GRADE
5

Building Conceptual Understanding and Fluency Through Games

FOR THE NORTH CAROLINA STANDARD COURSE OF STUDY IN MATHEMATICS

North Carolina Department of
PUBLIC INSTRUCTION

K-12 MATHEMATICS

Building Conceptual Understanding and Fluency Through Games

Developing fluency requires a balance and connection between conceptual understanding and computational proficiency. Computational methods that are over-practiced without understanding are forgotten or remembered incorrectly. Conceptual understanding without fluency can inhibit the problem solving process. – NCTM, *Principles and Standards for School Mathematics*, pg. 35

WHY PLAY GAMES?

People of all ages love to play games. They are fun and motivating. Games provide students with opportunities to explore fundamental number concepts, such as the counting sequence, one-to-one correspondence, and computation strategies. Engaging mathematical games can also encourage students to explore number combinations, place value, patterns, and other important mathematical concepts. Further, they provide opportunities for students to deepen their mathematical understanding and reasoning. Teachers should provide repeated opportunities for students to play games, and let the mathematical ideas emerge as they notice new patterns, relationships, and strategies. Games are an important tool for learning. Here are some advantages for integrating games into elementary mathematics classrooms:

- Playing games encourages strategic mathematical thinking as students find different strategies for solving problems and it deepens their understanding of numbers.
- Games, when played repeatedly, support students' development of computational fluency.
- Games provide opportunities for practice, often without the need for teachers to provide the problems. Teachers can then observe or assess students, or work with individual or small groups of students.
- Games have the potential to develop familiarity with the number system and with "benchmark numbers" – such as 10s, 100s, and 1000s and provide engaging opportunities to practice computation, building a deeper understanding of operations.
- Games provide a school to home connection. Parents can learn about their children's mathematical thinking by playing games with them at home.

BUILDING FLUENCY

Developing computational fluency is an expectation of the North Carolina Standard Course of Study. Games provide opportunity for meaningful practice. The research about how students develop fact mastery indicates that drill techniques and timed tests do not have the power that mathematical games and other experiences have. Appropriate mathematical activities are essential building blocks to develop mathematically proficient students who demonstrate computational fluency (Van de Walle & Lovin, *Teaching Student-Centered Mathematics Grades K-3,* pg. 94). Remember, computational fluency includes efficiency, accuracy, and flexibility with strategies (Russell, 2000).

The kinds of experiences teachers provide to their students clearly play a major role in determining the extent and quality of students' learning. Students' understanding can be built by actively engaging in tasks and experiences designed to deepen and connect their knowledge. Procedural fluency and conceptual understanding can be developed through problem solving, reasoning, and argumentation (NCTM, P*rinciples and Standards for School Mathematics,* pg. 21). Meaningful practice is necessary to develop fluency with basic number combinations and strategies with multi-digit numbers. Practice should be purposeful and should focus on developing thinking strategies and a knowledge of number relationships rather than drill isolated facts (NCTM, *Principles and Standards for School Mathematics,* pg. 87). Do *not* subject any student to computation drills unless the student has developed an efficient strategy for the facts included in the drill (Van de Walle & Lovin, *Teaching Student-Centered Mathematics Grades K-3,* pg. 117). Drill can strengthen strategies with which students feel comfortable – ones they "own" – and will help to make these strategies increasingly automatic. Therefore, drill of strategies will allow students to use them with increased efficiency, even to the point of recalling the fact without being conscious of using a strategy. Drill without an efficient strategy present offers no assistance (Van de Walle & Lovin, *Teaching Student-Centered Mathematics Grades K-3,* pg. 117).

CAUTIONS

Sometimes teachers use games solely to practice number facts. These games usually do not engage children for long because they are based on students' recall or memorization of facts. Some students are quick to memorize, while others need a few moments to use a related fact to compute. When students are placed in situations in which recall speed determines success, they may infer that being "smart" in mathematics means getting the correct answer quickly instead of valuing the process of thinking. Consequently, students may feel incompetent when they use number patterns or related facts to arrive at a solution and may begin to dislike mathematics because they are not fast enough.

For students to become fluent in arithmetic computation, they must have efficient and accurate methods that are supported by an understanding of numbers and operations. "Standard" algorithms for arithmetic computation are one means of achieving this fluency.
– NCTM, *Principles and Standards for School Mathematics,* pg. 35

Overemphasizing fast fact recall at the expense of problem solving and conceptual experiences gives students a distorted idea of the nature of mathematics and of their ability to do mathematics.
– Seeley, *Faster Isn't Smarter: Messages about Math, Teaching, and Learning in the 21st Century,* pg. 95

Computational fluency refers to having efficient and accurate methods for computing. Students exhibit computational fluency when they demonstrate flexibility in the computational methods they choose, understand and can explain these methods, and produce accurate answers efficiently.
– NCTM, *Principles and Standards for School Mathematics,* pg. 152

Fluency refers to having efficient, accurate, and generalizable methods (algorithms) for computing that are based on well-understood properties and number relationships.
– NCTM, *Principles and Standards for School Mathematics,* pg. 144

INTRODUCE A GAME

A good way to introduce a game to the class is for the teacher to play the game against the class. After briefly explaining the rules, ask students to make the class's next move. Teachers may also want to model their strategy by talking aloud for students to hear his/her thinking. "I placed my game marker on 6 because that would give me the largest number."

