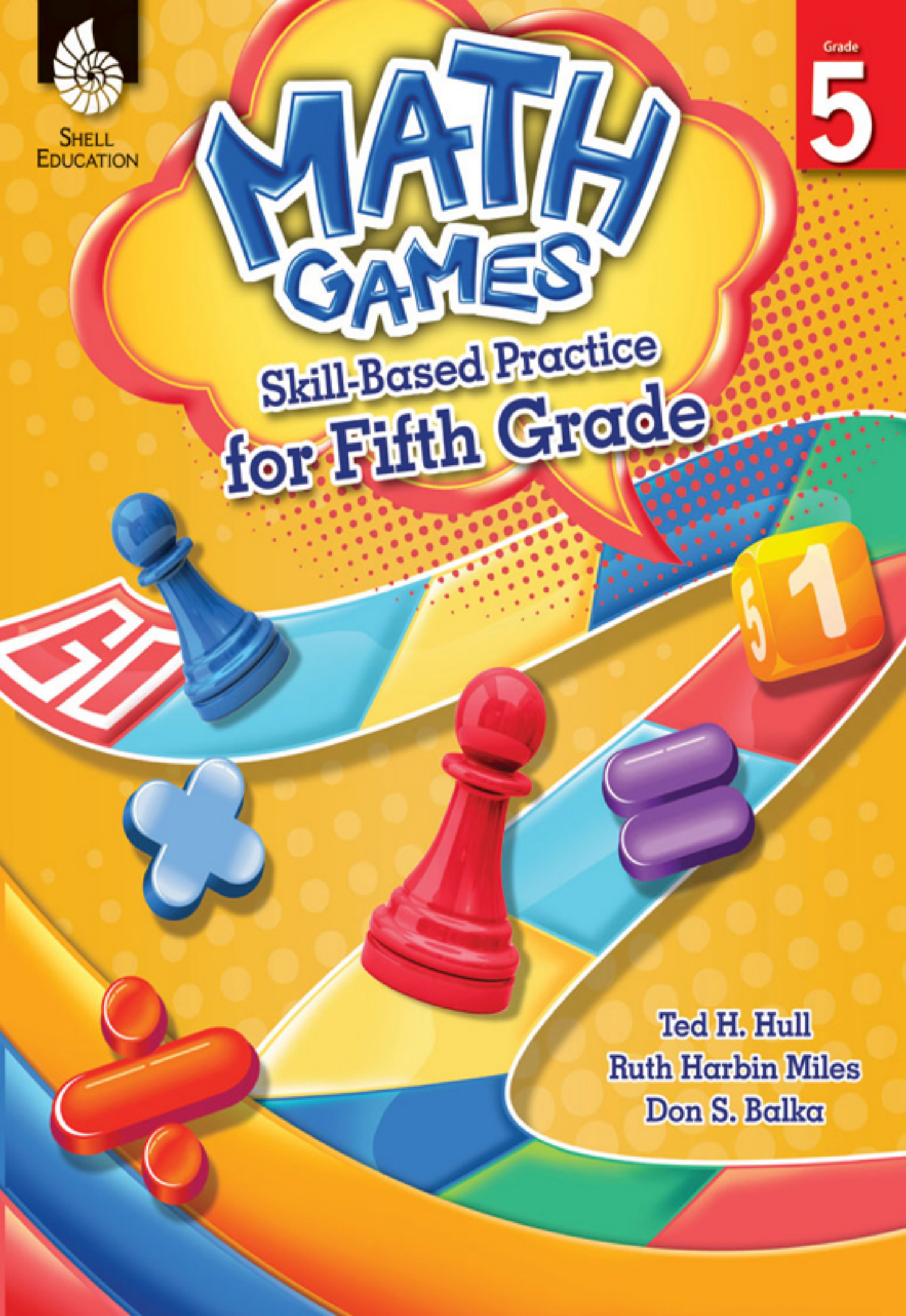
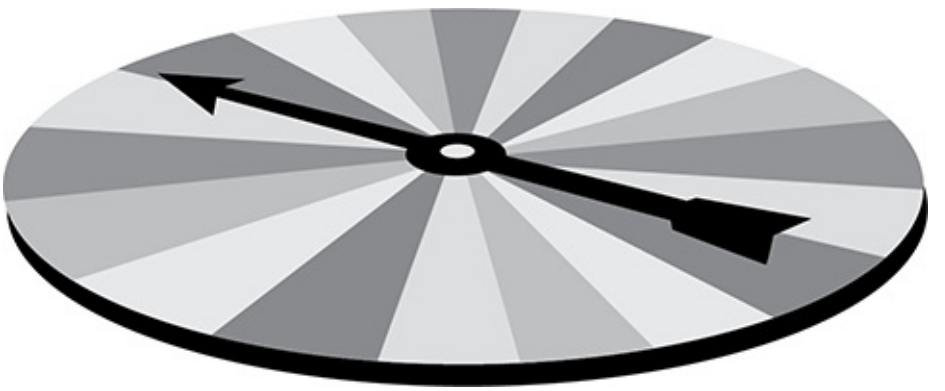

Shell Education
Grade 5
MATH GAMES
Skill-Based Practice for Fifth Grade
Ted H. Hull
Ruth Harbin Miles
Don S. Balka

# Table of Contents



# Importance of Games

Students learn from play. Play begins when we are infants and continues through adulthood. Games are motivational and educational (Hull, Harbin Miles, and Balka 2013; Burns 2009). They can assist and encourage students to operate as learning communities by requiring students to work together by following rules and being respectful. Games also foster students' thinking and reasoning since students formulate winning strategies. They provide much more sustained practices than do worksheets, and students are more motivated to be accurate. Worksheets may provide 20 to 30 opportunities for students to practice a skill, while games far exceed such prescribed practice opportunities. Lastly, games provide immediate feedback to students concerning their abilities.

