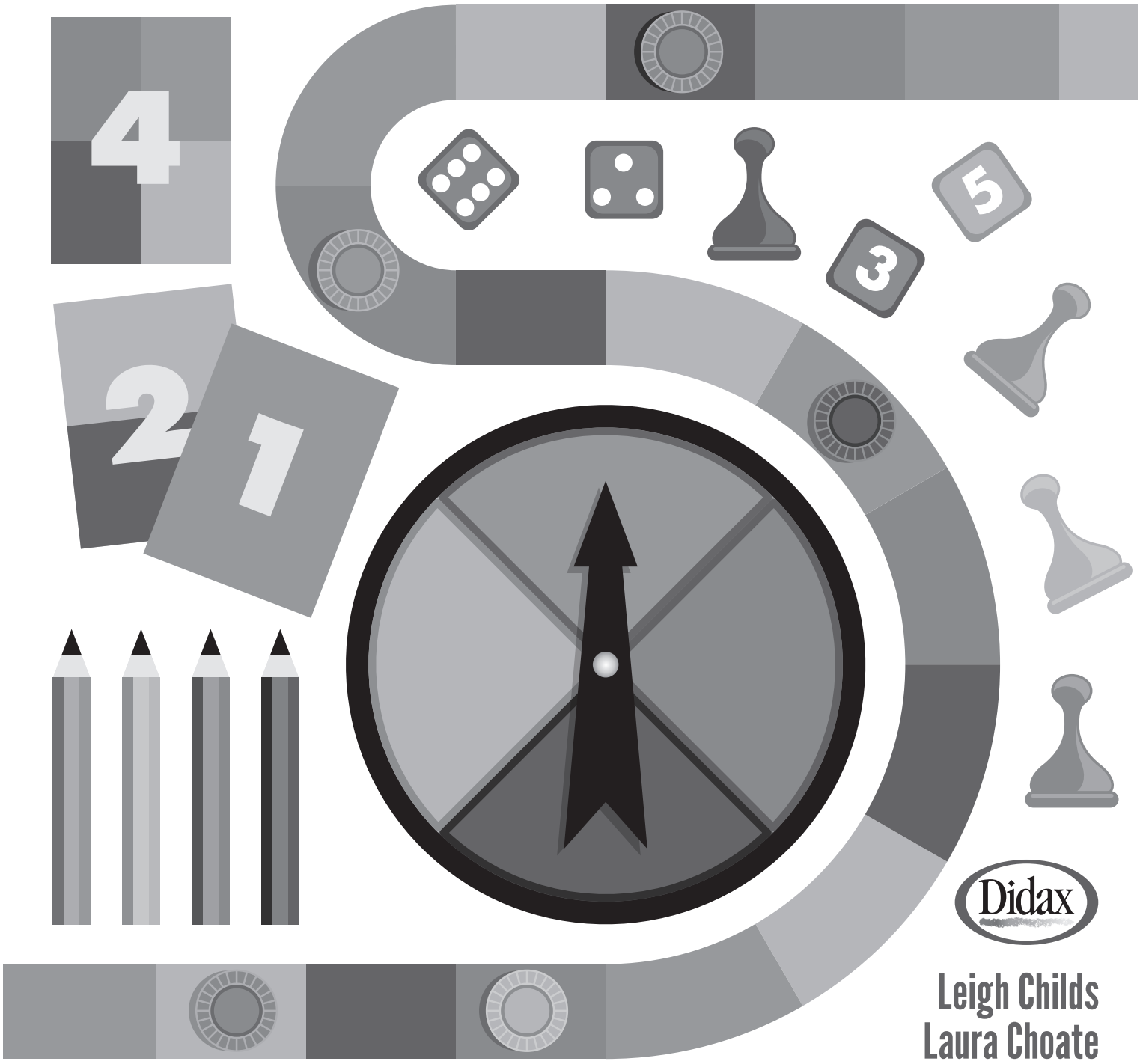
2nd Edition

Grade 3

Nimble *with* Numbers

Fluency Practice *for the* Math Standards



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Introduction

Welcome to the 2nd Edition!

Over the past ten years, thousands of teachers have enjoyed using *Nimble with Numbers* to provide engaging math experiences to their students. With this new edition we bring you expanded content, explicit connections to current mathematics standards, and more carefully planned practice activities and assessments. This book is not intended to cover every standard, but rather to further the basic number and operation sense central to all the domains of mathematics.

The bulk of the work in this book is appropriate for third-graders, but many activities will be useful to second- or fourth-graders as well. In this second edition, a concerted effort has been made to incorporate algebra readiness and to emphasize the often-neglected operation of subtraction. Also, practice with money is embedded in the computation units. Although we have linked the instruction to the content standards, we've elected to organize the book into units that provide a coherent approach to the instruction, rather than follow the sequence of the standards.

Students need a facility with number and operations to achieve success with today's mathematics programs. They are being asked to demonstrate proficiency not just in skills, but in problem solving, critical thinking, conceptual understanding, and performance tasks. Consequently, the reduced time teachers devote to number must be thoughtful, selective, and efficient.

This book meets the need for high-quality, engaging math experiences that provide meaningful practice and further the development of number sense, operation sense, and mathematical reasoning. These activities are designed to help students practice number concepts previously taught for understanding in a variety of contexts. *Nimble with Numbers:*

- provides a variety of adaptable formats for essential practice;
- supplements and enhances homework assignments;
- encourages parent involvement in improving their children's proficiencies with basic facts and computation; and
- provides motivating and meaningful lessons for a substitute teacher or student teacher.

