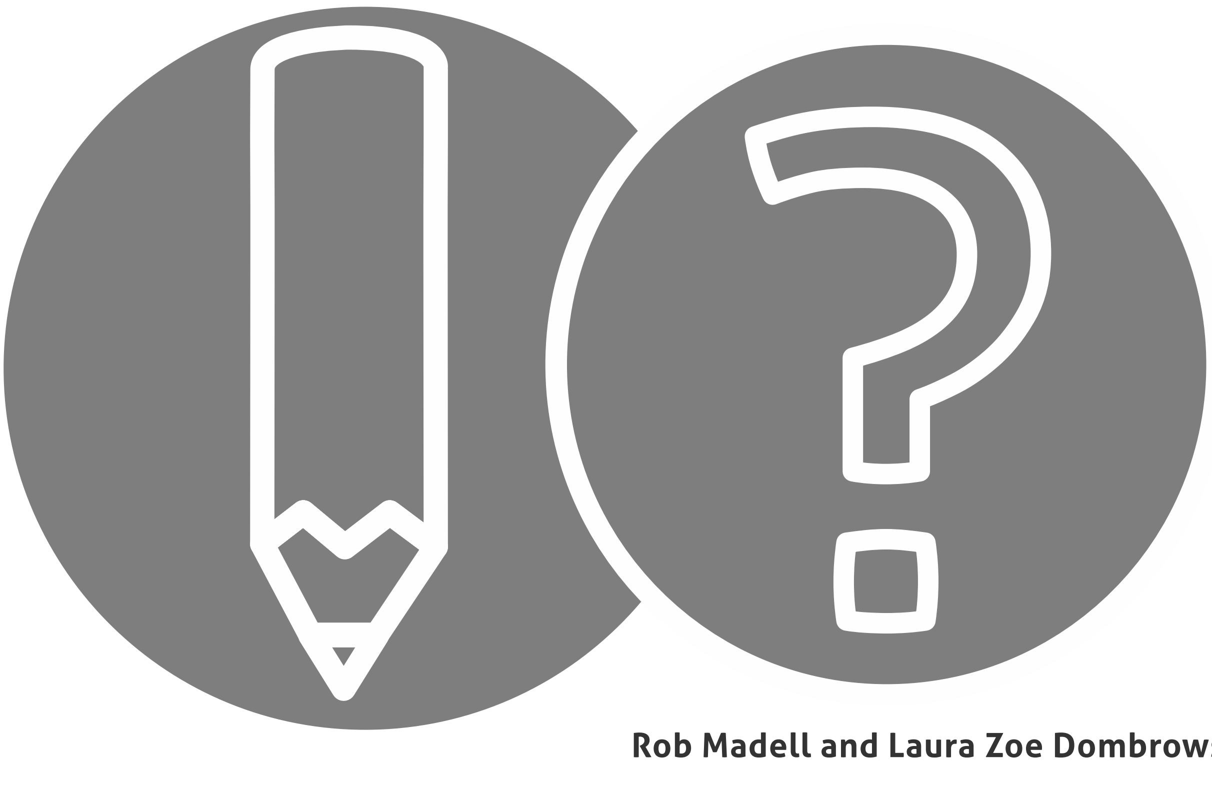
Grade K

Draw & Solve Word Problems



Rob Madell and Laura Zoe Dombrowski

Modeling Word Problems for **Addition and Subtraction within 10**

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Introduction

The ability to model word problems is the basis of all of whole-number arithmetic. The Math Standards define four types of word problems that children are expected to be able to model by the end of Kindergarten. Here is an example of one of those types.

Put Together/Total Unknown

3 toy cars are on the table.

2 toy boats are on the table.

How many toys are on the table altogether?

We might teach children to model this problem with counters:

1. Show me the 3 counters that will be the toy cars.
2. Show me the 2 counters that will be the toy boats.
3. Count how many toys there are altogether.