Games are fun and can create a context for developing students' mathematical reasoning. Through playing and analyzing games, students also develop their computational fluency by examining more efficient strategies and discussing relationships among numbers. Teachers can create opportunities for students to explore mathematical ideas by planning questions that prompt students to reflect about their reasoning and make predictions. Remember to always vary or modify the game to meet the needs of your leaners. Encourage the use of the Standards for Mathematical Practice.

HOLDING STUDENTS ACCOUNTABLE

While playing games, have students record mathematical equations or representations of the mathematical tasks. This provides data for students and teachers to revisit to examine their mathematical understanding.

After playing a game, have students reflect on the game by asking them to discuss questions orally or write about them in a mathematics notebook or journal:

1. What skill did you review and practice?
2. What strategies did you use while playing the game?
3. If you were to play the game a second time, what different strategies would you use to be more successful?
4. How could you tweak or modify the game to make it more challenging?

A Special Thank-You

The development of the NC Department of Public Instruction Document, *Building Conceptual Understanding and Fluency Through Games* was a collaborative effort with a diverse group of dynamic teachers, coaches, administrators, and NCDPI staff. We are very appreciative of all of the time, support, ideas, and suggestions made in an effort to provide North Carolina with quality support materials for elementary level students and teachers. The North Carolina Department of Public Instruction appreciates any suggestions and feedback, which will help improve upon this resource. Please send all correspondence to **Denise Schulz** (denise.schulz@dpi.nc.gov)

GAME DESIGN TEAM

The Game Design Team led the work of creating this support document. With support of their school and district, they volunteered their time and effort to develop *Building Conceptual Understanding and Fluency Through Games*.

Erin Balga, Math Coach, Charlotte-Mecklenburg Schools
Robin Beaman, First Grade Teacher, Lenoir County
Emily Brown, Math Coach, Thomasville City Schools
Leanne Barefoot Daughtry, District Office, Johnston County
Ryan Dougherty, District Office, Union County
Paula Gambill, First Grade Teacher, Hickory City Schools
Tami Harsh, Fifth Grade teacher, Currituck County
Patty Jordan, Instructional Resource Teacher, Wake County
Tania Rollins, Math Coach, Ashe County
Natasha Rubin, Fifth Grade Teacher, Vance County
Dorothie Willson, Kindergarten Teacher, Jackson County
Kitty Rutherford, NCDPI Elementary Consultant
Denise Schulz, NCDPI Elementary Consultant
Allison Eargle, NCDPI Graphic Designer
Renée E. McHugh, NCDPI Graphic Designer

STANDARDS FOR MATHEMATICAL PRACTICE

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

OPERATIONS AND ALGEBRAIC THINKING

Write and interpret numerical expressions.

NC.5.OA.2 Write, explain, and evaluate numerical expressions involving the four operations to solve up to two-step problems. Include expressions involving:
- Parentheses, using the order of operations.
- Commutative, associative and distributive properties.

Analyze patterns and relationships.

NC.5.OA.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.
- Graph the ordered pairs on a coordinate plane.

NUMBER AND OPERATIONS IN BASE TEN

Understand the place value system.

NC.5.NBT.1 Explain the patterns in the place value system from one million to the thousandths place.
- Explain that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.
- Explain patterns in products and quotients when numbers are multiplied by 1,000, 100, 10, 0.1, and 0.01 and/or divided by 10 and 100.

NC.5.NBT.3: Read, write, and compare decimals to thousandths.
- Write decimals using base-ten numerals, number names, and expanded form.
- Compare two decimals to thousandths based on the value of the digits in each place, using >, =, and < symbols to record the results of comparisons.

Perform operations with multi-digit whole numbers.

NC.5.NBT.5 Demonstrate fluency with the multiplication of two whole numbers up to a three-digit number by a two-digit number using the standard algorithm.

NC.5.NBT.6 Find quotients with remainders when dividing whole numbers with up to four-digit dividends and two-digit divisors using rectangular arrays, area models, repeated subtraction, partial quotients, and/or the relationship between multiplication and division. Use models to make connections and develop the algorithm.

Perform operations with decimals.