Games must be part of the overall instructional approach that teachers use because successful learning requires active student engagement (Hull, Harbin Miles, and Balka 2013; National Research Council 2004), and games provide students with the motivation and interest to become highly engaged. Instructional routines need balance between concept development and skill development. They must also balance teacher-led and teacher-facilitated lessons. Students need time to work independently and collaboratively in order to assimilate information, and games can help support this.

When games are used appropriately, students also learn mathematical concepts.

## Mathematical Learning

Students must learn mathematics with understanding (NCTM 2000). Understanding means that students know the relationship between mathematical concepts and mathematical skills—mathematical procedures and algorithms work because of the underlying mathematical concepts. In addition, skill proficiency allows students to explore more rigorous mathematical concepts. From this relationship, it is clear that a balance between skill development and conceptual development must exist. There cannot be an emphasis of one over the other.

The National Council of Teachers of Mathematics (2000) and the National Research Council (2001) reinforce this idea. Both organizations state that learning mathematics requires both conceptual understanding and procedural fluency. This means that students need to practice procedures as well as develop their understanding of mathematical concepts in order to achieve success. The games presented in this book reinforce skill-based practice and support students' development of proficiency. These games can also be used as a springboard for discourse about mathematical concepts. The counterpart to this resource is *Math Games: Getting to the Core of Conceptual Understanding,* which builds students' conceptual understanding of mathematics through games.

The *Common Core State Standards for Mathematics* (2010) advocate a balanced

mathematics curriculum by focusing standards both on mathematical concepts and skills. This is also stressed in the Standards for Mathematical Practice, which discuss the process of “doing” mathematics and the habits of mind students need to possess in order to be successful.

The Standards for Mathematical Practice also focus on the activities that foster thinking and reasoning in which students need to be involved while learning mathematics. Games are an easy way to initiate students in the development of many of the practices. Each game clearly identifies a Common Core domain, a standard, and a skill, and allows students to practice them in a fun and meaningful way.

## Games vs. Worksheets

In all likelihood, many mathematics lessons are skill related and are taught and practiced through worksheets. Worksheets heavily dominate elementary mathematics instruction. They are not without value, but they often command too much time in instruction. While students need to practice skills and procedures, the way to practice these skills should be broadened.

Worksheets generally don’t promote thinking and reasoning. They become so mechanical that students cease thinking. They are lulled into a feeling that completing is the goal. This sense of “just completing” is not what the Common Core Standards for Mathematical Practice mean when they encourage students to “persevere in solving problems.”

Students need to be actively engaged in learning.

Students need to be actively engaged in learning. While worksheets do serve a limited purpose in skill practice, they also contain many potential difficulties. Problems that can occur include the following:

- **Worksheets are often completed in isolation,** meaning that students who are performing a skill incorrectly most likely practice the skill incorrectly for the entire worksheet. The misunderstanding may not be immediately discovered, and in fact, will most likely not be discovered for several days!
- **Worksheets are often boring to students.** Learning a skill correctly is not the students’ goal. Their goal becomes to finish the worksheet. As a result, careless errors are often made, and again, these errors may not be immediately discovered or corrected.
- **Worksheets are often viewed as a form of subtle punishment.** While perhaps not obvious, the perceived punishment is there. Students who have mastered the skill and can complete the worksheet correctly are frequently “rewarded” for their efforts with another worksheet while they wait for their classmates to finish. At the same time, students who have not mastered the skill and do not finish the worksheet on time are “rewarded” with the requirement to take the worksheet home to complete, or they

finish during another portion of the day, often recess or lunch.

- **Worksheets provide little motivation to learn a skill correctly.** There is no immediate correction for mistakes, and often, students do not really care if a mistake is made. When a game is involved, students want and need to get correct answers.

The *Common Core State Standards for Mathematics*, including the Standards for Mathematical Practice, demand this approach change. These are the reasons teachers and teacher leaders must consciously support the idea of using games to support skill development in mathematics.

# How to Use This Book

There are many ways to effectively utilize this book. Teachers, mathematics leaders, and parents may use this book to engage students in fun, meaningful, practical mathematics learning. These games can be used as a way to help students maintain skill proficiency or remind them of particular skills prior to a critical concept lesson. These games may also be useful during tutorial sessions, or during class when students have completed their work.

## Games at Home

Parents may use these games to work with their child to learn important skills. The games also provide easier ways for parents to interest their child in learning mathematics rather than simply memorizing facts. In many cases, their child is more interested in listening to explanations than correcting their errors.

Parents want to help their children succeed in school, yet they may dread the frequently unpleasant encounters created by completing mathematics worksheets at home. Families can easily use the games in this book by assuming the role of one of the players. At other times, parents provide support and encouragement as their child engages in the game. In either situation, parents are able to work with their children in a way that is fun, educational, and informative.

## Games in the Classroom

During game play, teachers are provided excellent opportunities to assess students' abilities and current skill development. Students are normally doing their best and drawing upon their current understanding and ability to play the games, so teachers see an accurate picture of student learning. Some monitoring ideas for teacher assessment include:

- Move about the room listening and observing
- Ask student pairs to explain what they are doing
- Ask the entire class about the game procedures after play
- Play the game against the class
- Draw a small group of students together for closer supervision
- Gather game sheets to analyze students' proficiencies

Ongoing formative assessment and timely intervention are cornerstones of effective classroom instruction. Teachers need to use every available opportunity to make student thinking visible and to respond wisely to what students' visible thinking reveals. Games are an invaluable instructional tool that teachers need to effectively use.

Students are able to work collaboratively during game play, thus promoting student discourse and deeper learning. The games can also be used to reduce the amount of time students spend completing worksheets.