Introduction

Activities to Create Mathematically Proficient Students

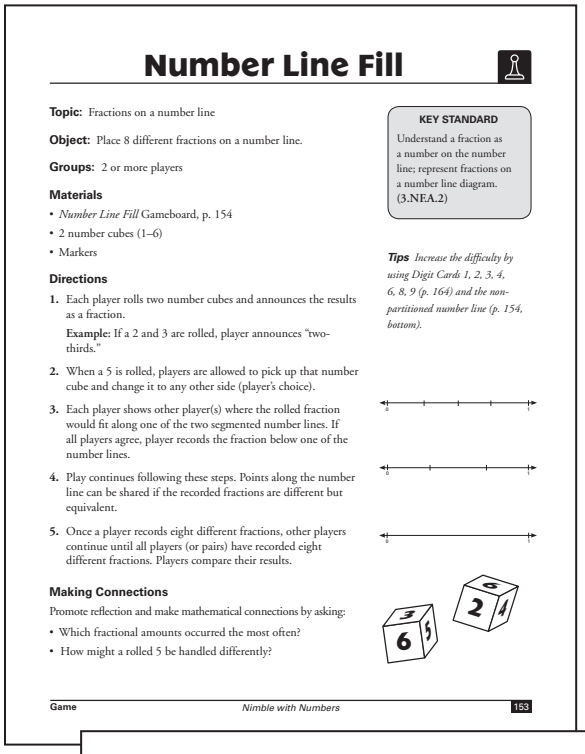
The activities in *Nimble with Numbers* are designed to use the amount of time dedicated to math efficiently. Current mathematics standards require greater focus on fewer topics, coherence from grade to grade, and rigor—that is, deep, authentic command of mathematical concepts, not making math harder or introducing topics at earlier grades. Accordingly, our criteria for selecting activities are that they be:

- Inviting (encourage participation)
- Engaging (maintain interest)
- Simple to learn
- Repeatable (able to be reused often, possibly throughout the school year)
- Open-ended, allowing multiple solutions
- Easy to prepare
- Easy to adapt for various levels
- Easy to vary for extended use

The basic design of the program is very much in keeping with current mathematical practice standards. The activities:

- Require a problem-solving approach
- Improve basic skills
- Enhance number sense and operation sense
- Encourage strategic thinking
- Promote mathematical communication
- Promote positive attitudes toward mathematics as mathematical abilities improve

Here's an interesting Game from the Fractions unit:



Number Line Fill

Topic: Fractions on a number line

Object: Place 8 different fractions on a number line.

Groups: 2 or more players

Materials

- *Number Line Fill* Gameboard, p. 154
- 2 number cubes (1–6)
- Markers

Directions

1. Each player rolls two number cubes and announces the results as a fraction.
   Example: If a 2 and 3 are rolled, player announces "two-thirds."
2. When a 5 is rolled, players are allowed to pick up that number cube and change it to any other side (player's choice).
3. Each player shows other player(s) where the rolled fraction would fit along one of the two segmented number lines. If all players agree, player records the fraction below one of the number lines.
4. Play continues following these steps. Points along the number line can be shared if the recorded fractions are different but equivalent.
5. Once a player records eight different fractions, other players continue until all players (or pairs) have recorded eight different fractions. Players compare their results.

Making Connections

Promote reflection and make mathematical connections by asking:

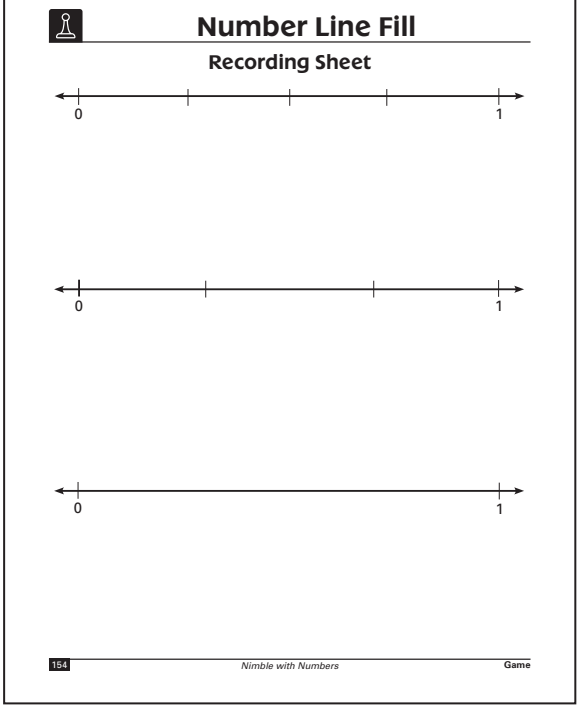
- Which fractional amounts occurred the most often?
- How might a rolled 5 be handled differently?

KEY STANDARD

Understand a fraction as a number on the number line; represent fractions on a number line diagram. (3.NF.A.2)

Tips *Increase the difficulty by using Digit Cards 1, 2, 3, 4, 6, 8, 9 (p. 164) and the non-partitioned number line (p. 154, bottom).*

Game — *Nimble with Numbers* — 153



Number Line Fill

Recording Sheet

0 1

0 1

0 1

154 — *Nimble with Numbers* — Game

Introduction

Organization of the Book

This book has seven units that cover the high-priority number topics for third-graders and many fourth-graders as well. In our teaching, we find some third- and fourth-graders who have yet to master the addition and subtraction facts. Consequently, the first section (Subtraction and Addition Facts) provides practice for those facts.