NC.5.NBT.7 Compute and solve real-world problems with multi-digit whole numbers and decimal numbers.
- Add and subtract decimals to thousandths using models, drawings or strategies based on place value.
- Multiply decimals with a product to thousandths using models, drawings, or strategies based on place value.
- Divide a whole number by a decimal and divide a decimal by a whole number, using repeated subtraction or area models. Decimals should be limited to hundredths.
- Use estimation strategies to assess reasonableness of answers.

NUMBER AND OPERATIONS – FRACTIONS

Use equivalent fractions as a strategy to add and subtract fractions.

NC.5.NF.1 Add and subtract fractions, including mixed numbers, with unlike denominators using related fractions: halves, fourths and eighths; thirds, sixths, and twelfths; fifths, tenths, and hundredths.
- Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.
- Solve one- and two-step word problems in context using area and length models to develop the algorithm. Represent the word problem with an equation.

Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

NC.5.NF.3 Use fractions to model and solve division problems.
- Interpret a fraction as an equal sharing context, where a quantity is divided into equal parts.
- Model and interpret a fraction as the division of the numerator by the denominator.
- Solve one-step word problems involving division of whole numbers leading to answers in the form of fractions and mixed numbers, with denominators of 2, 3, 4, 5, 6, 8, 10, and 12, using area, length, and set models or equations.

NC.5.NF.4 Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction, including mixed numbers.
- Use area and length models to multiply two fractions, with the denominators 2, 3, 4.
- Explain why multiplying a given number by a fraction greater than 1 results in a product greater than the given number and when multiplying a given number by a fraction less than 1 results in a product smaller than the given number.
- Solve one-step word problems involving multiplication of fractions using models to develop the algorithm.

NC.5.NF.7 Solve one-step word problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions using area and length models, and equations to represent the problem.

MEASUREMENT AND DATA

Convert like measurement units within a given measurement system.

NC.5.MD.1 Given a conversion chart, use multiplicative reasoning to solve one-step conversion problems within a given measurement system.

Represent and interpret data.

NC.5.MD.2 Represent and interpret data.

- Collect data by asking a question that yields data that changes over time.
- Make and interpret a representation of data using a line graph.
- Determine whether a survey question will yield categorical or numerical data, or data that changes over time.

Understand the concepts of volume.

NC.5.MD.4 Recognize volume as an attribute of solid figures and measure volume by counting unit cubes, using cubic centimeters, cubic inches, cubic feet, and improvised units.

NC.5.MD.5 NC.5.MD.5 Relate volume to the operations of multiplication and addition.

- Find the volume of a rectangular prism with wholenumber 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.
- Build understanding of the volume formula for rectangular prisms with whole-number edge lengths in the context of solving problems.
- Find volume of solid figures with one-digit dimensions composed of two non-overlapping rectangular prisms.

GEOMETRY

Understand the coordinate plane.

NC.5.G.1 Graph points in the first quadrant of a coordinate plane, and identify and interpret the x and y coordinates to solve problems.

Classify quadrilaterals.

NC.5.G.3 Classify quadrilaterals into categories based on their properties.

- Explain that attributes belonging to a category of quadrilaterals also belong to all subcategories of that category.
- Classify quadrilaterals in a hierarchy based on properties.

Table of Contents

Operations and Algebraic Thinking

Number and Operations in Base Ten

Number and Operations – Fractions

Measurement and Data

Geometry

Online Games for Each Category

Operation Target

Building Fluency: creating equations and the use of parentheses.

Materials: digit cards (0-9) and a recording sheet per player

Number of Players: 2

Directions:

1. The cards are shuffled and placed face down in a stack.
2. The first player draws three cards.
3. The player decides how to arrange the three numbers and which operations to use to achieve a score equal to or as close the "target number" as possible for Round One.
4. The player then records the number sentence, using parentheses if necessary, in the space provided on their recording sheet
5. The numbers are written in the triangles and the chosen operations in the circles.
6. The player records the answer in the space provided and the difference in the "How Close?" column.
7. The cards are discarded to one side. These are reshuffled and used again if needed.
8. The other player has a turn.
9. The player who is closer to the target at the end of a round is the winner. This is indicated with a check mark.
10. If a round ends in a tie, both players record a win for that round.
11. The player who wins the greater number of rounds is the overall winner.

Variation/Extension: Students can use number tiles or dice (0-9). Students can make shorter or longer equations. Once students understand how this game works they can record the equation in their math notebook instead of using recording sheet.