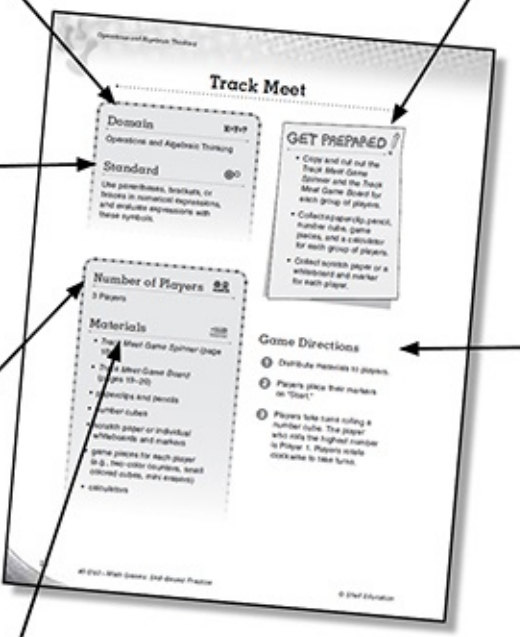
Each game in this book is based upon a common format. This format is designed to assist teachers in understanding how the game activities are played and which standards and mathematical skills students will be practicing.

**Domain**
The domain that students will practice is noted at the beginning of each lesson. Each of the five domains addressed in this series has its own icon.

**Standards**
One or more *Common Core State Standards* will state the specific skills that students will practice during game play.

**Number of Players**
The number of players varies for each game. Some may include whole-group game play, while others may call for different-size groups.

**Materials**
A materials list is provided for each game to notify the teacher what to have available in order to play the games.




**Get Prepared!**
Everything a teacher needs to be prepared for game play is noted in the Get Prepared! section. This includes how many copies are needed as well as other tasks that need to be completed with the materials.

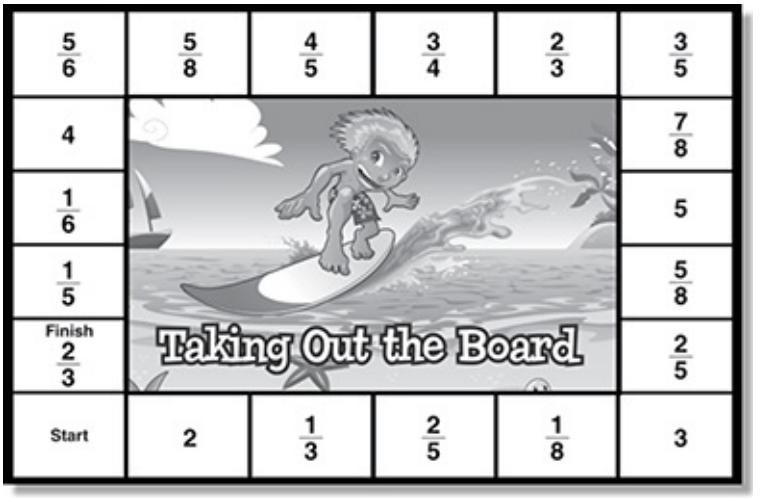
**Game Directions**
The directions allow for step-by-step guidance on how to easily implement each game.

All game resources can be found on the **Digital Resource CD**. (For a complete list of the files, see pages 114–115.)


Many games include materials such as game boards, activity cards, score cards, and spinners. You may wish to laminate materials for durability.

**Game Boards**

Some game boards spread across multiple book pages in order to make them larger for game play. When this is the case, cut out each part of the game board and tape them together. Once you cut them apart and tape them together, you may wish to glue them to a large sheet of construction paper and laminate them for durability.

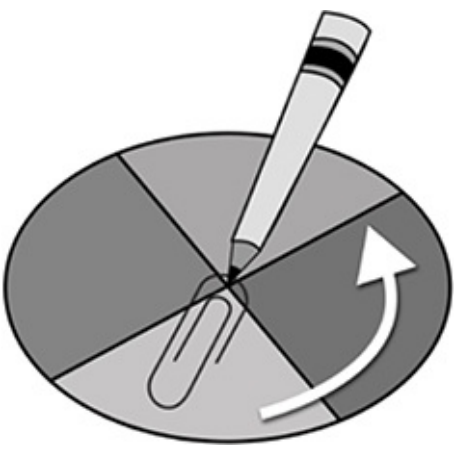



**Activity Cards**

Some games include activity cards. Once you cut them apart, you may wish to laminate them for durability.

**Spinners**


Some games include spinners. To use a spinner, cut it out from the page. Place the tip of a pencil in the center with a paperclip around it. Use your other hand to flick the other side of the paperclip.



# Correlation to the Standards

Shell Education is committed to producing educational materials that are research and standards based. In this effort, we have correlated all of our products to the academic standards of all 50 United States, the District of Columbia, the Department of Defense Dependent Schools, and all Canadian provinces.

## How to Find Standards Correlations

To print a customized correlation report of this product for your state, visit our website at **http://www.shelleducation.com** and follow the on-screen directions. If you require assistance in printing correlation reports, please contact Customer Service at 1-877-777-3450.

## Purpose and Intent of Standards

Legislation mandates that all states adopt academic standards that identify the skills students will learn in kindergarten through grade twelve. Many states also have standards for Pre–K. This same legislation sets requirements to ensure the standards are detailed and comprehensive.

Standards are designed to focus instruction and guide adoption of curricula. Standards are statements that describe the criteria necessary for students to meet specific academic goals. They define the knowledge, skills, and content students should acquire at each level. Standards are also used to develop standardized tests to evaluate students' academic progress. Teachers are required to demonstrate how their lessons meet state standards. State standards are used in the development of all of our products, so educators can be assured they meet the academic requirements of each state.

## Common Core State Standards

Many games in this book are aligned to the Common Core State Standards. The standards support the objectives presented throughout the lessons and are provided on the Digital Resource CD (standards.pdf).

