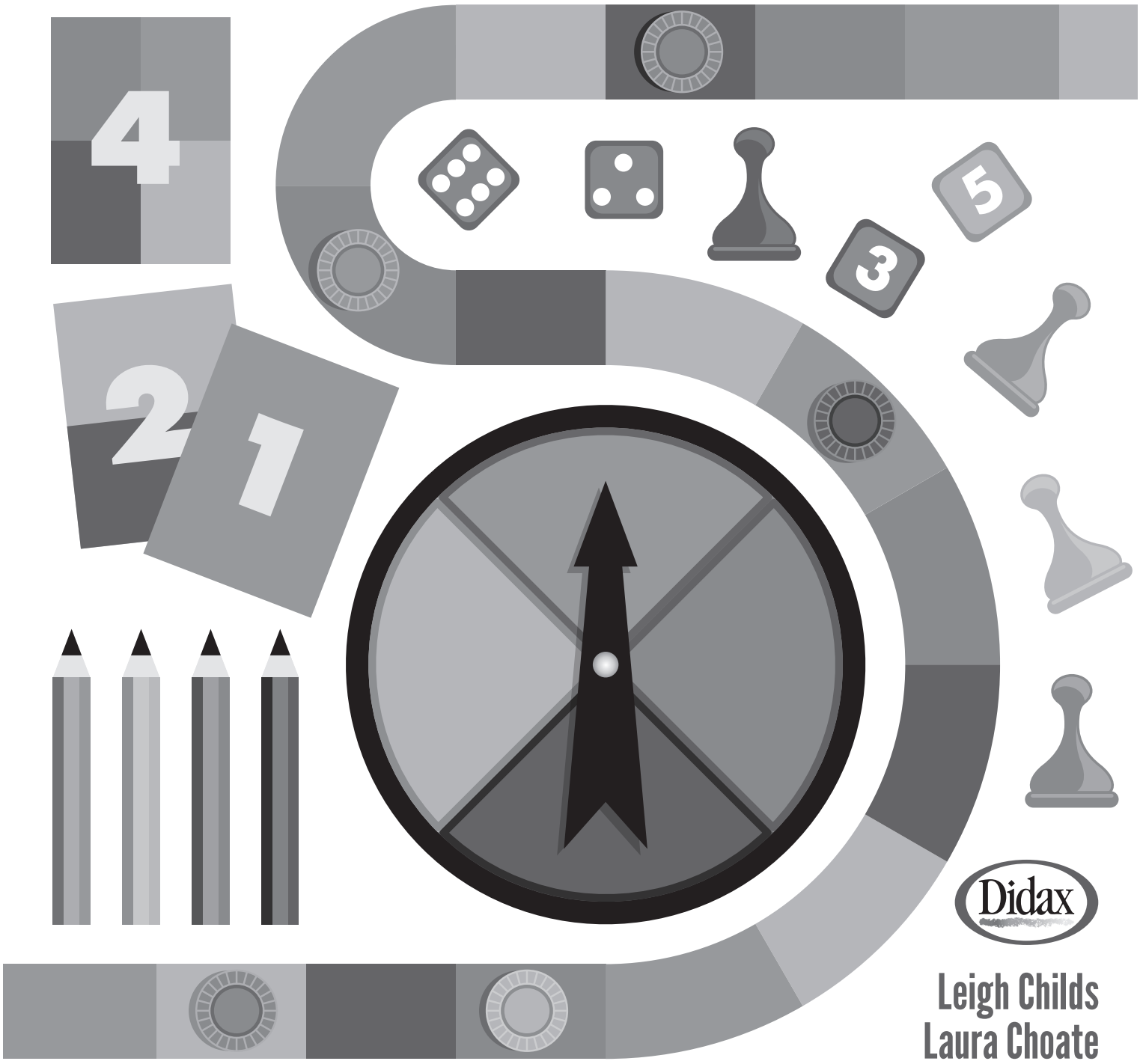
2nd Edition

Grade 4

Nimble *with* Numbers

Fluency Practice *for the* Math Standards



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Introduction

Welcome to the 2nd Edition!

