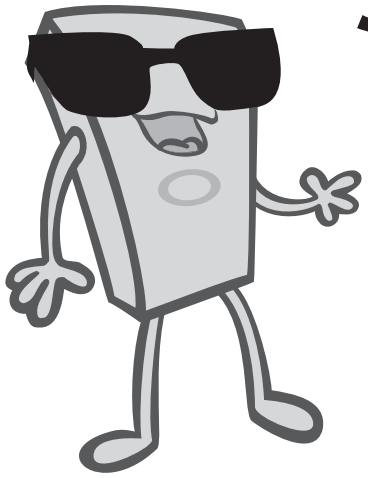


Summer School

Teacher's Guide
Grade 3

DIGI-BLOCK®
See the Math

Table of Contents

Introduction

I. Why Digi-Block Materials for Summer School?

The Digi-Block Summer School Program provides a way for students to gain a powerful understanding of our number system. Place value concepts are often difficult to teach; however they are not difficult for students to learn if concrete materials are available for them to explore. Students assigned to summer school, because they have not been successful in mathematics, often have not had enough opportunities using manipulative tools to build an understanding of our number system.

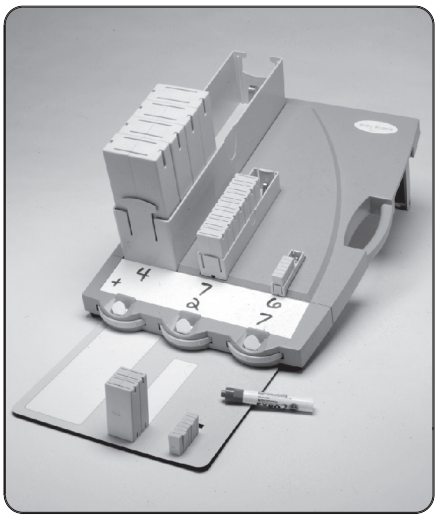
Digi-Block materials give students opportunities to explore our base-ten number system in a visual and physical way. They relate powers of ten to something students can see and touch, making the concepts of base ten meaningful and easy to internalize. Multiple experiences with the blocks over the course of the Summer School Program along with guided instruction give students the time and tools they need to develop their number sense and understanding of place value and operations.

II. What Materials Are Used in the Digi-Block Learning System?

A. The Blocks

At the core of the Digi-Block system is a system of small rectangular-shaped blocks and empty holders. When the small holder is filled with exactly ten single blocks and covered with another holder, a new block is formed. This block-of-10 looks exactly the same as the single block, except it is ten times larger in volume. Ten of these blocks pack in a still larger holder to create a block-of-100. Again, this block looks the same as the block-of-10, except that it is ten times larger in volume. The process repeats to make a block-of-1000.

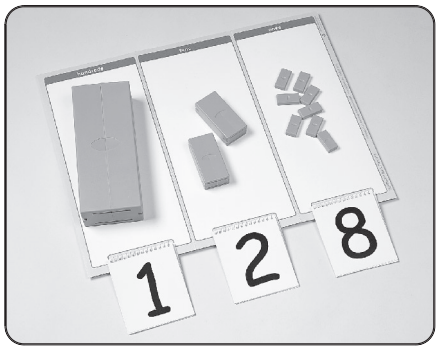
B. The Counter and the Counter Mat



An important feature of the system is the Three-Place Counter, which is a plastic inclined board. There are specific places on the board on which to place holders. The teacher or students can then put blocks into the holders according to place (hundreds, tens, ones). The ejection feature ensures that no more than nine blocks are in each place. The Counter has dials so that the digits for a number shown on the Counter can be displayed and there is also a whiteboard and pen for recording the number represented by the blocks on the Counter. A three-place Counter mat is used with the Counter for work with more than one quantity, such as two addends. This mat has room for nine blocks in each place.