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

1. Draw 3 small circles that will be the toy cars.
2. Draw 2 small circles that will be the toy boats.
3. Count how many toys there are altogether.

This book, together with the others in the series, is intended to help children model the Math Standards problem types with paper and pencil. The four problem types that are required in Kindergarten are included here in this volume. There are 10 activities per problem type on the pages that follow, for a total of 40 activities.

How to Use This Book

Start by reminding yourself of the four problem types that children in Kindergarten are expected to learn to model. The Introduction to Addition discusses the two types of addition problems, and the Introduction to Subtraction discusses the two types of subtraction problems.

Next, introduce your students to solving 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.

At some later point you can introduce paper-and-pencil models and then have children work largely on their own with 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

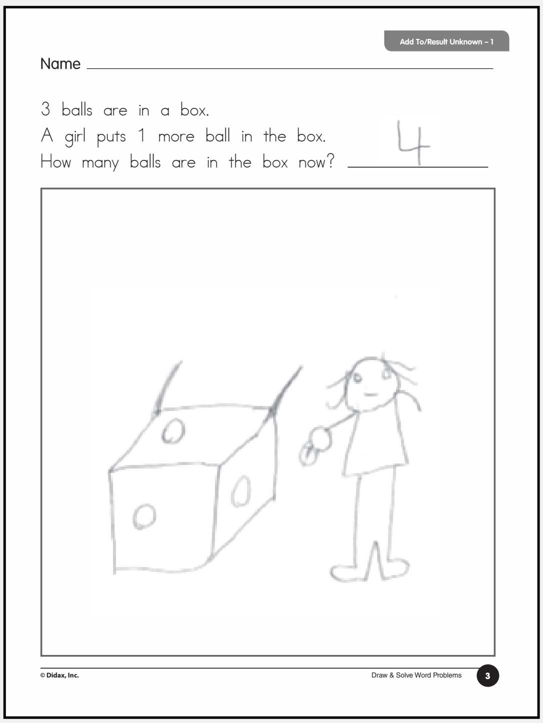
Eventually children will learn to represent word problems with equations, and to solve those word problems, and to solve those equations, with strategies beyond counting. For example, the problem about toys can be represented by the equation

$$3 + 2 = \square$$

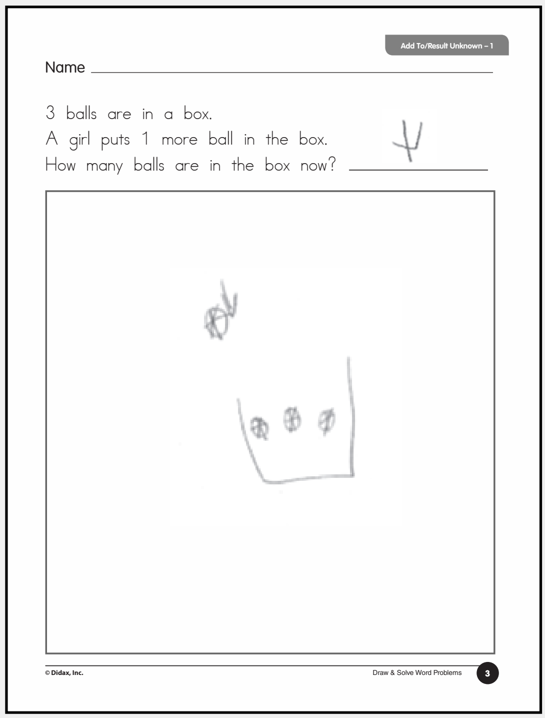
and can be solved by reasoning that since $2 + 2 = 4$, then $3 + 2$ must equal 5. But first children must learn what these word problems mean—in this case that the two kinds of toys should be put together and counted one by one. These books are about teaching children what word problems mean.

A Note About Drawing

Some children like to make elaborate drawings. They may want to give the toy cars wheels and doors, and they may want to give toy boats sails and sailors. But none of this detail is essential to the mathematics. Those toys can be represented by circles or squares or tally marks. In fact, the Math Standards 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.