△ = NUMBER ○ = OPERATION * USE PARENTHESES IF NECESSARY

Round	Number Sentence	Target	How Close?
1	△ ○ △ ○ △ = ____	5	
2	△ ○ △ ○ △ = ____	10	
3	△ ○ △ ○ △ = ____	20	
4	△ ○ △ ○ △ = ____	50	
5	△ ○ △ ○ △ = ____	60	

Round	Number Sentence	Target	How Close?
1	△ ○ △ ○ △ = ____		
2	△ ○ △ ○ △ = ____		
3	△ ○ △ ○ △ = ____		
4	△ ○ △ ○ △ = ____		
5	△ ○ △ ○ △ = ____		

Round	Number Sentence	Target	How Close?
1	△ ○ △ ○ △ = ____		
2	△ ○ △ ○ △ = ____		
3	△ ○ △ ○ △ = ____		
4	△ ○ △ ○ △ = ____		
5	△ ○ △ ○ △ = ____		

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

Order Up

Building Fluency: compare decimals to thousands

Materials: recording sheet, digit cards (or 0-9 die)

Number of Players: 2-4

Directions:

1. The first player selects 6 digit cards and makes the largest possible six-digit number with those digits using a decimal. Example: cards show these digits: 6, 4, 3, 3, 2, 1, this order makes the largest possible number for those digits.
2. The player writes that number on line 1.
3. The second player selects 6 digit cards and makes the smallest possible number for those digits.
4. The player writes that number on line 10.
5. The next player selects 6 digit cards and must make a number that falls between the other two. They can choose any line to place that number on.
6. The next player selects 6 digit cards and makes a number using those digits that could be placed on an empty line between any two existing numbers.
7. Game continues until a number is correctly placed on each line. (All 10 lines contain a number and they are in the correct order), OR players cannot place a number correctly on any of the empty lines.

Variation/Extension: Once students understand the game they can create their own recording sheet in their math notebook. Teacher can modify this game by changing the number of digits or number of lines.

1 ____________________

2 ____________________

3 ____________________

4 ____________________

5 ____________________

6 ____________________

7 ____________________

8 ____________________

9 ____________________

10 ____________________

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

Race to a Meter: A Decimal Game

Building Fluency: read, write and compare decimals to a thousand

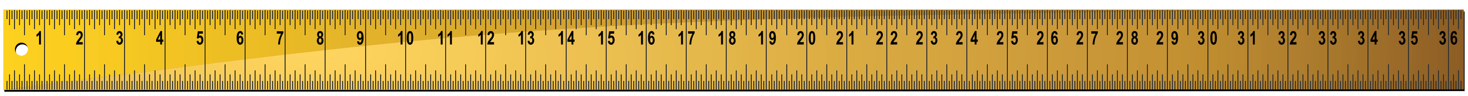
Materials: meter stick, base-10 blocks (40 small cubes and 25 longs), recording sheet, and playing cards

Number of Players: 2

Directions:

1. Players play on opposite sides of the meter stick.
2. Players begin at zero, and place the appropriate number of rods or cubes along the edge of the meter stick according to the number selected from the pile of cards.
3. When a player has 10 or more cubes, they should trade them for a ten-cm rod.
4. After each round, each player should record the move on the recording sheet.
5. The winner is the player to reach the end of the meter stick. Player does not have to land exactly on one meter, but may finish beyond the end of the meter stick.

Variation/Extension: Student may use decimal or fraction dice. Students may also create additional cards and extend the length of the meter stick to two meters. Students may also start at the end of the meter stick and subtract the number selected – first player to get to 0 wins.



PLAYER 1

NUMBER ON CARD	TOTAL SCORE TO THIS POINT

PLAYER 2

NUMBER ON CARD	TOTAL SCORE TO THIS POINT

$\frac{1}{10}$	$\frac{5}{100}$	$\frac{10}{100}$	$\frac{5}{10}$
$\frac{10}{10}$	$\frac{2}{10}$	$\frac{50}{100}$	$\frac{2}{100}$
$\frac{8}{10}$	$\frac{8}{100}$	.1	.2
.5	.50	.25	.05
.01	.04	.6	.8

Sum with Decimals

Building Fluency: read, write and compare decimals, add decimals to the hundredth place and use concrete models to represent decimals.

Materials: Pair of dice and recording sheet

Number of Players: 2

Directions:

1. Roll 2 dice and used the numbers rolled to create a decimal to the hundredths place. Example, if you roll a 3 and a 4, you would form the decimal .34 or .43, go to the first grid (on recording sheet) and shade in that fraction of the grid.
2. Roll again and shade in the decimal created on the second grid.
3. Add both boards, highest total decimal wins.

Variation/Extension: Students could compare each decimal represented on the grid. Teacher can reduce or increased the number of grids. An additional recording sheet has been added for adding 4 decimals for your convenience, if you choose to use it. Teacher may modify by adding decimals together on one grid using different color pencils to represent the different decimals.