## TESOL and WIDA Standards

The lessons in this book promote English language development for English language learners. The standards listed on the Digital Resource CD (standards.pdf) support the language objectives presented throughout the lessons.

# Standards Correlation Chart

| Standard | Game(s) |
|---|---|
| **5.OA.A.1**—Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols. | Track Meet (p. 16) |
| **5.OA.A.2**—Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. For example, express the calculation “add 8 and 7, then multiply by 2” as 2 × (8 + 7). Recognize that 3 × (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product. | Make a Match (p. 21) |
| **5.OA.B.3**—Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. For example, given the rule “Add 3” and the starting number 0, and given the rule “Add 6” and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so. | Back to Earth (p. 27) |
| **5.NBT.A.3b**—Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons. | Drag Race (p. 33); Winner Takes All (p. 37); Compare It (p. 40); Greater Than/ Less Than (p. 44) |
| **5.NBT.A.3a**—Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., 347.392 = 3 × 100 + 4 × 10 + 7 × 1 + 3 × (1/10) + 9 × (1/100) + 2 × (1/1000). | Greater Than/Less Than (p. 44) |
| **5.NBT.A.4**—Use place value understanding to round decimals to any place. | A-Round the World (p. 48) |
| **5.NBT.B.6**—Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between | Car Chase (p. 54) |

| | |
|---|---|
| multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. | |
| **5.NBT.B.7**—Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. | Race Is On (p. 59); Race to the Top (p. 64) |
| **5.NF.A.1**—Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. For example, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, *a/b* + *c/d* = (*ad* + *bc*)/*bd*.) | Chase Is On (p. 69) |
| **5.NF.B.4**—Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. | Taking Out the Board Fractions (p. 76); Fraction Checkers (p. 80); Multiplication Madness (p. 84) |
| **5.NF.B.7**—Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. | Fraction Checkers (p. 80); 4 Square Division (p. 88) |
| **5.MD.C.5a**—Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication. | Volume Construction (p. 92) |
| **5.MD.B.2**—Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots. For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally. | Dash to the Finish (p. 96) |
| **5.G.A.1**—Use a pair of perpendicular number lines, | Digging for Treasure (p. |

| | |
|---|---|
| called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., *x*-axis and *x*-coordinate, *y*-axis and y-coordinate). | 102);<br>Space Exploration (p. 107) |

# About the Authors

**Ted H. Hull, Ed.D.,** served in public education for 32 years as a mathematics teacher, a K–12 mathematics coordinator, a school principal, director of curriculum and instruction, and project director for the Charles A. Dana Center at the University of Texas in Austin. While at the University of Texas, he directed the research project "Transforming Schools: Moving from Low-Achieving to High Performing Learning Communities." After retiring, Ted opened LCM: Leadership · Coaching · Mathematics with his coauthors and colleagues. Ted has coauthored numerous books addressing mathematics improvement and has served as the Regional Director for the National Council of Supervisors of Mathematics (NCSM).

**Ruth Harbin Miles, Ed.S.,** currently coaches inner-city, rural, and suburban mathematics teachers and serves on the Board of Directors for the National Council of Teachers of Mathematics, the National Council of Supervisors of Mathematics and Virginia's Council of Mathematics Teachers. Her professional experiences include coordinating the K–12 Mathematics Department for Olathe, Kansas Schools and adjunct teaching for Mary Baldwin College and James Madison University in Virginia. A coauthor of four books on transforming teacher practice through team leadership, mathematics coaching, and visible student thinking and co-owner of Happy Mountain Learning, Ruth's specialty and passion include developing teachers' content knowledge and strategies for engaging students to achieve high standards in mathematics.

**Don S. Balka, Ph.D.,** a former middle school and high school mathematics teacher, is Professor Emeritus in the Mathematics Department at Saint Mary's College in Notre Dame, Indiana. Don has presented at over 2,000 workshops, conferences, and in-service trainings throughout the United States and has authored or coauthored over 30 books on mathematics improvement. Don has served as director for the National Council of Teachers of Mathematics, the National Council of Supervisors of Mathematics, TODOS: Mathematics for All, and the School Science and Mathematics Association. He is currently president of TODOS and past president of the School Science and Mathematics Association.

# Track Meet

## Domain

Operations and Algebraic Thinking

## Standard

Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

## Number of Players

3 Players

## Materials

- *Track Meet Game Spinner* (page 18)
- *Track Meet Game Board* (pages 19–20)
- paperclips and pencils
- number cubes
- scratch paper or individual whiteboards and markers
- game pieces for each player (e.g., two-color counters, small colored cubes, mini erasers)
- calculators

## GET PREPARED

- Copy and cut out the *Track Meet Game Spinner* and the *Track Meet Game Board* for each group of players.
- Collect a paperclip, pencil, number cube, game pieces, and a calculator for each group of players.
- Collect scratch paper or a whiteboard and marker for each player.