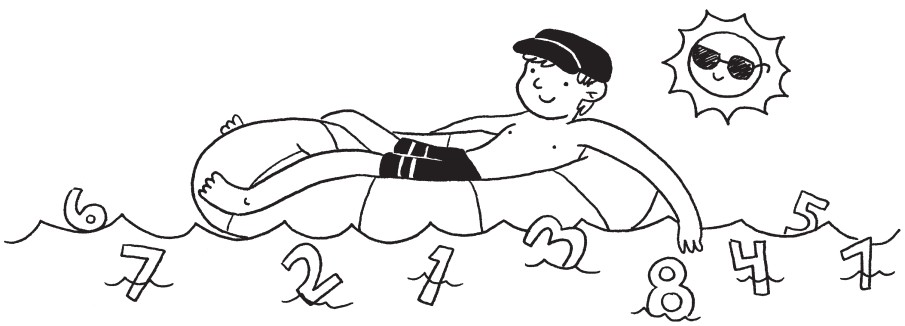
Over the past ten years, thousands of teachers have enjoyed using *Nimble with Numbers* to provide engaging math experiences to their students. With this new edition we bring you expanded content, explicit connections to current mathematics standards, and more carefully planned practice activities and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

The bulk of the work in this book is appropriate for fourth-graders, but many activities will be useful to third- or fifth-graders as well. In this second edition, a concerted effort has been made to incorporate algebra readiness, along with continued emphasis on subtraction practice. 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 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

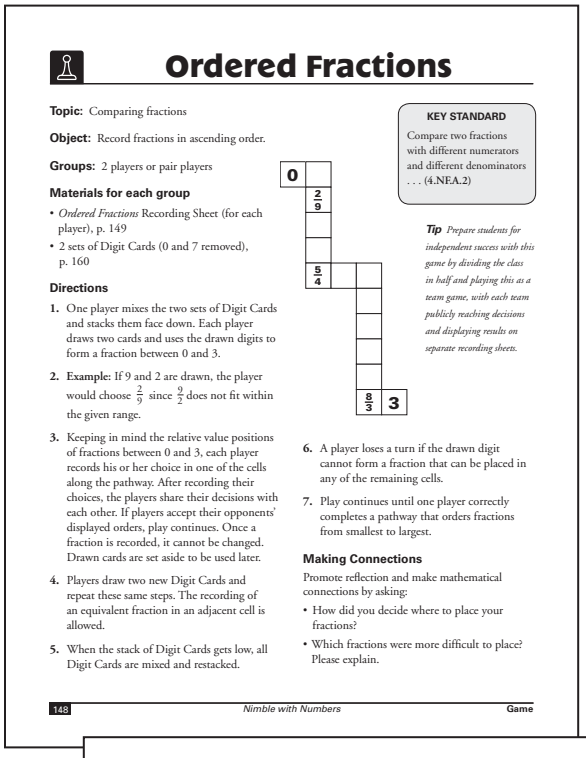
The activities in *Nimble with Numbers* are designed to use the amount of time dedicated to math efficiently. Current mathematics standards require greater focus on fewer topics, coherence from grade to grade, and rigor—that is, deep, authentic command of mathematical concepts, not making math harder 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 is an interesting Game from the Fractions unit:



Ordered Fractions

Topic: Comparing fractions

Object: Record fractions in ascending order.

Groups: 2 players or pair players

Materials for each group

- *Ordered Fractions* Recording Sheet (for each player), p. 149
- 2 sets of Digit Cards (0 and 7 removed), p. 160

Directions

1. One player mixes the two sets of Digit Cards and stacks them face down. Each player draws two cards and uses the drawn digits to form a fraction between 0 and 3.
2. **Example:** If 9 and 2 are drawn, the player would choose $\frac{2}{9}$ since $\frac{9}{2}$ does not fit within the given range.
3. Keeping in mind the relative value positions of fractions between 0 and 3, each player records his or her choice in one of the cells along the pathway. After recording their choices, the players share their decisions with each other. If players accept their opponents' displayed orders, play continues. Once a fraction is recorded, it cannot be changed. Drawn cards are set aside to be used later.
4. Players draw two new Digit Cards and repeat these same steps. The recording of an equivalent fraction in an adjacent cell is allowed.
5. When the stack of Digit Cards gets low, all Digit Cards are mixed and restacked.
6. A player loses a turn if the drawn digit cannot form a fraction that can be placed in any of the remaining cells.
7. Play continues until one player correctly completes a pathway that orders fractions from smallest to largest.