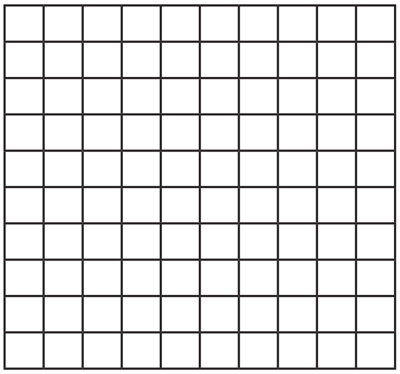
PLAYER 1

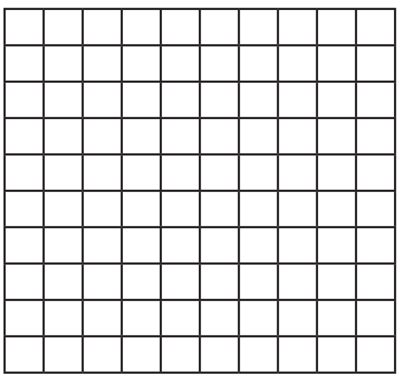
TOTAL

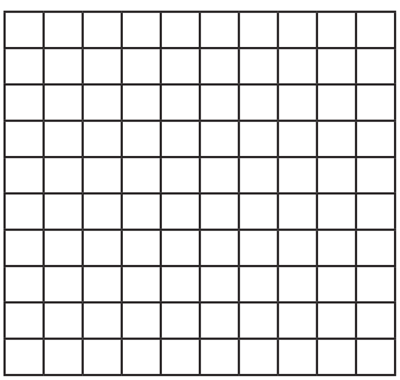
PLAYER 2

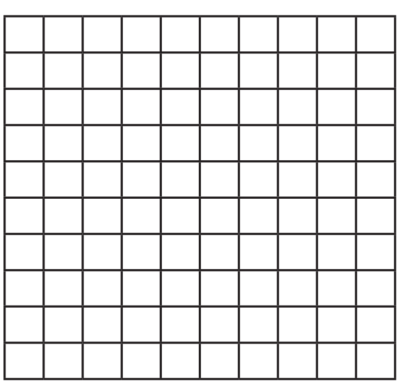
TOTAL

PLAYER 1



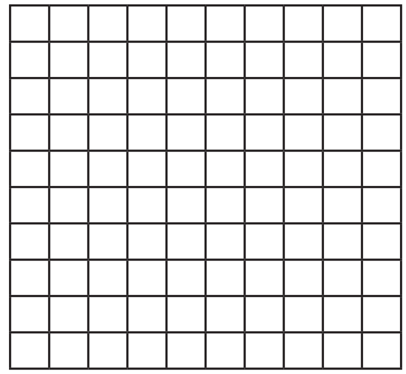


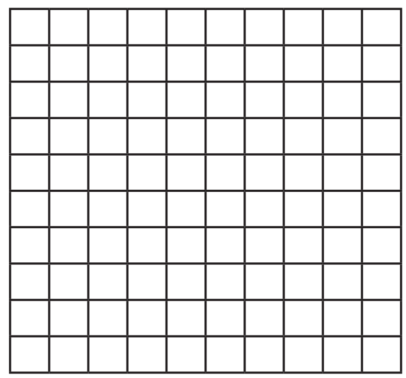


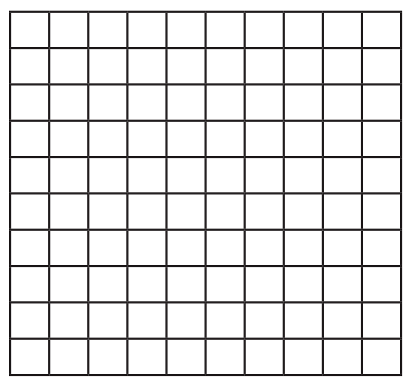


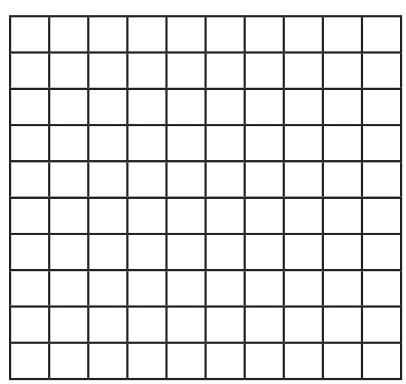
TOTAL

PLAYER 2









TOTAL

Sum with Decimals – Part II

Building Fluency: read, write and compare decimals, add decimals to the thousandths place and use concrete models to represent decimals.