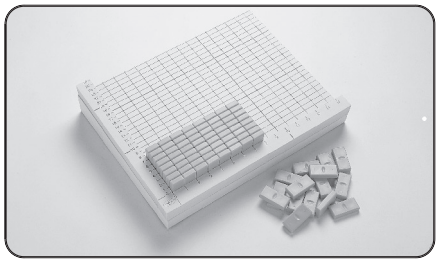
C. Place Value Mats and Digit Cards

Laminated 14" x 18" mats are used by students to organize the blocks into places. They are folded into three panels labeled hundreds, tens, and ones There is a designated area for "digit cards" at the bottom of each place. Spiral-bound cards, called "digit cards," are a set of digits 0–9 that can be used to display a digit for each place in a number while working on the place value mat.



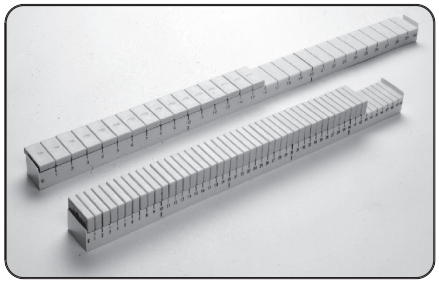
D. Array Platforms

Students use an array platform to model multiplication and division. Students place single blocks on the platform to create rectangular arrays.



E. Digi-Block Number Line

This paper strip is numbered from 0 to 1000. Students place blocks on the number line upright as they skip count and explore a linear view of numbers. These number lines are much more concrete than traditional number lines because students are counting real things—blocks—rather than the abstraction of a line or a space between lines. (Note: Paper and plastic versions of the number line are also available for purchase.)



III. What are the components of the Digi-Block Summer School Program?

A. Content Areas

1. Number Sense

In order to be successful in the third grade, students need to understand the underlying concepts of our base-ten number system. That knowledge gives them strong number sense and is the foundation upon which other mathematics concepts are built. Giving students experiences with blocks that represent powers of 10 helps them understand, in a very concrete way, the rules of our number system.

2. Addition

The understanding of how numbers are grouped into tens carries over as students use the blocks to build and combine numbers with three and four digits. By physically modeling addition with the Digi-Block materials, students can readily grasp when and how to regroup by packing and moving groups of ten blocks. Mastery of the basic addition facts is also very important. Once students have mastered the facts, they can use their facts to help them become proficient in algorithms for addition. The addition sequence helps students to transition from

blocks to drawings and finally to numerical algorithms without losing their understanding.

3. Subtraction

The sequence for subtraction is the same as for addition. However, because more students struggle with subtraction, students need to spend more time working physically with the blocks, drawing, and developing algorithms. Mastery of basic subtraction facts also helps students become proficient in the algorithms for subtraction. By physically modeling three and four-place subtraction problems with blocks, students learn when and how to regroup by unpacking blocks-of-10 and blocks-of-100.

4. Multiplication

Third graders should also understand the concept of multiplication and be acquainted with strategies for learning the basic multiplication facts. Working with groups of blocks helps students understand multiplication as combining equal groups. They learn through exploring the commutative property that they have a choice for how to model a given multiplication problem. Students learn to use the array model for multiplication to help them derive unknown facts. Students work through each of the facts from 0–9, and then they experience the power of the blocks by modeling products of 10 and 100.

5. Division

The last lesson in the book is an introductory lesson on division in which students explore the sharing model of division.

B. Student Pages

Teachers are granted peremission to reproduce student pages in this guide. To avoid the expense of photocopying individual pages, consumable student books are available.

1. Activity Pages

An activity page is included with each lesson. It is designed to accompany and reinforce the teaching lesson.

2. Practice Pages

An optional practice page is provided for each lesson. The practice page may be used in class or as homework depending on your objectives and students' needs.

3. Home Connection Letters and Home Activities

At the beginning of each unit, there is a letter for parents informing them of the topic that will be studied during the week. A home activity is included that encourages parents to work with their students at home in order to reinforce concepts learned at school.