KEY STANDARD

Compare two fractions with different numerators and different denominators . . . (4.NF.A.2)

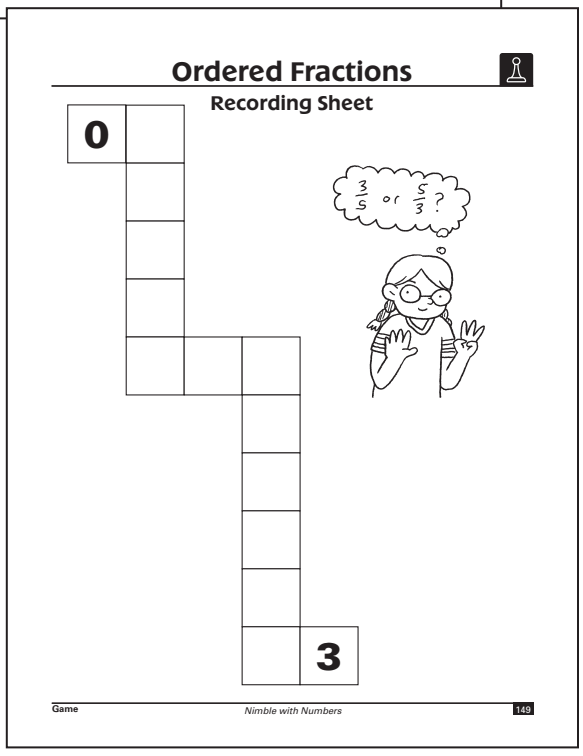
Tip *Prepare students for independent success with this game by dividing the class in half and playing this as a team game, with each team publicly reaching decisions and displaying results on separate recording sheets.*

Making Connections

Promote reflection and make mathematical connections by asking:

- How did you decide where to place your fractions?
- Which fractions were more difficult to place? Please explain.

148 *Nimble with Numbers* Game



Ordered Fractions

Recording Sheet

Game *Nimble with Numbers* 149

Introduction

Organization of the Book

This book has six units that cover the high-priority number topics for fourth-graders, and many fifth-graders as well. In our teaching, we find some fourth- and fifth-graders who have yet to fully master the basic facts. Consequently, the first section (Mixed Facts) provides practice with all four operations.

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:

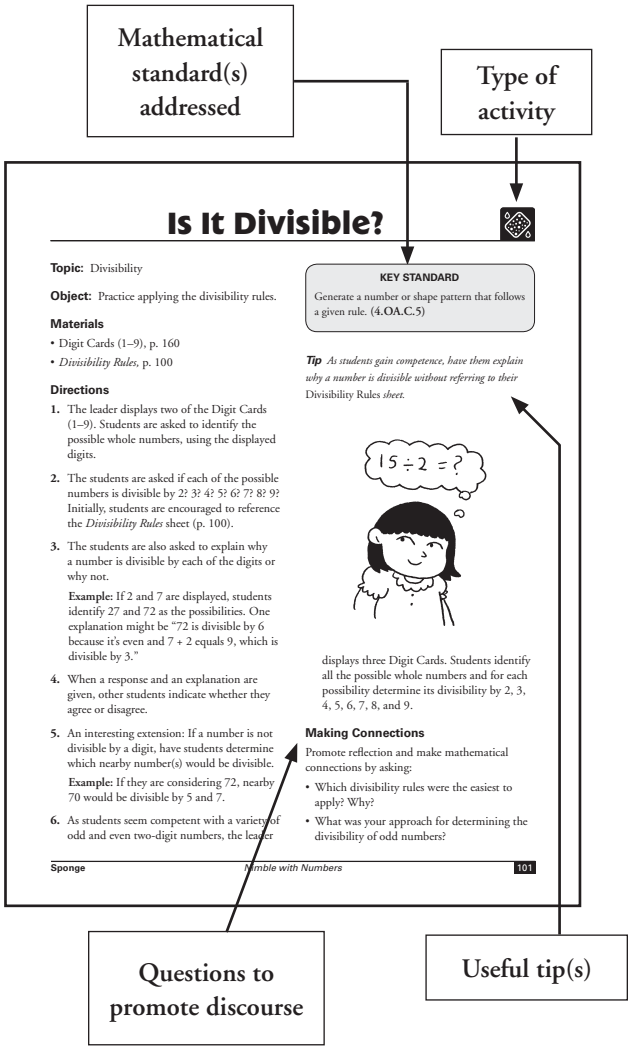
Sponges (S)
Games (G)
Mini-Assessments (A)
Independent Activities (I)