The book contains activities for whole groups, small groups, pairs, and individuals. Each unit begins with an overview and suggestions to highlight the activities and provide some time-saving advice. Throughout all units, we make an obvious attempt to promote mental computation. Each unit includes:

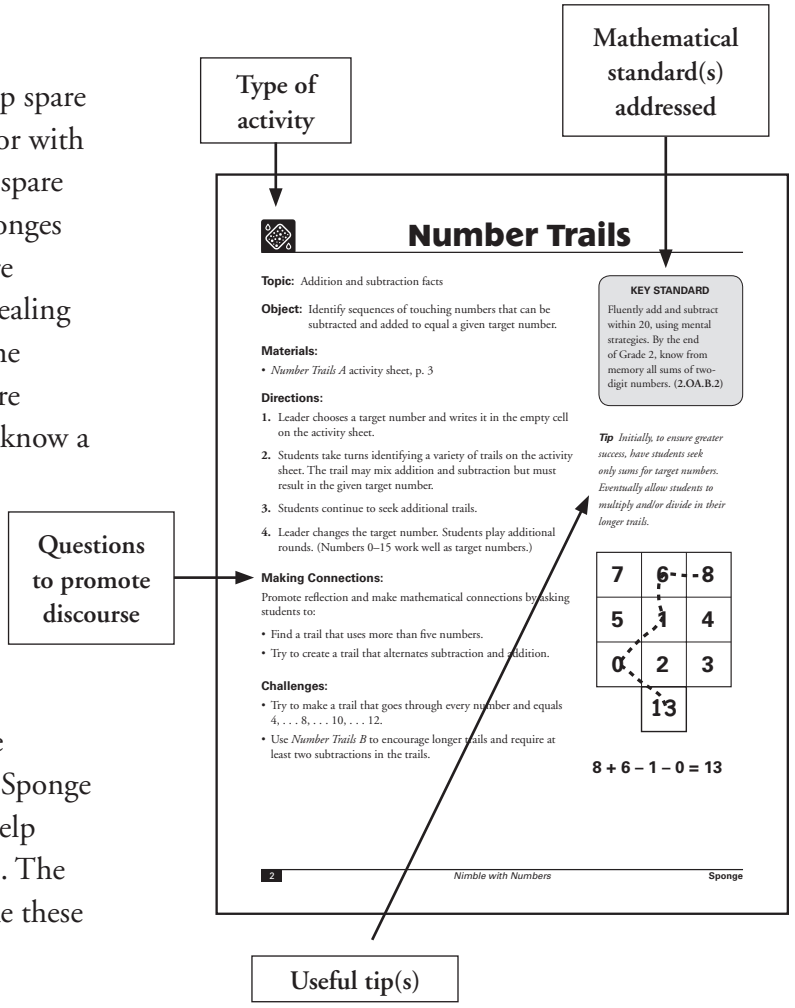
Sponges (S)	Mini-Assessments (A)
Games (G)	Independent Activities (I)

Sponges

Sponges are enriching activities for soaking up spare moments. Use Sponges with the whole class or with small groups as warm-up activities or during spare time to provide additional math practice. Sponges usually require little or no preparation and are short in duration (3–15 minutes). These appealing activities are repeatable, and once they become familiar, some can be student-led. Students are motivated to finish a task quickly when they know a favorite Sponge will follow.

Key content standards are listed for Sponges, but the instruction provided may cover other standards as well.

Features of the Sponges and Games follow. The Making Connections questions promote reflection and discourse. To capitalize on the Sponge or Game experience, use these questions to help students make the mathematical connections. The time-saving, useful Tips provide ways to make these activities accessible to more students.



Introduction

Mini-Assessments

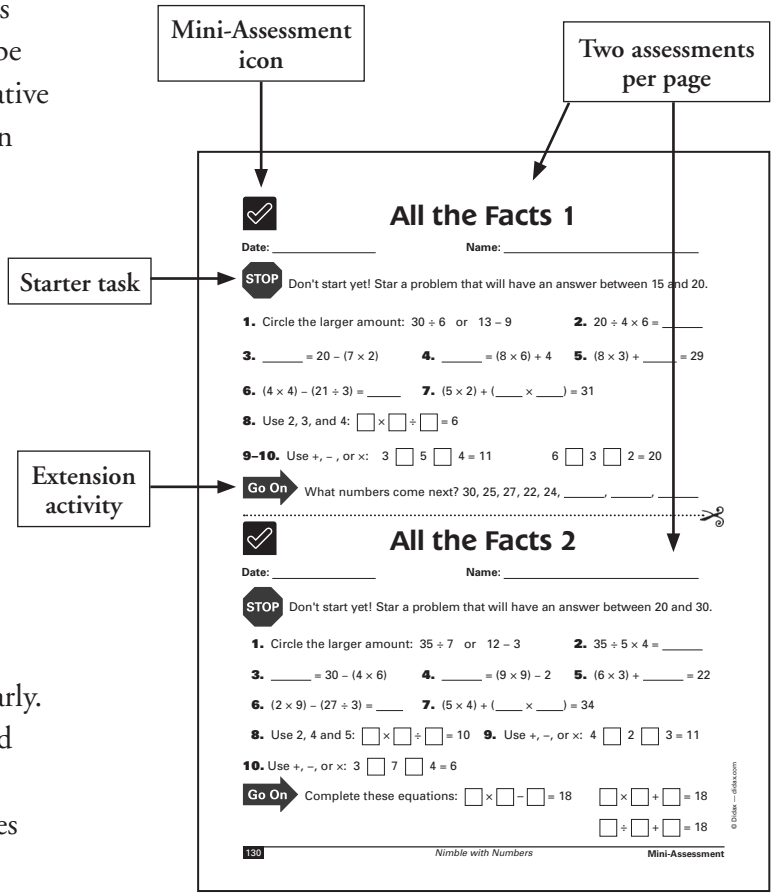
The six Mini-Assessments in each section provide a way to show students' improvement to parents, as well as to the students. Each page is designed to be duplicated and cut in half, providing six comparative records for each student. Before answering the ten problems in each assessment, students should respond to the starter task following the STOP sign. These starter tasks mentally prepare students for sense-making and greater success.