C. Assessment

There are many assessment choices for teachers in the Digi-Block Summer Program.

1. Pre- and Post-Tests

A pre-test is available to assess incoming students' understanding of number sense, place value, addition, subtraction, and basic multiplication. The information gleaned from the test helps to determine which content strands students need the most. Because students placed in summer school enter with varying levels of understanding and skills in the content areas outlined above, certain strands or

units may need to be lengthened or shortened. The post-test mirrors the pre-test so that students' progress over the course of the summer program can be measured.

3. **Quick Checks**

   A "quick check" is provided in every lesson. It is designed as either a written problem or a question presented to the students one-on-one. These checks provide a quick, easy way to tell those students who understand the concept of the day from those who do not.

3. **Questioning**

   One of the best ways to determine a student's mathematical understanding is by asking good questions. There are many suggested questions provided, in bold type, throughout the lessons.

4. **Practice Pages**

   These pages can provide additional insight into students' level of understanding. If students need more practice in one of the content areas, additional ideas are suggested. There is also an extensive source of lessons provided on the Digi-Block website: www.digi-block.com.

5. **Teacher Observation**

   As students are working on an activity, observation of how students approach a task is encouraged. Carrying a clipboard to jot down observations about their thinking and to note the ways in which they use the materials is helpful.s

Home-School Connection

Dear Family,

In summer school, your child will be using Digi-Block materials to learn math. These materials provide a model for our number system that students can see and touch, using blocks in various sizes to represent ones, tens, hundreds, and thousands. By enabling students to model numbers and operations in a physical way, these materials help them discover mathematical ideas. During the course of the program, students will use these blocks to learn and practice important concepts such as place value, addition, subtraction, and multiplication.

During the first few days of summer school, students will explore the blocks and discover an underlying principle of our number system, grouping by tens. They will learn that 10 ones make a 10, 10 tens make a hundred and 10 hundreds make a thousand. They will learn that the value of a digit depends on the place it occupies in a number. Students will build their mathematical confidence and flexibility by exploring different ways to represent a number. For example, the number 258 can be named as 2 hundreds and 58 ones or 2 hundreds, 5 tens, and 8 ones. It also can be thought of as 25 tens and 8 ones. Students explore these ideas by building the number in different ways: 258 single blocks or 2 blocks-of-100 and 58 single blocks, and so on. The value of using Digi-Block materials is that they help students of all ability levels discover how and why numbers work the way they do.

Throughout the summer I will send letters briefly explaining the mathematics your child is learning in class. A home activity also will be included with each letter. Please work with your child on each of these activities throughout the summer. These activities will reinforce concepts your child is working on at school. I look forward to working with your child this summer in the Digi-Block Summer School Program.

Sincerely,

Home Activity #1

- Choose a 3-digit number. Example: 426.
- List all the different numbers you can make with these three digits by mixing up their order.
- After you make your list, put the numbers in order from least to greatest. Example: 246, 264, 426, 462, 624, 642
- Repeat several more times. If you want a challenge, try a number with four or more digits. Examples: 1823 and 27,981

Unit 3

Subtraction

This unit focuses on subtraction of multi-digit numbers. The sequence of lessons for subtraction is similar to the sequence for addition. However, because students tend to have more difficulty with subtraction, you may want to spend more time or days on each lesson. In the subtraction sequence, students begin by subtracting with the blocks and keeping records of their work. Next, they visualize the blocks and make a drawing of what they think will happen when they model the subtraction problem with blocks. Finally, the students use written records (paper-and-pencil methods) to predict the answer to the problem. In effect, they learn to use an algorithm for subtraction. The last lesson of the unit combines addition and subtraction as students are challenged to problem solve using either operation.

In Lesson 6 of Unit 2, students worked on their subtraction facts. You may want students to review these facts before beginning the lessons in this unit.