Materials: 3 dice and recording sheet

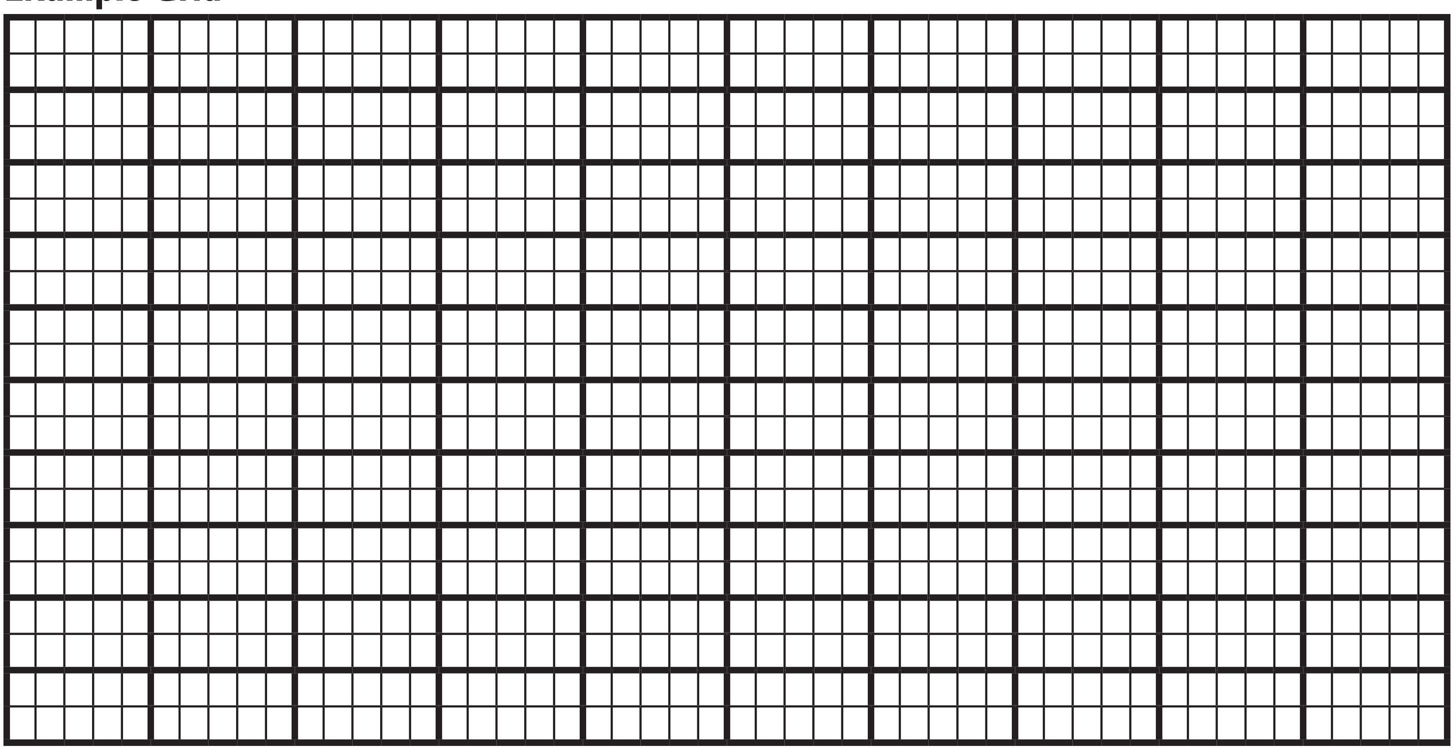
Number of Players: 2

Directions:

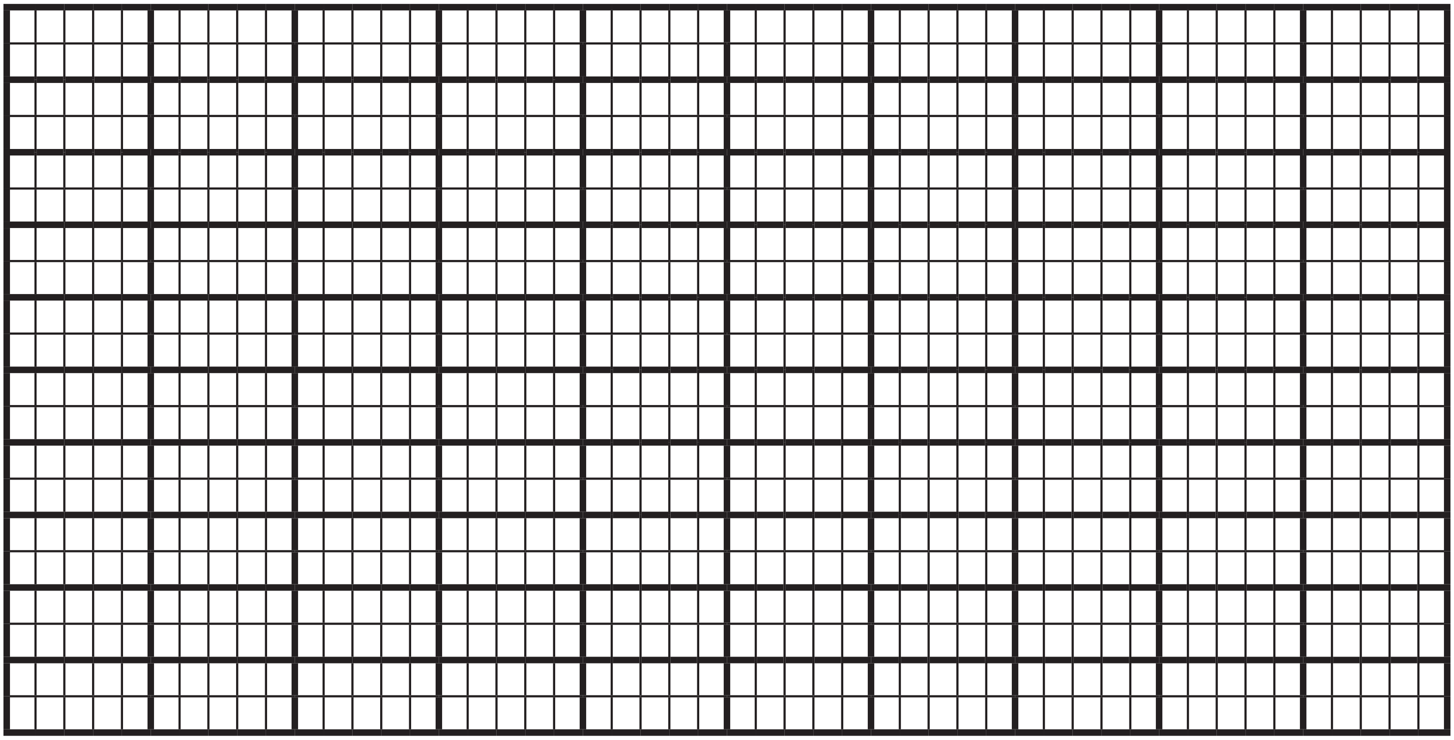
1. Roll 3 dice and make a three digit decimal to the thousandths place. For example, if you roll a 4, 3 and a 4, you would form the decimal .434, go to the first grid (on grid sheet) and shade in that fraction of the grid.
2. Roll again and shade in the decimal created on the second grid.
3. Add both boards, highest decimal wins.

Variation/Extension: Students could compare each decimal represented on the grid. Teacher may reduce or increased the number of grids. Teacher may modify this game by adding decimals together on one grid using different color pencils to represent the different decimals.