Most students will complete an assessment in 10 to 15 minutes. Some teachers believe their students perform better on the assessments if the responses to the STOP task are shared and discussed first.

The concluding extension problem, labeled "Go On," accommodates those students who finish early. We recommend that early finishers be encouraged to create similar problems for others to solve. By having students share and discuss their approaches and responses to the STOP task and to some of the problems, teachers help students discover more efficient mental computation strategies.

These Mini-Assessments can help teachers determine whether further review of a concept is needed by the entire class or by an identified smaller group of students, determine which concepts are confusing to some students (e.g., identifying fractions on a number line), and identify which students require practicing the topic for a longer period of time.

Here is a sample page from the *Just the Facts* Mini-Assessment in the Subtraction and Addition Facts unit:



Games

Initially a new Game might be modeled with the entire class, even though Games are intended to be played by small groups or pair players after the rules are understood. ("Pair players" refers to a pair of students playing against another pair. This recommended arrangement promotes mathematical thinking and discourse as students collaborate to develop and share successful strategies.) Some games include easy versions as well as more challenging versions.

Introduction

The CD that is included with the book will enable the teacher to present many of the games to the whole class on the interactive whiteboard or using a computer and projector. Virtual manipulatives are provided that can be dragged onto the game boards to clearly illustrate game play.

An excellent option is to share the Game with a few students who then teach the Game to others. The teacher may provide some procedure for selecting the first player and may suggest that players take turns in a clockwise direction. Most Games require approximately 20 to 45 minutes of playing time. Games are ideal for home use because they provide students with additional practice and reassure parents that the number strand continues to be valued. When sending gameboards home, be sure to include the directions.

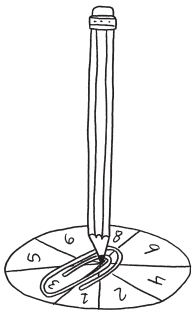
Independent Activities

These sheets are designed to encourage practice of many more facts and computation than would seem apparent at first glance. WARNING: Not all of these sheets can be solved in a class period, as many require mental computation and mathematical sense-making. For some Independent Activities, you might assign only half a sheet, then provide feedback before students complete the entire sheet. Some Independent Activity sheets allow multiple solutions and many have built-in feedback. Some sheets encourage students to create similar puzzles for classmates to solve, providing additional practice and student recognition. When deemed helpful, an open-ended blackline master is included to facilitate this possibility. Independent Activity sheets also work as homework.

Suggestions for Using *Nimble with Numbers*

Materials

An effort has been made to minimize the materials needed. When appropriate, blackline masters are provided. The last section of the book contains more generic types of blackline masters, including patterns for spinners. A six-sectioned spinner can substitute for a number cube or die. A simple spinner, like the one shown, can be assembled using one of the blackline master spinner bases, a paper clip, and a pencil.



A number of activities require two sets of Digit Cards (blackline master, p. 164). Take time now to duplicate two sets on card stock (or substitute sets of 0–9 tiles). Cut the Digit Cards apart, place them in an appropriate container (plastic bag, coffee can, or margarine tub), and store in a handy place. Play money may be used for activities, although real coins may be more motivating.

Various materials work as markers on gameboards—different types of beans, multicolored cubes, buttons, or transparent color counters (our preference due to the see-through feature). It is assumed that students have access to scratch paper and pencils, especially when a recording sheet is used. It is assumed that a document camera is available, although a whiteboard will also work.

Introduction

Recommended Uses

The repeatable nature of these activities makes them ideal for additional use at home. Encouraging children to use these activities at home serves a dual purpose: parents are able to assist their children in gaining competence with the facts and with mental computation, and parents are reassured as they see the familiar basics practiced. Students will become competent and confident as they experience these activities frequently and over time. To support your work in this area, we have included a family letter and a list of helpful open-ended questions for parents to pose.

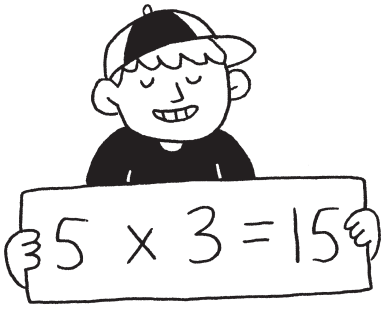
Besides being a source for more familiar homework, these activities offer a wide variety of classroom uses. The activities can be effectively used by substitute teachers as rainy-day options, for a change of pace, or for "Family Math" events.

Many activities are short-term and require little or no preparation, making them ideal for soaking up spare moments at the end or beginning of a class period. They also work well as choices for center activities. When students are absent from school, these activities can be sent home in independent work packets. You may package these activities in manila envelopes or self-closing transparent bags to facilitate frequent and easy checkout.

Feel free to modify the activities and/or change the rules. To accommodate the needs of your students, you might change the numbers, operations, and/or directions.

Getting the Most from These Activities

It is important to focus on increasing students' awareness of the mathematics being learned. To do this, pose open-ended questions that promote reflection, communication, and mathematical connections. For example, after using *Factors Pathway* (pp. 109–14), one teacher asked her students, "What mathematics are you doing?" Her third-graders identified multiplication facts, repeated addition, finding factors, division, and algebra ("finding unknowns"). After using *Possible Equations* (pp. 17–18), the teacher asked her students to estimate the total number of facts they had practiced. The range of responses was great. The next day, a student completed another *Possible Equations* task and reported having considered and tallied 30 facts while seeking multiple solutions for the first equation!