Lesson 10: Subtract with Base-Ten Representations

Students begin their exploration of multi-digit subtraction with 3-digit numbers. They learn to model and separate groups of blocks, unpacking (regrouping) as necessary.

Lesson 11: Subtract with Block Drawings

Students record their subtraction models with pictures and words. They show regrouping, reflect on the process, and explain their thinking. This lesson helps students begin to transition from the concrete to the symbolic.

Lesson 12: Predict and Use Written Records to Subtract

Students begin to use written records in place of drawings and blocks. They record with numbers what they think will happen when they model a subtraction problem with blocks. They use number sense to estimate the range of the answer and their written records to predict the actual answer.

Lesson 13: Predict and Use Algorithms to Subtract

Students practice predicting and recording. Their written records serve as alternative, invented algorithms. Students also model the steps in the standard, U.S. algorithm for subtraction.

Lesson 14: Problem Solving with Addition and Subtraction

This lesson combines addition and subtraction. Students rely on their experiences with the blocks as a foundation for solving problems using algorithms. They learn that certain situations may be solved with either operation and that one operation is the inverse of the other.

LESSON 11

Subtract with Block Drawings

Lesson Goal

To solve subtraction problems by drawing the blocks and predicting the difference

Materials

Teacher:	the Counter, the Counter mat, blocks, and holders
Per Group:	a place value mat, digit cards, and 4 blocks-of-100
Per Student:	3 activity pages (student book contains 3 pages), blank paper (as needed), and one practice page for Lesson 11

Overview

This lesson begins the transition from blocks to drawings to computational methods. Students are shown a problem and are asked to visualize and draw the starting number of blocks. Then, they visualize what will happen when blocks are taken away as indicated in the problem and record this step in their drawings. They look at their drawings to determine the answer. Finally, students use blocks to model the problem and to check their predictions. While solving the problem, they also record on the numbers to begin the transition to computational methods. Students who are not ready to visualize the blocks before modeling are encouraged to model first with the blocks and then draw what they see.

Introduction (25–30 min.)

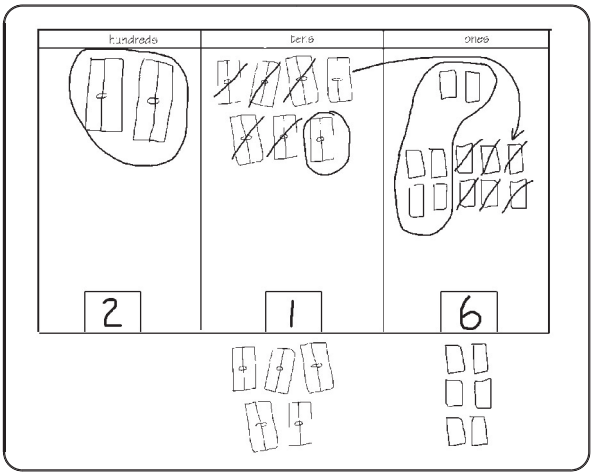
Present the problem: 272 – 56. Have students draw the starting number of blocks: 272.

Distribute the activity sheets. Begin by displaying the problem: 272 – 56.

- Have students write the problem on their activity sheets.
- Tell students to draw the starting number of blocks: 272. Students should draw 2 blocks-of-100, 7 blocks-of-10, and 2 single blocks. (Note: As in addition, make sure students realize that all they have to be able to do is determine the number of blocks from their drawings. The blocks in their drawings do not have to be perfectly shaped.)
- Place 2 blocks-of-100, 7 blocks-of-10, and 2 single blocks on a place value mat.
- Allow students to adjust their drawings as needed.

Have students show in their drawings what they think will happen when they take away 56 blocks:

- Tell them to draw what they think the blocks would look like as they take them away. (Note: If students find the visualizing and drawing difficult, model with the blocks and have students draw what they see.)
- You may want to suggest that students make their drawings in stages. For example, they can show all the single blocks, and then indicate if a block-of-10 was unpacked, making more single blocks available.
- Have students predict the answer by looking at their drawings. Make sure they record their predictions as numbers.
- Have students show and explain their drawings:
- Ask questions about students' drawings. For example:



Where are the blocks you started with?