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

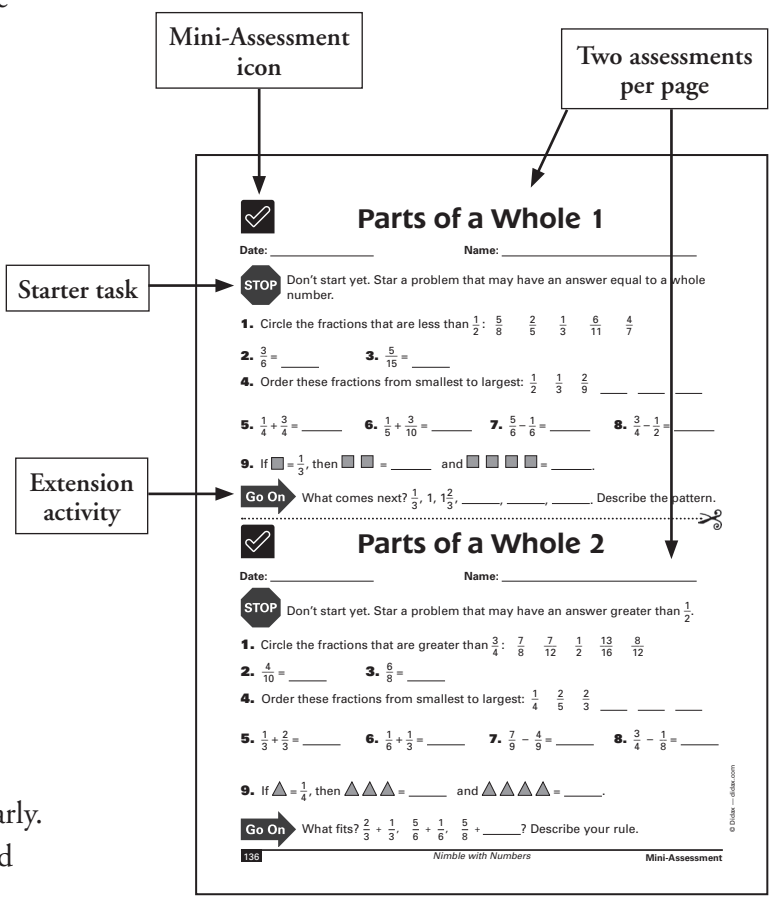
The six Mini-Assessments in each section provide a way to show students' improvement to parents, as well as to students. Each page is designed to be duplicated and cut in half, providing six comparative records for each student.

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. After students have responded to the STOP task, allow them to go ahead and answer the ten problems. 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 begin to develop 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., applying the divisibility rules), and identify which students require practicing the topic for a longer period of time.

Here is a sample page from the *Parts of a Whole* Mini-Assessment in the Fractions 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 gameboards 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

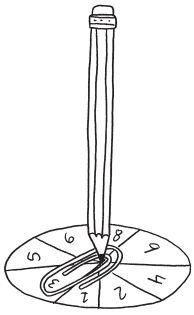
These sheets are designed to encourage practice of many more facts and computation than would seem apparent at first glance. Keep in mind that not all of these sheets can be solved in the class period, since many require significant mental computation and mathematical sense-making. For some, you might 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. Independent Activity sheets provide meaningful homework. Some of the Independent Activity sheets encourage students to create similar puzzles for classmates to solve. This provides additional practice and student recognition. When deemed helpful, an open-ended blackline master is included to facilitate this possibility.

Suggestions for Using *Nimble with Numbers*

Materials

An effort has been made to minimize the materials needed. The last section of the book contains blackline masters, including patterns for spinners. 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. 160). Take time now to duplicate two sets on card stock. Cut these cards apart and place them in an appropriate container. Some teachers find blank cubes easier to manage than Digit Cards or six-sectioned spinners. Number tiles 0–9 can substitute for Digit Cards. By placing tiles in a sock, the hidden digits are immediately reusable for another round of Sponges. 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* (page *xii*) 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, include these activities 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. To facilitate repeated use of Sponges, use transparencies with water-soluble ink.

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 *Finding Products* (pp. 96–98), one teacher asked her students, "What mathematics are you doing?" Her fourth-graders identified multiplication, addition, subtraction, division, and missing factors. After using *Joining Neighbors* (pp. 27–28), the teacher asked her students to estimate the total number of facts they had practiced. The range of responses was great.

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 (page *xiii*) help children make sense of mathematics, build their confidence, and encourage mathematical thinking and communication. These sample questions 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:

– **Multiplication Facts Made Easy** (p. *xiv*) is a simple but effective approach for parents to help their children.

