9 more subtraction problems than addition problems. How many subtraction problems are there? 15

Draw a picture.



Write an equation. $6 + 9 = 15$

2. There are 26 addition problems for homework. There are 38 more subtraction problems than addition problems. How many subtraction problems are there? 64

Show your strategy.

$8 + 6 = 14$
 $20 + 30 = 50$
 $14 + 50 = 64$

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The “picture” in the first problem is not what we had in mind, but it works. See if you can figure out what this child was thinking. The strategy for the second problem is one of many possibilities.

Name _____ Date _____

1. A woman has 12 hats. She buys 6 more hats. How many hats does she have now? _____

Draw a picture.

Write an equation. _____

2. A woman has 31 hats. She buys 25 more hats. How many hats does she have now? _____

Show your strategy.

Name _____ Date _____

1. There are 12 children playing tag. There are 6 children playing ball. How many children are there in all? _____

Draw a picture.

Write an equation. _____

2. There are 11 children playing tag. There are 18 children playing ball. How many children are there in all? _____

Show your strategy.