A typical kindergarten drawing, but with more detail than is necessary to represent the arithmetic—the girl, her hand and fingers holding a ball, and the 3-D box.



A much simpler representation. It has no unnecessary details. Notice the arrow showing the additional ball joining those already in the box.

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.

A Note About Reading

We have tried to make the word problems in this book as easy to read as possible. We hope that this allows for the challenge of the word problems to be mathematical rather than one of reading. A complete list of all the words used can be found in the word list on page 45.

But in your class discussion we suggest that you restate the problems to sound more natural. For example, where a problem reads,

> 2 ducks sit in the grass.
>
> 3 more ducks come to sit in the grass.
>
> How many ducks are in the grass now?

you might say instead,

> 2 ducks were sitting in the grass.
>
> Then 3 more ducks came to sit with them.
>
> How many ducks are in the grass now?

—Rob Madell and Laura Dombrowski

Introduction to Addition

The Math Standards define four types of word problems that children are expected to be able to model by the end of Kindergarten. Of those four, two can be solved by addition. Here is an example of each of those two addition types.

Add To/Result Unknown

A boy had 5 dolls.

Then his sister gave him 3 more dolls.

How many dolls does the boy have now?

Put Together/Total Unknown

5 pigs are in the mud.

3 pigs are on the grass.

How many pigs are there altogether?

Although in general there are significant differences among the different types of word problems, these two types are very similar to one another—two sets of objects are to be joined together and counted. Here is the distinction.

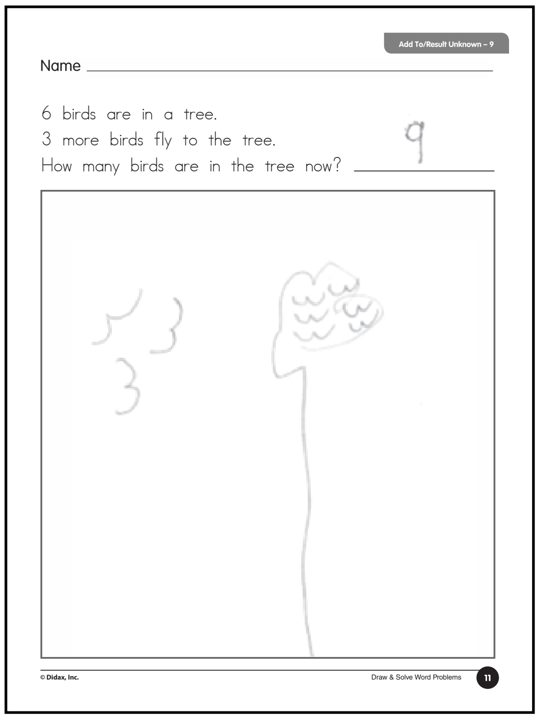
Add To/Result Unknown problems happen over time and explicitly describe the joining of two sets. **At first** the boy had 5 dolls. **Then** he got 3 more.

Put Together/Total Unknown problems describe two sets (the **pigs in the mud** and the **pigs on the grass**) at one fixed point in time. Nothing is said about these two sets of pigs coming together.

In our experience it is relatively easy to teach children to model both types, and it is rarely the case that a child understands one type but not the other. In any case, it is clear that children should be taught to model both problems in the same way.

Step	Add To/ Result Unknown	Put Together/ Total Unknown
1	Draw the 5 dolls the boy had.	Draw the 5 pigs in the mud.
2	Draw the 3 dolls his sister gave to him.	Draw the 3 pigs on the grass.
3	Count the dolls altogether.	Count the pigs altogether.

In the pages that follow, you will find **Add To/ Result Unknown** problems beginning on page 3, followed by **Put Together/Total Unknown** problems beginning on page 13. But because these word problems are so similar to one another, in our own classrooms we have integrated the two sets and not tried to point out the distinctions to our students.