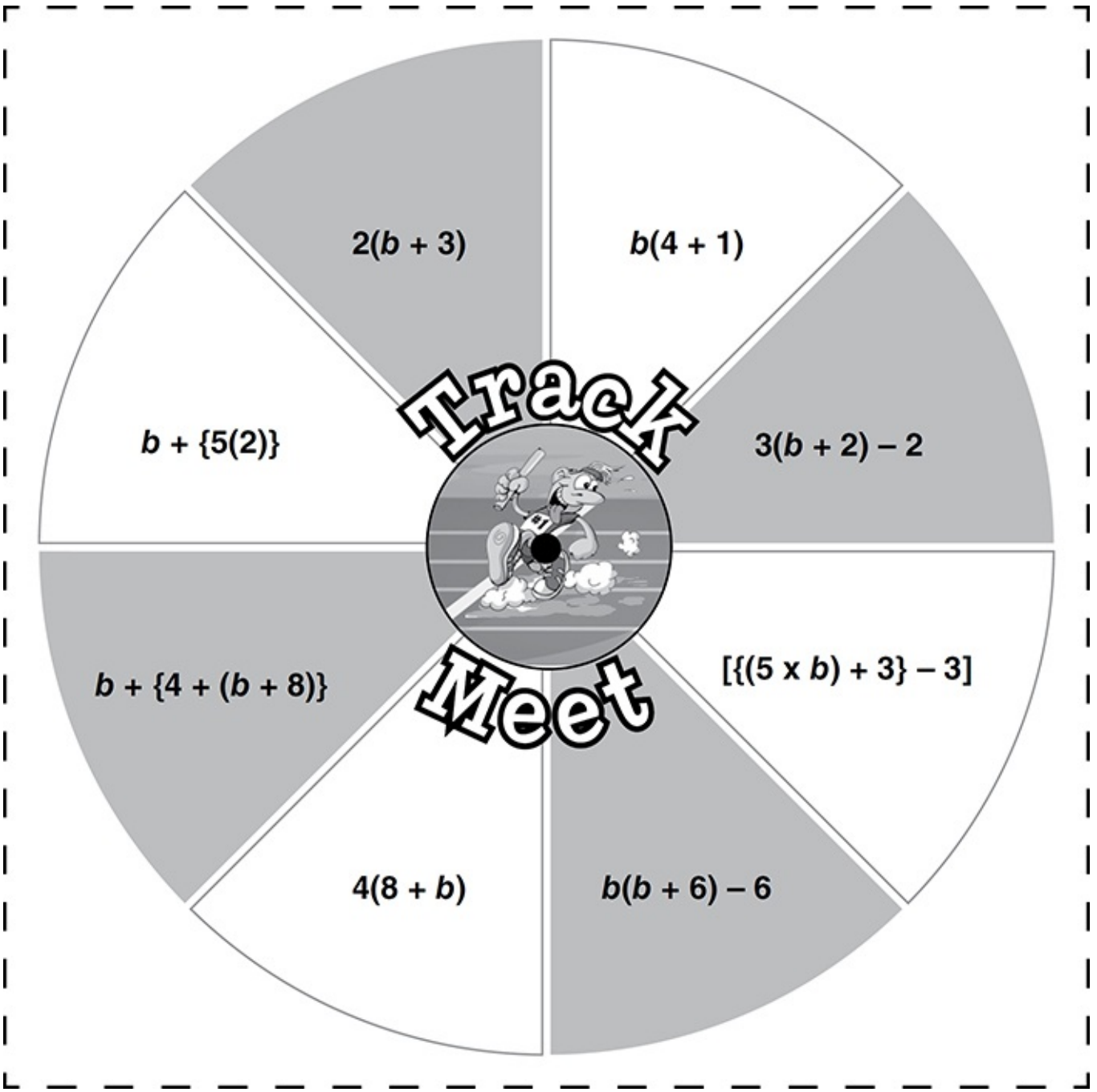
## Game Directions

1. Distribute materials to players.
2. Players place their markers on “Start.”
3. Players take turns rolling a number cube. The player who rolls the highest number is Player 1. Players rotate clockwise to take turns.
4. Player 1 rolls the number cube and moves forward the designated number of places. The value *b* is given on the *Track Meet Game Board* space.
5. Player 1 flicks the paperclip in the center of the *Track Meet Game Spinner* to determine the expression to be evaluated.
6. All three players independently substitute the value *b* into the expression on the spinner sheet, and evaluate it using scratch paper or whiteboards.
7. If Players 2 and 3 verify that Player 1 has answered correctly, Player 1 remains on the space. If Player 1 is incorrect, he or she returns the game piece to the space it was on prior to the roll.
8. Players 2 and 3 repeat steps 4 to 7.
9. The player who first reaches or passes “Finish” wins!

# Track Meet

## Game Spinner

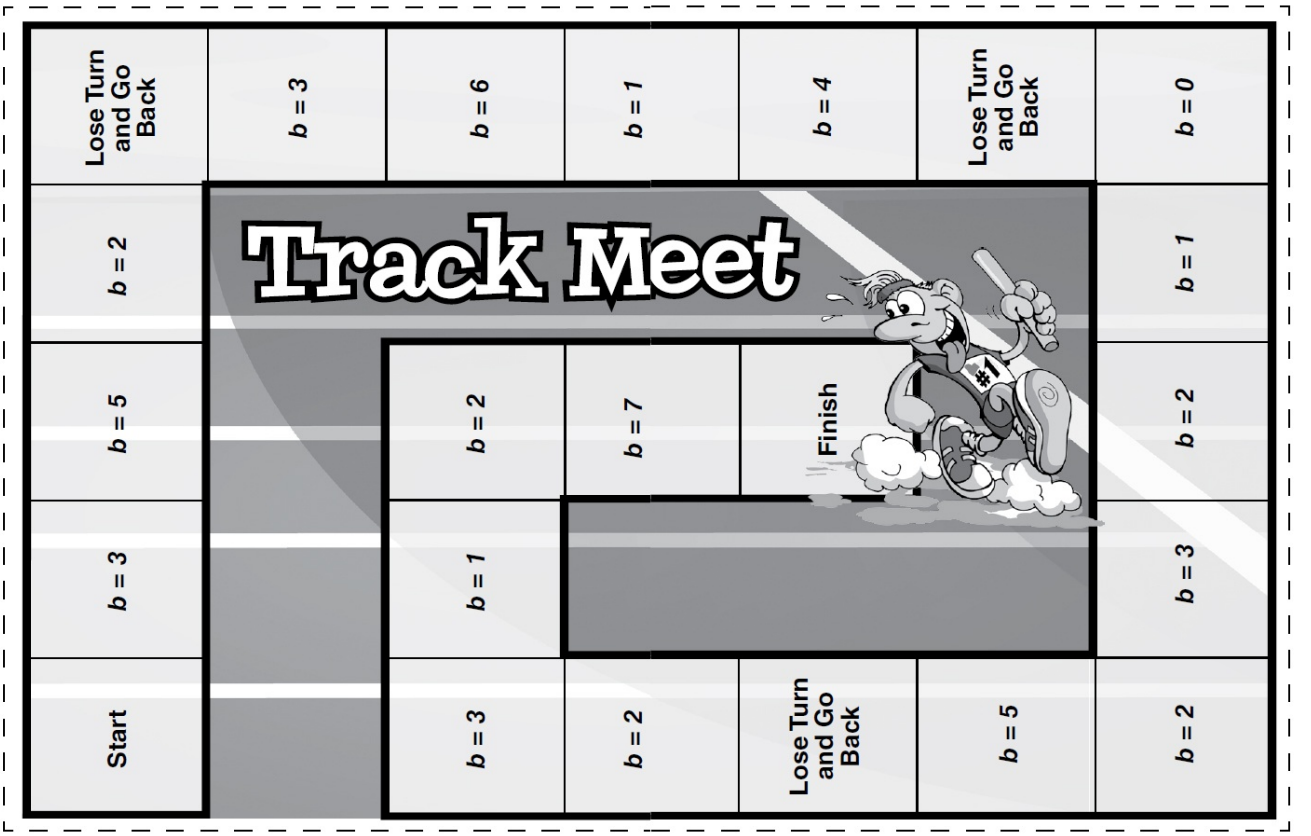
**Directions:** Copy and cut out the spinner for each group of players. For directions on how to assemble this spinner, see page 10.