Do you think you will have to unpack (regroup)?

How do you indicate blocks that are unpacked (regrouped) in your drawing?

Where are the blocks you took away?

Where do you show the answer in your drawing?

- You may want to take some time to discuss ways to show regrouping (unpacking). Students may want to cross off a block-of-10 and show 10 single blocks, others may draw an arrow, etc.

Take 56 blocks off the mat to check students' predictions:

Have students remove 56 blocks and discuss whether or not their results were the same with their drawings as with the blocks. ***Repeat this demonstration several times with other examples until you believe students have a good understanding of what to do:***

- Make sure you model a variety of problems, for example: 204 – 37, 362 – 142, and 209 – 84. As a challenge, you might want to try numbers in the thousands: 1004 – 386.
- For each example, have students draw the problem first, predict the difference, then check their prediction by observing the class model with the blocks.
- Have students share drawings and predictions. Allow students to comment on the elements in each other's drawings that help them understand how that person predicted the problem.
- Distribute additional activity sheets as needed.

Activity (25 min.)

When you believe students are ready, let them work in groups to solve problems using drawings and modeling with blocks. Distribute materials to each group. The activity sheets provide space for a total of six problems. For more recording space, have students use blank paper.

Suggested problems are:

333 – 245 217 – 134 307 – 209 300 – 122 240 -178

Check to be sure that students are recording the numbers in the problem as they work on their drawings. This will be important for the next lesson. Also, make sure that students check each answer with blocks.

Observe groups as they work. Focus on having them explain why they think their drawings show what will happen when they use the blocks. Also ask students to tell you how their drawings relate to the numbers they are recording. Some questions to ask might include:

- **Where is the starting number in your drawing?**
- **Do you think you will have to regroup (unpack)? Why or why not?**
- **Where is the number you take away?**
- **Can you show me in your drawing where you have to regroup?**
- **Can you show me the answer in your drawing?**
- **How does your prediction compare to the answer you found with the blocks?**

Closure (10 min.)

When you believe students are comfortable with this procedure, have the class describe how to use drawings to subtract.

- Have students compare their drawings and methods of representation.
- Encourage them to ask questions of one another in order to help them clarify their explanations.

Quick Check

Give everyone in the class a problem to predict: 246 – 183. They may use drawings and numbers to help them. Collect students' predictions. Look for major errors (rather than minor counting errors). If possible, meet with students individually and ask each student to explain his/her prediction and drawing for the problem.

Practice

Have students complete the practice page for Lesson 11. (Note: It is okay if students use addition or counting up to model problems #3 and/or #5.) Encourage students to continue drawing and making predictions before modeling with blocks. If students struggle with making drawings of the blocks before modeling, allow them to model with blocks first and draw what they see for each step.

If further practice is needed, have students continue to model problems with blocks and record their work in drawings and numbers. Use blank paper or copy the blackline master, "Draw the Blocks," from p.140 in the Appendix.