Having students work together as pair players is of great value in increasing student confidence. While working this way, students have more opportunities to communicate strategies and to explain their thinking. When asked to identify and to share their successful Game strategies verbally and in writing, students grow mathematically. It is worthwhile to ask students to improve these activities or to create new high-interest games.

Introduction

Good questions help children make sense of mathematics, build their confidence, and encourage mathematical thinking and communication. The sample questions we have included on page *xiii* are designed to help teachers and parents see where students are relative to key mathematical practice standards. Because the teacher's or parent's response impacts learning, we have included suggestions for responding. Share this list with parents for their use as they assist their children with these activities and with other unfamiliar homework tasks.

Concluding Thought

We hope that by using these materials, your students will develop more positive feelings toward mathematics as they become mathematically confident and numerically nimble.

Parent Support

Most parents place high priority on attention to the basic facts. Thus, parents will appreciate the inviting and repeatable activities in this book. Because most parents share the responsibility for short periods of practice, the following items are designed to promote parent involvement:

– **Addition and Multiplication Facts Made Easy** (pp. *xiv–xv*) are simple but effective approaches for parents to help their children minimize the task of memorizing all the facts;

– **Good Questions** (p. *xiii*) give parents a framework to interact with and guide their children in persevering in problem solving and thinking about math, while demonstrating their involvement and commitment;

– **The Family Letter** (p. *xii*) is a sample to help you easily involve parents. The letter may be modified to fit your situation.

Over the course of the year, a number of packets may be sent home to parents. The first might include the *Family Letter, Good Questions, Addition Facts Made Easy,* and the *Place Value Paths* activity (pp. 30–31) with the appropriate materials. A future home packet might include *Multiplication Facts Made Easy* and *Four in a Row* (pp. 106–107).

Sponge and Independent Activity sheets can be sent home as packets as well. Their advantage is that, unlike Games, they can be used while a monitoring family member prepares dinner, packs lunches, or attends to other household tasks.

Family Letter

Dear Family,

Today the working world requires an understanding of all areas of mathematics, including statistics, logic, geometry, and probability. To be successful in these areas, students must know their basic facts and be able to compute. It is important that we be more efficient and effective in the time we devote to arithmetic. You can help your child in this area!

Throughout the school year, our mathematics program will focus on enhancing your child's understanding of number concepts. However, students must devote time at school and at home to practice and to improve these skills. Periodically, I will send home activities and related worksheets that will build number sense and provide much-needed practice. These games and activities have been carefully selected to engage your child in practicing more math facts than are usually answered on a typical page of drill or during a flash card session.

By using the enclosed *Good Questions* during homework sessions, you can help your child without revealing the answers. The questions are categorized to help you select the most appropriate questions for your situation. If your child is having difficulty getting started with a homework assignment, try one of the questions in the first section. If your child gets stuck while completing a task, ask one of the questions from the second section. Try asking one of the questions from the third and fourth sections to have your child clarify his or her mathematical thinking.

Good Questions will help your child make sense of the mathematics, build confidence, and improve mathematical thinking and communication. I recommend posting the Questions in a convenient place so you can refer to it often while helping your child with homework.

Your participation in this crucial area is most welcome!

Sincerely,

Good Questions

Getting Started

How might you begin?

What do you know now?

What do you need to find out?

While Working

How can you organize your information?

How can you make a drawing (model) to explain your thinking?

What approach (strategy) are you developing to solve this?

What other possibilities are there?

What would happen if . . . ?

What do you need to do next?

What assumptions are you making?

What patterns do you see? . . . What relationships?

What prediction can you make?

Why did you . . . ?

Checking Your Solutions

How did you arrive at your answer?

Why do you think your solution is reasonable?

What did you try that didn't work?

How can you convince me that your solution makes sense?

Expanding the Response

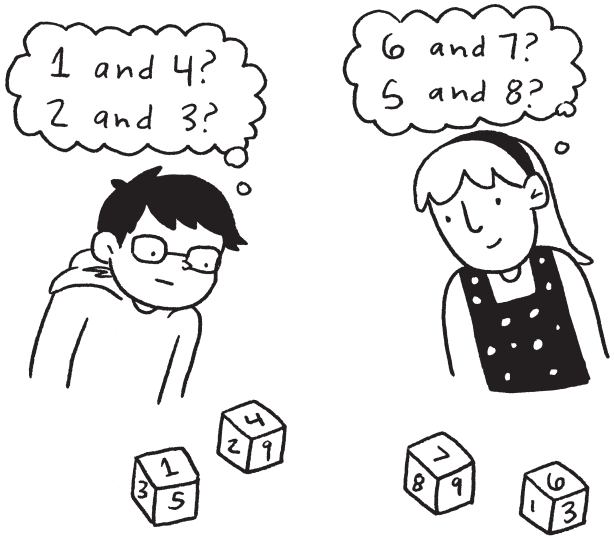
(To help clarify your child's thinking, avoid stopping when you hear the "right" answer and avoid correcting the "wrong" answer. Instead, respond with one of the following.)

Why do you think that?

Tell me more.

In what other way might you do that? What other possibilities are there?

How can you convince me?



Number Trails

Topic: Addition and subtraction facts

Object: Identify sequences of touching numbers that can be subtracted and added to equal a given target number.

Materials:

- *Number Trails A* activity sheet, p. 3

Directions:

1. Leader chooses a target number and writes it in the empty cell on the activity sheet.
2. Students take turns identifying a variety of trails on the activity sheet. The trail may mix addition and subtraction but must result in the given target number.
3. Students continue to seek additional trails.
4. Leader changes the target number. Students play additional rounds. (Numbers 0–15 work well as target numbers.)