# Track Meet

## Game Board

**Directions:** Copy and cut out the game board for each group of players. Tape it to the game board on page 20.



# Make a Match

## Domain

Operations and Algebraic Thinking

## Standard

Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them.

## Number of Players

2 Players

## Materials

- *Make a Match Game Cards* (pages 22–26)
- number cubes

### GET PREPARED

- Copy and cut out a set of *Make a Match Game Cards* for each pair of players.
- Collect a number cube for each pair of players.

## Game Directions

1. Distribute materials to players.
2. Players take turns rolling a number cube. The player who rolls the higher number is Player 1.
3. Player 1 shuffles the *Make a Match Game Cards* and deals six cards to each player. The remaining *Make a Match Game Cards* are placed facedown in a deck.
4. Player 1 selects a card from his or her hand and reads it aloud.
5. If Player 2 has the matching card (with the same expression in a different form), he or she hands over the card to Player 1. Player 1 makes a “match,” then places the two cards in his or her winning pile and takes another turn.
6. If Player 2 does not have the requested card, Player 1 draws a card from the deck,

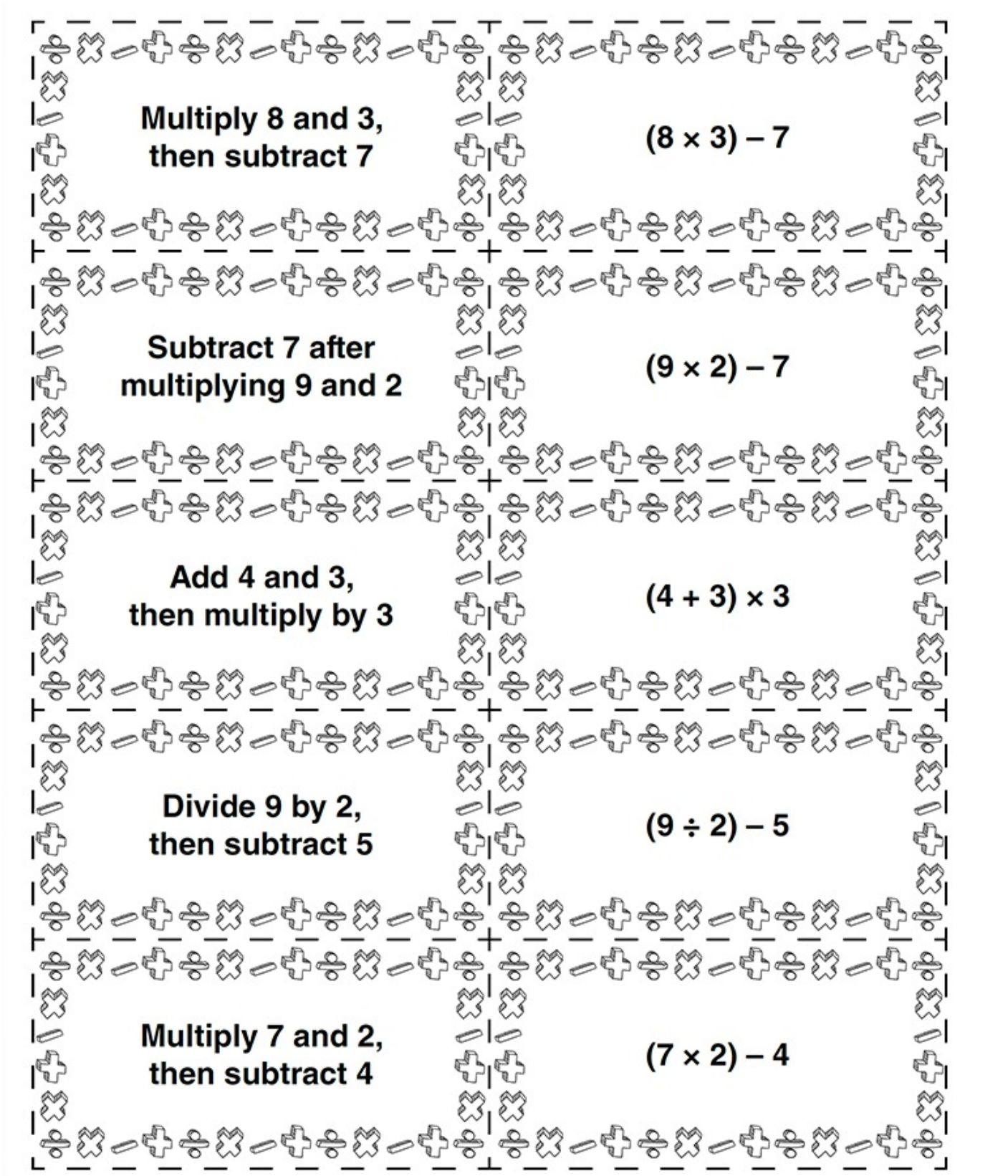
and Player 2 selects a card from his or her hand to request a match.