– **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. Modify the letter 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,* and the *Neighbors Count* activity (pp. 12–13) with the appropriate materials. A future home packet might include *Multiplication Facts Made Easy* and *Products Bingo* (pp. 83–86).

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 your solution makes sense?

Expanding the Response

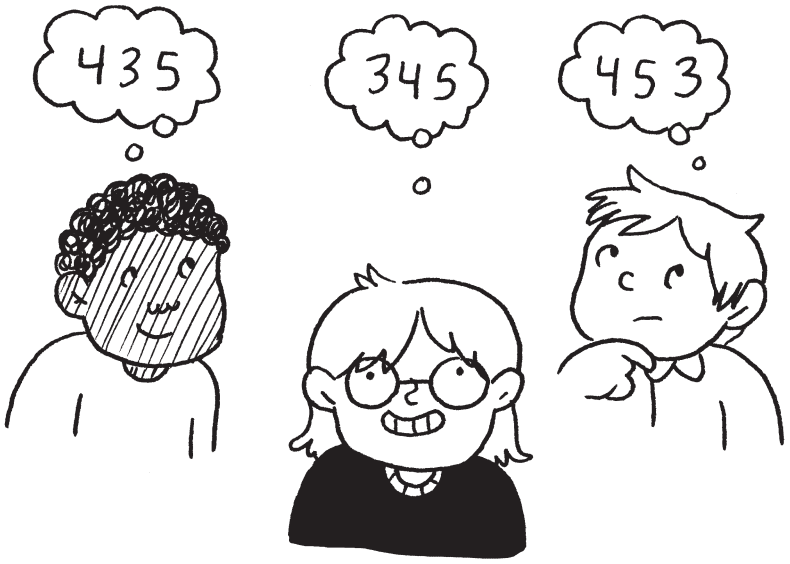
(To help clarify your child's thinking, avoid stopping when you hear the "right" answer and avoid correcting the "wrong" answer. Instead, respond with one of the following.)

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?



What's My Rule?

Topic: Numeric patterns and algebraic thinking

Object: Identify the rule that connects two numbers.

Materials

- *What's My Rule?* activity sheet, p. 6
- Prepared rules for beginning rounds

Directions

1. The leader displays the *What's My Rule?* activity form and provides one example of input based on a prepared but hidden rule. Students are informed that two operations have occurred.
2. The action is recorded in the "In/Out" T-table. **Example:** "If 4 is the input number, the output number is 5."
3. A student volunteers another input number, and the leader identifies the resulting output number, which is also recorded in the same T-table. **Example:** "If 7 is the input number, the output number is 11."
4. As students continue to suggest new input numbers, other students try to identify the corresponding output numbers.
5. After many students are able to identify the output numbers for given input numbers, students are asked to describe the pattern and state the rule, which is then recorded in the "Rule" box. ($2n - 3$)

In	Out
4	5

In	Out
4	5
7	11

KEY STANDARD

Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. (**4.OA.C.5**)

Tip *If students work in pairs to create new rules and beginning examples, this becomes a student-led activity.*

6. The leader begins a new round with another rule and beginning numbers, following the previous steps.

   Additional possible rules:

$n \times 4 + 1$	$(n - 2) \times 3$
$4n + 1$	$3(n - 2)$

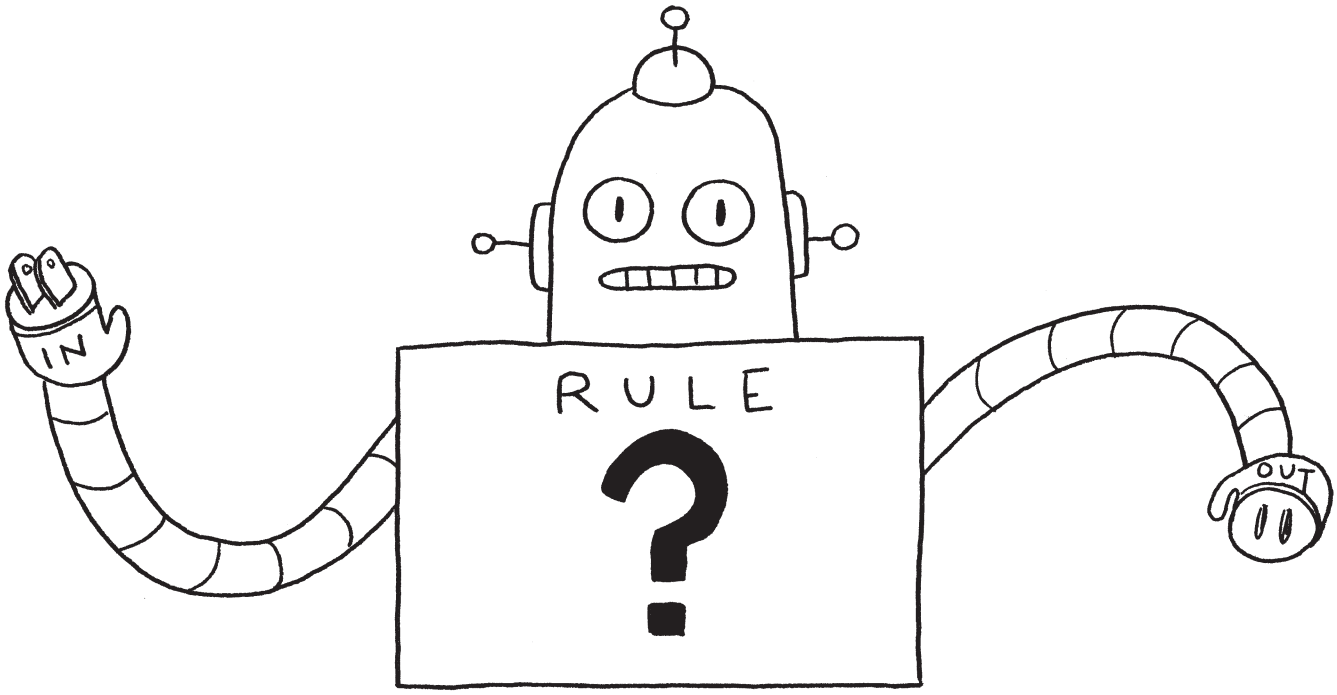
7. Eventually students identify the common characteristics and express rules algebraically, using n for any number.

Making Connections

Promote reflection and make mathematical connections by asking:

- What were your initial approaches for identifying the output number?
- Why is it necessary to have at least two examples before identifying possible rules?
- What helped you translate the identified input/output pattern into an algebraic expression?

What's My Rule?



In	Out

Rule

Just the Facts 1

Date: _____ **Name:** _____

STOP Don't start yet! Star problems in the top row that may have odd answers.

1. $\begin{array}{r} 8 \\ \times\ 7 \\ \hline \end{array}$ **2.** $4\overline{)32}$ **3.** _____ = 15 ÷ 3 **4.** _____ = (56 ÷ 8) × (45 ÷ 5)

5. (45 ÷ 9) + 8 = _____ **6.** (12 ÷ 2) × (17 – 9) = _____ **7.** _____ = (4 × 3) + 5

8. Use 5, 3, and 2.

(☐ + ☐) × ☐ = 25

9. Use 2, 4, and 6.

12 = (☐ × ☐) ÷ ☐

10. Use 3, 6, and 9.

(☐ ÷ ☐) × ☐ = 18

Go On Using at least two operations, write three equations that equal 17.

_____, _____, _____

Just the Facts 2

Date: _____ **Name:** _____

STOP Don't start yet! Star a problem that may have the greatest answer.

1. $\begin{array}{r} 7 \\ \times\ 6 \\ \hline \end{array}$ **2.** $9\overline{)27}$ **3.** _____ = 30 ÷ 5 **4.** _____ = (48 ÷ 6) × (40 ÷ 8)

5. (49 ÷ 7) + 9 = _____ **6.** (28 ÷ 7) × (14 – 8) = _____ **7.** _____ = (3 × 6) – 4

8. Use 3, 4, and 5.

(☐ + ☐) × ☐ = 27

9. Use 3, 5, and 6.

10 = (☐ × ☐) ÷ ☐

10. Use 2, 6, and 8.

(☐ ÷ ☐) × ☐ = 24

Go On Use any four digits to complete each equation.

(☐ + ☐) – (☐ ÷ ☐) = 12 (☐ × ☐) ÷ (☐ + ☐) = 3

Just the Facts 3

Date: _____ **Name:** _____

STOP Don't start yet! Star problems in the top row that may have even answers.

1. $\begin{array}{r} 9 \\ \times\ 6 \\ \hline \end{array}$ **2.** $4\overline{)24}$ **3.** _____ = 18 ÷ 3 **4.** _____ = (54 ÷ 9) × (63 ÷ 7)

5. (42 ÷ 7) + 9 = _____ **6.** (21 ÷ 3) × (13 – 9) = _____ **7.** _____ = (6 × 4) – 2

8. Use 2, 4, and 5.

(☐ + ☐) × ☐ = 28

9. Use 4, 6, and 9.

6 = (☐ × ☐) ÷ ☐

10. Use 2, 4, and 6.

(☐ ÷ ☐) × ☐ = 12

Go On Using at least two operations, write three equations that equal 27.