Making Connections:

Promote reflection and make mathematical connections by asking students to:

- Find a trail that uses more than five numbers.
- Try to create a trail that alternates subtraction and addition.

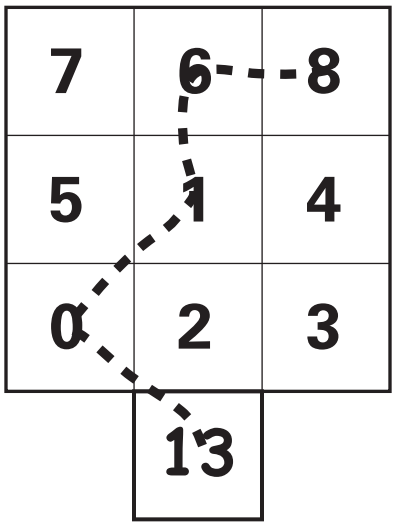
Challenges:

- Try to make a trail that goes through every number and equals 4, . . . 8, . . . 10, . . . 12.
- Use *Number Trails B* to encourage longer trails and require at least two subtractions in the trails.

KEY STANDARD

Fluently add and subtract within 20, using mental strategies. By the end of Grade 2, know from memory all sums of two-digit numbers. (**2.OA.B.2**)

Tip *Initially, to ensure greater success, have students seek only sums for target numbers. Eventually allow students to multiply and/or divide in their longer trails.*



8 + 6 – 1 – 0 = 13

Number Trails A

7	6	8
5	1	4
0	2	3

Number Trails B

8	6	7	9
4	7	5	6
5	0	3	4
3	2	1	0

Just the Facts 1

Date: _____ **Name:** _____

STOP Don't start yet. Star any problem that may have an odd number answer.

1. 9 + 7 = _____

2. 8 + 6 = _____

3.
$$\begin{array}{r} 4 \\ 5 \\ +\ 7 \\ \hline \end{array}$$

4.
$$\begin{array}{r} 3 \\ 7 \\ 8 \\ +\ 2 \\ \hline \end{array}$$

5. _____ = 13 – 5

6.
$$\begin{array}{r} 14 \\ -\ 7 \\ \hline \end{array}$$

7. 15 – 6 + 3 = _____

8. (12 – 6) + (13 – 8) = _____

9. _____ = 12 – 4 + 3

10. (9 – 4) + (11 – 8) = _____

Go On What number is missing? 19, 16, 13, _____ , 7, 4. Describe your rule.

Just the Facts 2

Date: _____ **Name:** _____

STOP Don't start yet. Star a problem that may have one of the largest answers.

1. 8 + 8 = _____

2. 6 + 9 = _____

3.
$$\begin{array}{r} 7 \\ 6 \\ +\ 2 \\ \hline \end{array}$$

4.
$$\begin{array}{r} 4 \\ 6 \\ 5 \\ +\ 3 \\ \hline \end{array}$$

5. _____ = 12 – 9

6.
$$\begin{array}{r} 15 \\ -\ 8 \\ \hline \end{array}$$

7. 14 – 8 + 5 = _____

8. (11 – 4) + (12 – 9) = _____

9. _____ = 12 – 6 + 4

10. (13 – 7) + (10 – 6) = _____

Go On The answer is 11. Write 3 facts that fit this rule.

Just the Facts 3

Date: _____ **Name:** _____

STOP Don't start yet. Star a problem that may have one of the smallest answers.

1. 9 + 6 = _____

2. 8 + 7 = _____

3.
$$\begin{array}{r} 6 \\ 3 \\ +\ 5 \\ \hline \end{array}$$

4.
$$\begin{array}{r} 3 \\ 5 \\ 7 \\ +\ 2 \\ \hline \end{array}$$

5. _____ = 14 – 7

6.
$$\begin{array}{r} 17 \\ -\ 9 \\ \hline \end{array}$$

7. 12 – 4 + 5 = _____

8. (11 – 5) + (14 – 7) = _____

9. _____ = 13 – 5 + 6

10. (12 – 8) + (11 – 6) = _____

Go On What are the next numbers in this pattern? 3, 7, 11, _____ , _____
Describe the pattern.

Just the Facts 4

Date: _____ **Name:** _____

STOP Don't start yet. Star any problem that may have an even number answer.

1. 5 + 8 = _____

2. 9 + 8 = _____

3.
$$\begin{array}{r} 4 \\ 7 \\ +\ 6 \\ \hline \end{array}$$

4.
$$\begin{array}{r} 5 \\ 4 \\ 3 \\ +\ 6 \\ \hline \end{array}$$

5. _____ = 12 – 5

6.
$$\begin{array}{r} 13 \\ -\ 7 \\ \hline \end{array}$$

7. 13 – 5 + 4 = _____

8. (13 – 6) + (11 – 7) = _____

9. _____ = 11 – 5 + 3

10. (11 – 9) + (13 – 9) = _____

Go On What other number fits in this group?
Explain your answer.

	13	
17		**15**

Just the Facts 5

Date: _____ **Name:** _____

STOP Don't start yet. Star a problem that may have an answer less than 8.

1. 9 + 5 = _____

2. 7 + 7 = _____

3.
$$\begin{array}{r} 5 \\ 3 \\ +\ 7 \end{array}$$

4.
$$\begin{array}{r} 9 \\ 4 \\ 1 \\ +\ 3 \end{array}$$

5. _____ = 15 – 9

6.
$$\begin{array}{r} 13 \\ -\ 9 \end{array}$$

7. 14 – 5 + 3 = _____

8. (13 – 8) + (11 – 7) = _____

9. _____ = 15 – 9 + 3

10. (12 – 7) + (9 – 7) = _____

Go On What's next in this pattern? 1, 3, 8, 10, 15, _____ , _____
Describe the pattern.