A very simple drawing that clearly captures the meaning of the problem.

Name ____

3 balls are in a box.

A girl puts 1 more ball in the box.

How many balls are in the box now? ______________

Name ____

A boy has 2 red cars and 2 blue cars.
How many cars does he have in all? ______________

Introduction to Subtraction

The Math Standards define four types of word problems that children are expected to be able to model by the end of Kindergarten. Of those four, two can be solved by subtraction. Here is an example of each of those two subtraction types.

Take From/Result Unknown

A boy had 6 rabbits.

Then 4 of his rabbits ran away.

How many rabbits does he have left?

Take Apart/Addend Unknown

A farmer has 6 eggs.

Some eggs are brown and some are white.

4 of the eggs are brown.

How many eggs are white?

The distinction between these two problem types mirrors the distinction described in the Introduction to Addition.

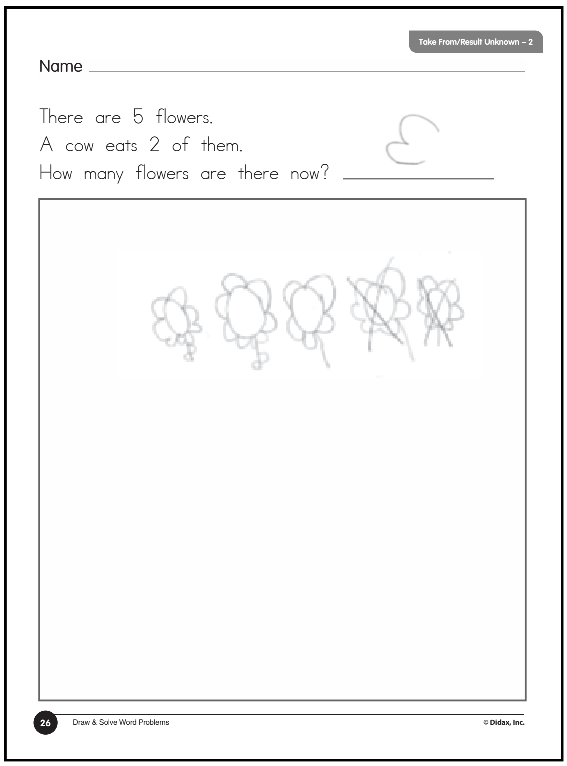
Take From/Result Unknown problems happen over time and explicitly describe the separating of a set into two parts. **At the start,** the boy had 6 rabbits. **Then** 4 of those rabbits **ran away.**

Take Apart/Addend Unknown problems describe a set (**the farmer's 6 eggs**) that has two parts (**the brown eggs and the white eggs**). Nothing happens over time, and nothing is said about these two parts physically separating from one another.

In spite of these distinctions, the chart that follows shows that there is little or no difference in the way these problems are modeled.

Step	Take From/ Result Unknown	Take Apart/ Addend Unknown
1	Draw the 6 rabbits.	Draw the 6 eggs.
2	Show which 4 rabbits ran away.	Show the 4 eggs that are brown.
3	Count the rabbits that are left.	Count the eggs that are white.

In the pages that follow, you will find **Take From/ Result Unknown** problems beginning on page 25 followed by **Take Apart/Addend Unknown** problems beginning on page 35. As in the case of the addition problems, in our own classrooms we have integrated the two sets of subtraction problems. For some students you may even want to integrate instruction in the addition models with instruction in the subtraction models.



Take From/Result Unknown – 2

Name ____________________

There are 5 flowers.
A cow eats 2 of them.
How many flowers are there now? ____3____

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The drawing shows that this child understands Take From/Result Unknown—5 flowers with 2 crossed out. The flowers have more detail than necessary—but at least there is no cow.

Name ____

A girl has 3 balls.
She gives 1 of them to a boy.
How many balls does the girl have now? ____________

Name ______________________________

A boy has 5 toy cars.

3 of them are yellow.

The rest are black.

How many cars are black? ____________