_____, _____, _____

Just the Facts 4

Date: _____ **Name:** _____

STOP Don't start yet! Star a problem that may have the least answer.

1. $\begin{array}{r} 8 \\ \times\ 8 \\ \hline \end{array}$ **2.** $4\overline{)36}$ **3.** _____ = 42 ÷ 6 **4.** _____ = (63 ÷ 9) × (56 ÷ 7)

5. (36 ÷ 4) + 8 = _____ **6.** (35 ÷ 5) × (13 – 7) = _____ **7.** _____ = (3 × 5) + 4

8. Use 3, 4, and 5.

(☐ + ☐) × ☐ = 32

9. Use 4, 6, and 8.

3 = (☐ × ☐) ÷ ☐

10. Use 4, 8, and 8.

(☐ ÷ ☐) × ☐ = 16

Go On Use any four digits to complete each equation.

(☐ + ☐) – (☐ ÷ ☐) = 7 (☐ × ☐) ÷ (☐ + ☐) = 8

Just the Facts 5

Date: _____ **Name:** _____

STOP Don't start yet! Star problems in the top row that may have two-digit answers.

1. $\begin{array}{r} 8 \\ \times\ 9 \\ \hline \end{array}$ **2.** $4\overline{)28}$ **3.** _____ = 21 ÷ 7 **4.** _____ = (35 ÷ 5) × (36 ÷ 9)

5. (28 ÷ 7) + 9 = _____ **6.** (48 ÷ 6) × (15 – 9) = _____ **7.** _____ = (7 × 5) – 4

8. Use 2, 3, and 7.

(☐ + ☐) × ☐ = 27

9. Use 4, 5, and 8.

10 = (☐ × ☐) ÷ ☐

10. Use 2, 7, and 8.

(☐ ÷ ☐) × ☐ = 28

Go On Using at least two operations, write three equations that equal 31.

_____, _____, _____

Just the Facts 6

Date: _____ **Name:** _____

STOP Don't start yet! Star a problem that may have even answers.

1. $\begin{array}{r} 9 \\ \times\ 7 \\ \hline \end{array}$ **2.** $3\overline{)24}$ **3.** _____ = 40 ÷ 5 **4.** _____ = (32 ÷ 4) × (25 ÷ 5)

5. (45 ÷ 9) + 8 = _____ **6.** (42 ÷ 6) × (16 – 8) = _____ **7.** _____ = (6 × 6) + 3

8. Use 2, 5, and 6.

(☐ + ☐) × ☐ = 42

9. Use 3, 6, and 8.

4 = (☐ × ☐) ÷ ☐

10. Use 3, 8, and 9.

(☐ ÷ ☐) × ☐ = 24

Go On Use any four digits to complete each equation.

11 = (☐ + ☐) – (☐ ÷ ☐) 4 = (☐ × ☐) ÷ (☐ + ☐)

Four in a Row

Topic: Multiplication facts

Object: Cover four numbers in a row with your markers.

Groups: Pairs of players

KEY STANDARD

Find all factor pairs for a whole number in the range 1–100. (**4.OA.B.4**)

Materials for each group

- *Four in a Row* Gameboard, p. 11
- 2 paper clips
- Markers (different color for each pair)

Tip *For players feeling insecure with the facts, allow three markers in a row to win.*

Directions

1. The first pair places two paper clips at the bottom of the gameboard, indicating two factors. The same pair multiplies the selected factors and places one of their markers on the resulting product.
2. The other pair moves only one of the paper clips to a new factor. Next, this pair multiplies the two factors and places one of their markers on that product. (It is permissible to have two paper clips on the same factor.)
3. Play continues with pairs alternating turns, moving one paper clip each time, multiplying the factors, and placing markers on the gameboard.
4. The winner is the first pair to have four markers in a row horizontally, vertically, or diagonally.

1	2	3	4	5	6
7	8	9	10	12	14
15	16	18	20	21	24
25	27	28	30	32	35
36	40	42	45	48	49
54	56	63	64	72	81

1 2 3 4 5 6 7 8 9

Making Connections

Promote reflection and make mathematical connections by asking:

- What do you notice about the numbers used on the grid?
- What strategies helped you line up your markers in a row?