Just the Facts 6

Date: _____ **Name:** _____

STOP Don't start yet. Star a problem that may have one of the largest answers.

1. 9 + 9 = _____

2. 7 + 6 = _____

3.
$$\begin{array}{r} 3 \\ 9 \\ +\ 6 \end{array}$$

4.
$$\begin{array}{r} 7 \\ 4 \\ 3 \\ +\ 5 \end{array}$$

5. _____ = 14 – 8

6.
$$\begin{array}{r} 16 \\ -\ 7 \end{array}$$

7. 17 – 9 + 2 = _____

8. (4 + 8) – (11 – 5) = _____

9. _____ = 11 – 7 + 5

10. (9 – 5) + (13 – 5) = _____

Go On What number is missing? 20, 16, 12, _____ , 4. Describe your rule.

Matching Sums

Topic: Addition facts

Object: Create matching sums.

Groups: Whole class as pair players or small group

Materials for each group:

- *Matching Sums* Recording Sheet, p. 10
- Number cube (1–6)
- Calculator (for determining score)

Directions

1. Leader rolls the number cube and calls out the number rolled.
2. Each pair writes the number in one of the nine cells on the recording sheet. Once a number is recorded, it cannot be changed.
3. Leader continues rolling the number cube, and pairs enter the rolled number in the same nine-cell grid.
4. After nine numbers have been called and recorded, pairs add their numbers and write the sums in the circles adjacent to each row, column, and diagonal. Each pair should have eight sums.
5. Sums that have no matches are eliminated (crossed out). Only matching sums are totaled to determine each pair's score. (Access to calculators seems appropriate.)
6. The pairs with the highest totals are the winners.

Making Connections

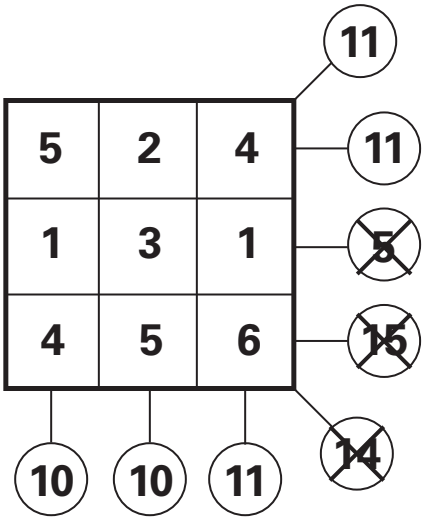
Promote reflection and make mathematical connections by asking:

- What strategy helped you make matches?
- When you play this again, what will you do differently?

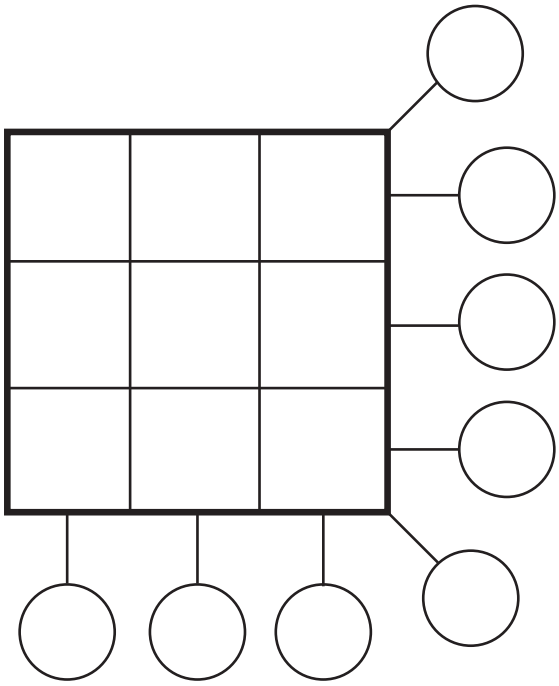
KEY STANDARD

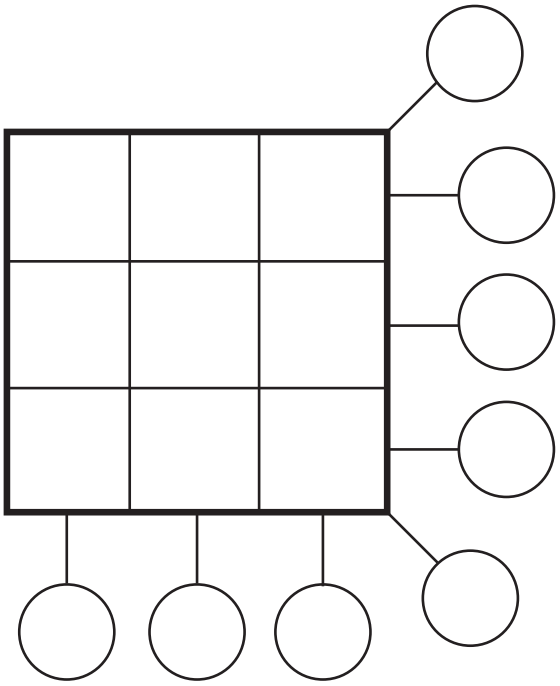
Fluently add and subtract within 20, using mental strategies. By end of Grade 2, know from memory all sums of two-digit numbers. (**2.OA.B.2**)