7. The winner is the player with more *Make a Match Game Cards* in his or her winning pile when all the deck cards have been drawn, or a player has no cards remaining in his or her hand.

# Make a Match

## Game Cards

**Directions:** Copy and cut out one set of cards for each pair of players.



| | |
|---|---|
| Subtract 5 after multiplying 8 and 2 | $(8 \times 2) - 5$ |
| Add 4 and 4, then multiply by 2 | $(4 + 4) \times 2$ |
| Divide 5 by 2, then subtract 5 | $(5 \div 2) - 5$ |
| Add 3 and 4, then add 7 | $(3 + 4) + 7$ |
| Subtract 6 from 8, then divide by 3 | $(8 - 6) \div 3$ |

| | |
|---|---|
| Multiply 7 and 2, then subtract 1 | $(7 \times 2) - 1$ |
| Subtract 2 after multiplying 8 and 5 | $(8 \times 5) - 2$ |
| Add 5 and 5, then multiply by 5 | $(5 + 5) \times 5$ |
| Divide 2 by 2, then subtract 4 | $(2 \div 2) - 4$ |
| Multiply 4 and 5, then subtract 2 | $(4 \times 5) - 2$ |

| | |
|---|---|
| Multiply 6 and 5, then add 9 | $(6 \times 5) + 9$ |
| Multiply 7 and 3, then subtract 1 | $(7 \times 3) - 1$ |
| Subtract 3 after multiplying 1 and 2 | $(1 \times 2) - 3$ |
| Add 9 and 9, then multiply by 3 | $(9 + 9) \times 3$ |
| Divide 10 by 2, then subtract 5 | $(10 \div 2) - 5$ |

| | |
|---|---|
| Subtract 4 from 10, then divide by 3 | $(10 - 4) \div 3$ |
| Add 7 after multiplying 8 and 7 | $(8 \times 7) + 7$ |
| Divide 6 by 2, then divide by 3 | $(6 \div 2) \div 3$ |
| Multiply 5 and 3, then add 7 | $(5 \times 3) + 7$ |
| Subtract 3 from 4, then multiply by 2 | $(4 - 3) \times 2$ |

# Back to Earth

## Domain

Operations and Algebraic Thinking

## Standard

Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from two patterns, and graph the ordered pairs on a coordinate plane.

## Number of Players

2 Players

## Materials

- *Back to Earth Game Board* (pages 29–30)
- *Back to Earth Recording Sheet* (page 31)
- *Back to Earth Value Cards* (page 32)
- straight edges (rulers)

### GET PREPARED

- Copy and cut out one *Back to Earth Game Board* for each player.
- Copy one *Back to Earth Recording Sheet* for each pair of players.
- Copy and cut out one set of *Back to Earth Value Cards* for each pair of players.
- Collect a straight edge (ruler) for each pair of players.

## Game Directions

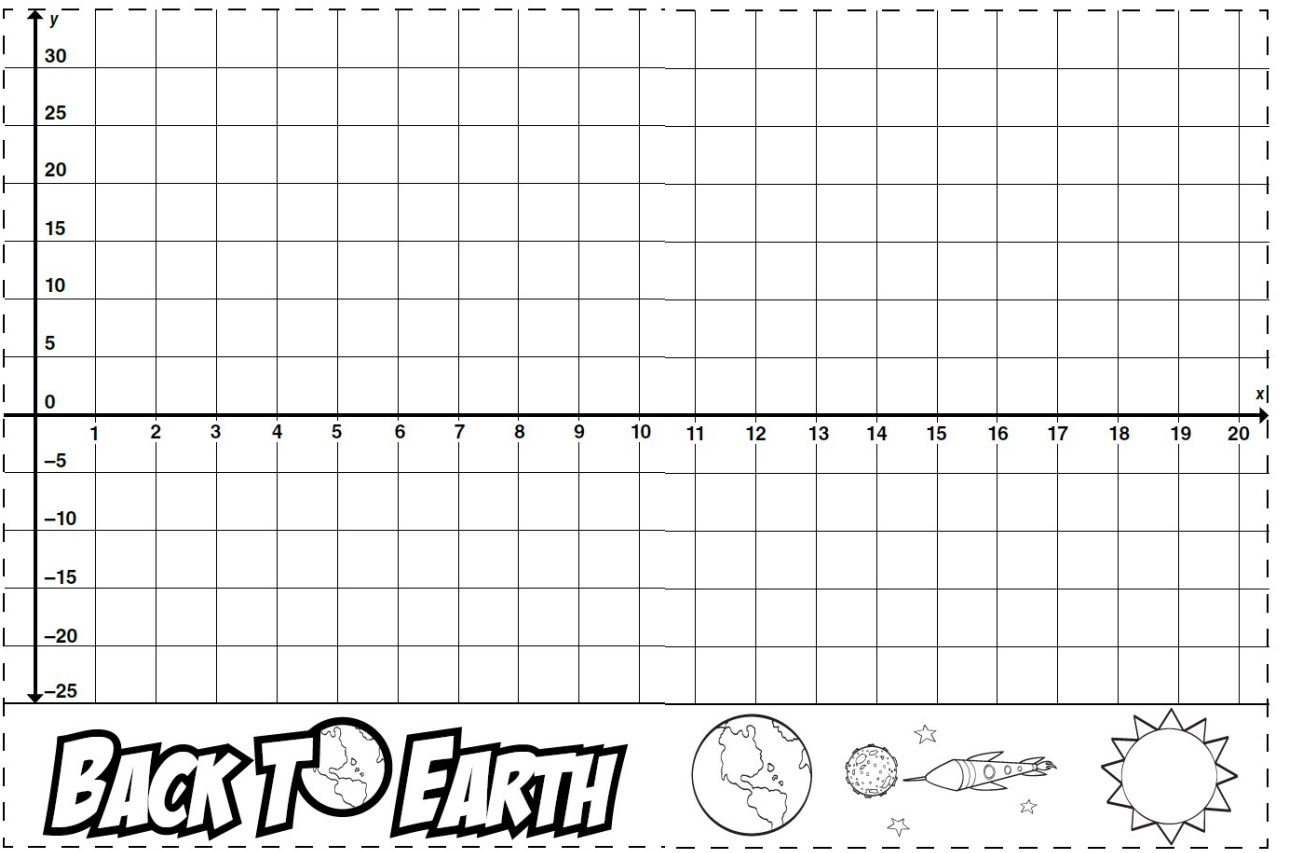
1. Distribute materials to players.
2. Each player chooses a 2 × 2 square anywhere on his or her *Back to Earth Game Board* and shades it. This square represents the sun. Each player also chooses and shades a 2 × 1 rectangle to represent the Earth and a 1 × 1 square to represent the moon. Shaded areas may not touch the *x*- or *y*-axis.