Extension

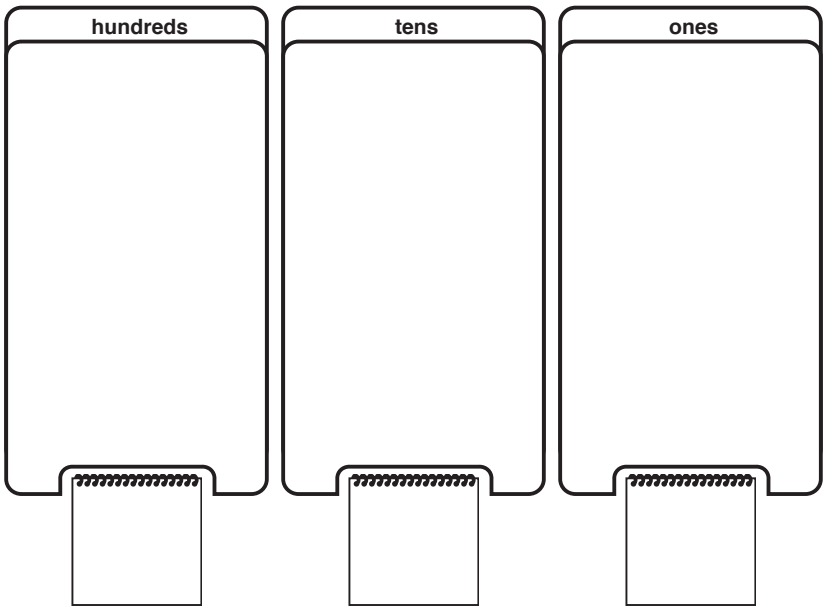
As a class, use blocks to model subtraction problems in the thousands: 1000 – 824, 2156 – 852, etc. Have students draw blocks for the problems and using the drawings to predict the answers.

Lesson 11 Activity: Draw the Blocks for Subtraction

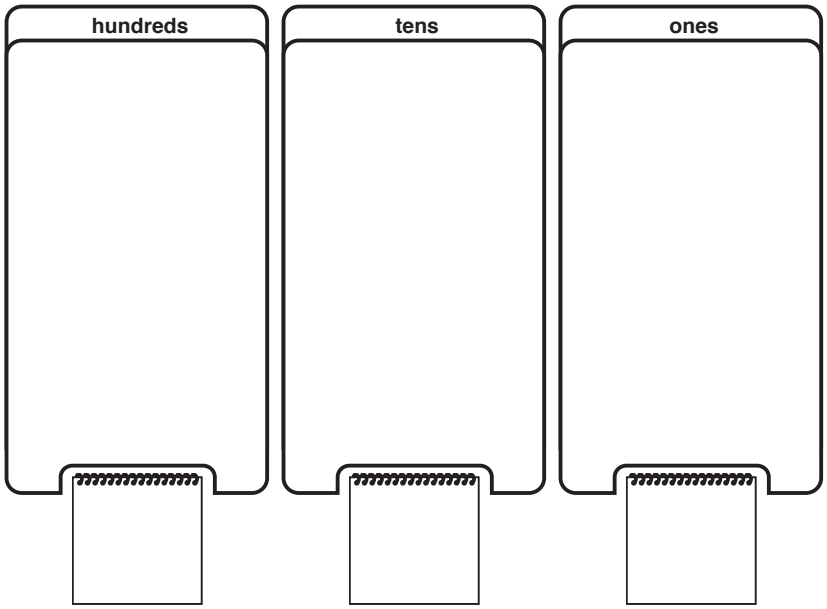
Name: _____

Directions: Write the subtraction problem. Draw the blocks for the problem. Use your drawing to predict the answer. Check your prediction with the blocks.

Problem



Problem



LESSON 11 PRACTICE

Name: _____

Use drawings of blocks to help you solve these problems.

1.
$$\begin{array}{r} 400 \\ -\ 273 \\ \hline \end{array}$$

2.
$$\begin{array}{r} 206 \\ -\ 128 \\ \hline \end{array}$$

Use drawings and words to tell how to use blocks to find the answers to these word problems.

3. This year, 282 students are at summer camp. Of those, 157 are boys. How many are girls?

4. You have 3 blocks-of-100 and 2 ones. You give away 1 block-of-100, 8 blocks-of-10, and 6 ones. How many blocks do you have left? Would you have to unpack or regroup?

5. Luke has 280 newspapers to deliver each morning. He has delivered 124 so far today. How many more newspapers does Luke have to deliver today?

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- ⊡ Addition
- ⊡ Subtraction
- ⊡ Multiplication

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