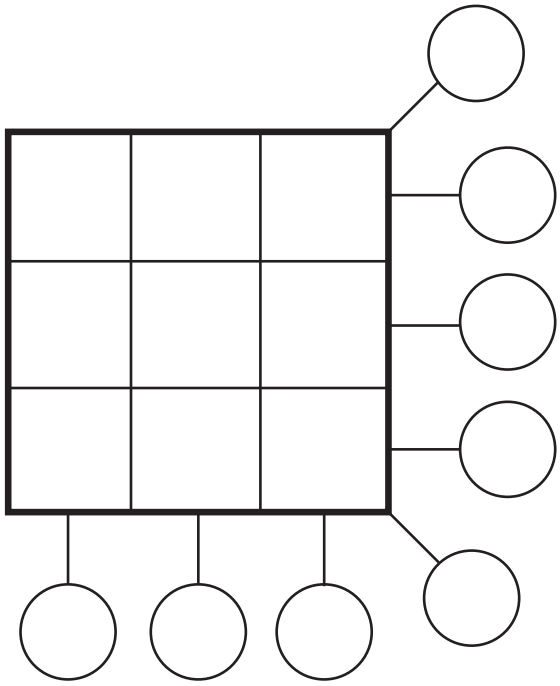
Tip *As students gain competence, use Digit Cards 1–9 or a 4–9 number cube to identify the number for each cell.*

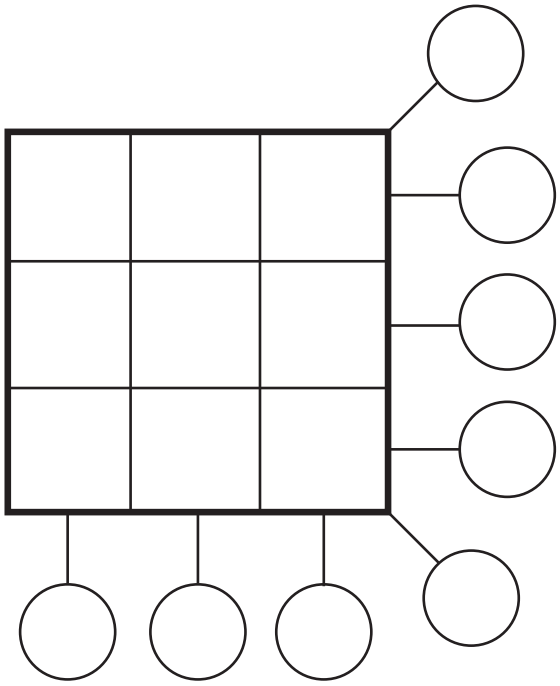


Matching Sums



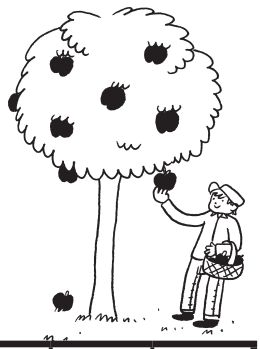






What's Left? A

Date _____ **Name** _____



To find what's left, cross out the answer to each clue in the grid at the right.

1. It's not **10 – 2** or **11 – 5**.
It's not **12 – 3** or **10 – 7**.
It's not **7 – 2** or **8 – 4**.
It's not an odd number.

What's left? _____

2. It's not **10 – 8** or **11 – 7**.
It's not **11 – 2** or **6 – 5**.
It's not **9 – 3** or **12 – 5**.
It's not greater than 4.

What's left? _____

3. It's not **10 – 4** or **12 – 9**.
It's not **11 – 3** or **8 – 7**.
It's not **8 – 3** or **12 – 3**.
It's not an even number.

What's left? _____

9	8	7
6	5	4
3	2	1

9	8	7
6	5	4
3	2	1

9	8	7
6	5	4
3	2	1

Trivia: The number left in Puzzle #3 equals the number of bones in a giraffe's neck.

What's Left? B

Date _____ **Name** _____

To find what's left, cross out the answer to each clue in the grid at the right.

1. It's not **11 – 7** or **13 – 8**.
It's not **12 – 9** or **13 – 7**.
It's not **11 – 4** or **8 – 7**.
It's not an even number.

What's left? _____

9	8	7
6	5	4
3	2	1

2. It's not **12 – 8** or **15 – 5**.
It's not **14 – 8** or **12 – 3**.
It's not **14 – 7** or **12 – 4**.
It's not an odd number.

What's left? _____

12	11	10
9	8	7
6	5	4

3. It's not **12 – 5** or **11 – 9**.
It's not **13 – 9** or **11 – 3**.
It's not **11 – 5** or **15 – 6**.
It's not an odd number.

What's left? _____

10	9	8
7	6	5
4	3	2

Trivia: The number left in Puzzle #3 equals the number of legs on a lobster.

What's Left? C

Date _____ **Name** _____

To find what's left, cross out the answer to each clue in the grid at the right.

1. It's not **12 – 6** or **9 – 6**.
It's not **8 – 3** or **10 – 8**.
It's not **11 – 2** or **9 – 5**.
It's not an odd number.

What's left? _____

9	**8**	**7**
6	**5**	**4**
3	**2**	**1**

2. It's not **14 – 7** or **12 – 3**.
It's not **15 – 9** or **16 – 8**.
It's not **11 – 9** or **12 – 8**.
It's not less than 4.

What's left? _____

9	**8**	**7**
6	**5**	**4**
3	**2**	**1**

3. It's not **15 – 6** or **11 – 8**.
It's not **12 – 4** or **13 – 7**.
It's not **14 – 9** or **17 – 16**.
It's not an even number.

What's left? _____

9	**8**	**7**
6	**5**	**4**
3	**2**	**1**

Trivia: The number left in Puzzle #3 equals the number of months with 31 days.