3. Players trade game boards.
4. Each player draws one of the *Back to Earth Value Cards*. The player with the greater number is Player 1 and goes first. The cards are returned to the deck.
5. Player 1 chooses any row on the *Back to Earth Recording Sheet* and draws a *Back to Earth Value Card*.
6. In the first column on the recording sheet, Player 1 writes the number from his or her card, which will be the *x*-coordinate. Player 1 then calculates the *y*-coordinate using the rule given. Player 1 records the ordered pair in the fourth column on the recording sheet. For example, Player 1 selects the 3rd row and draws a *Back to Earth Value Card* with a 9. Substituting into the rule $x + 3$, the *y*-coordinate is 12 and the ordered pair to record in the right column is (9, 12).
7. Player 1 locates the ordered pair on the grid, and draws a line using a straight edge from the origin (0, 0) to the ordered pair.
8. If a player hits the sun or moon, he or she loses the next turn.
9. Player 2 repeats steps 6 to 9.
10. The first player to get “Back to Earth” (intersect with the Earth rectangle on his or her grid) wins!

# BACK TO EARTH

## Game Board

**Directions:** Copy and cut out the game board. Tape it to the game board on page 30.



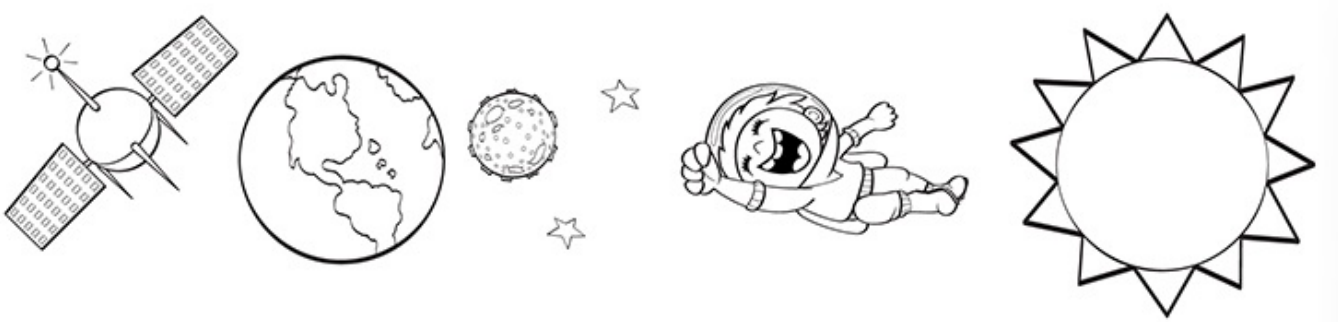
Name: _____ Date: _____

# *BACK TO EARTH*

## Recording Sheet

**Directions:** Choose a row on the chart below. Draw a *Back to Earth Value Card* and record the value, which will represent the *x*-coordinate. Use the rule given to calculate and record the *y*-coordinate. Then, write the ordered pair in the fourth column.

| Player 1 | | | | Player 2 | | | |
|---|---|---|---|---|---|---|---|
| Value (*x*-coordinate) | Rule | Value (*y*-coordinate) | Ordered Pair | Value (*x*-coordinate) | Rule | Value (*y*-coordinate) | Ordered Pair |
| | $x + 1$ | | | | $x - 1$ | | |
| | $x - 2$ | | | | $x + 2$ | | |
| | $x + 3$ | | | | $x - 3$ | | |
| | $x - 4$ | | | | $x + 4$ | | |
| | $x + 5$ | | | | $x - 5$ | | |
| | $x - 6$ | | | | $x + 6$ | | |
| | $x + 7$ | | | | $x - 10$ | | |
| | $x - 15$ | | | | $x + 8$ | | |
| | $x + 9$ | | | | $x - 20$ | | |
| | $x - 25$ | | | | $x + 10$ | | |



# *BACK TO EARTH*

## Value Cards

**Directions:** Copy and cut out one set of cards for each pair of players.