Four in a Row

Gameboard

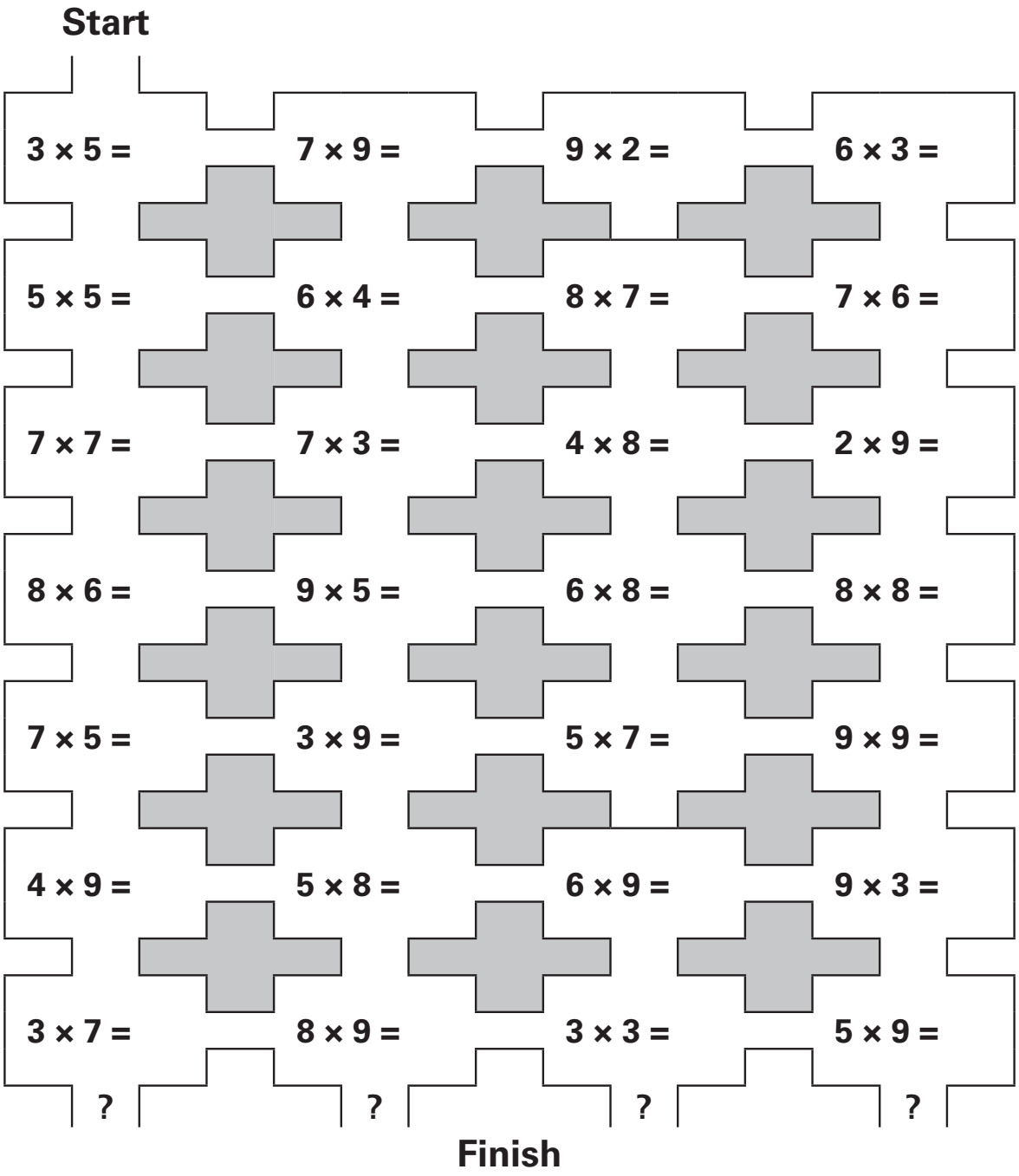
1	2	3	4	5	6
7	8	9	10	12	14
15	16	18	20	21	24
25	27	28	30	32	35
36	40	42	45	48	49
54	56	63	64	72	81

1 2 3 4 5 6 7 8 9

Multiplication Maze

Date _____ **Name** _____

Find each product. Get through the maze by following the path with odd products.



Challenge Create a multiplication maze for a classmate to solve that requires a path of even products. Try to create a maze with only one possible solution.