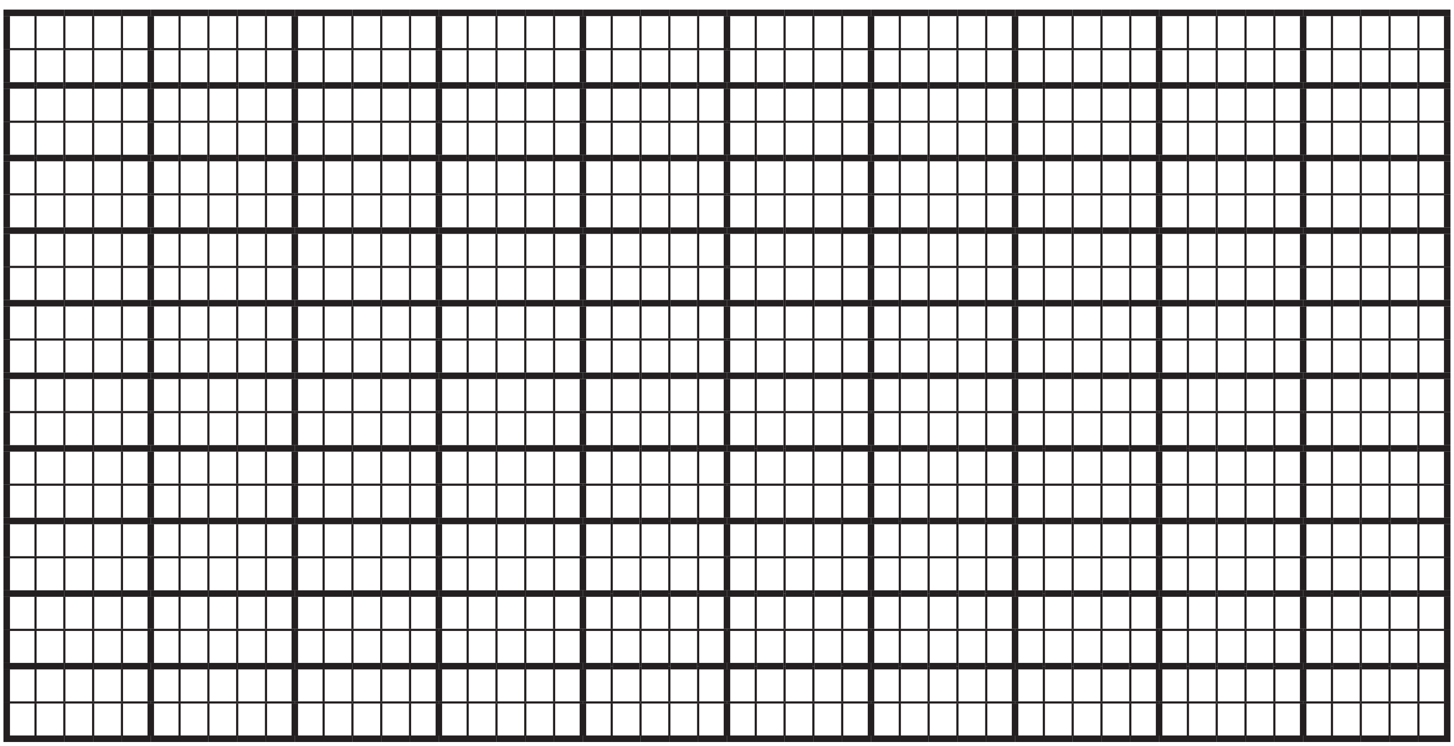
Example Grid



PLAYER 1



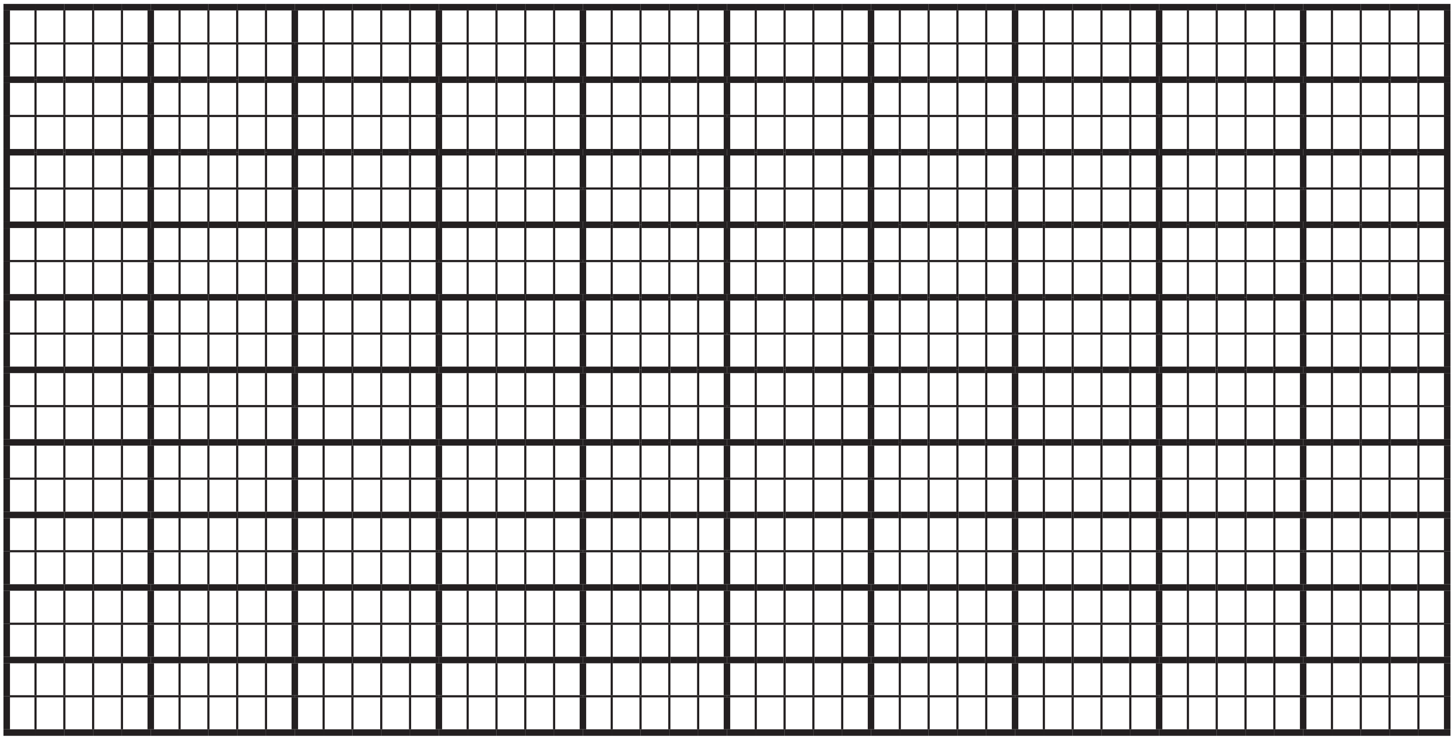
Decimal 1: _______________



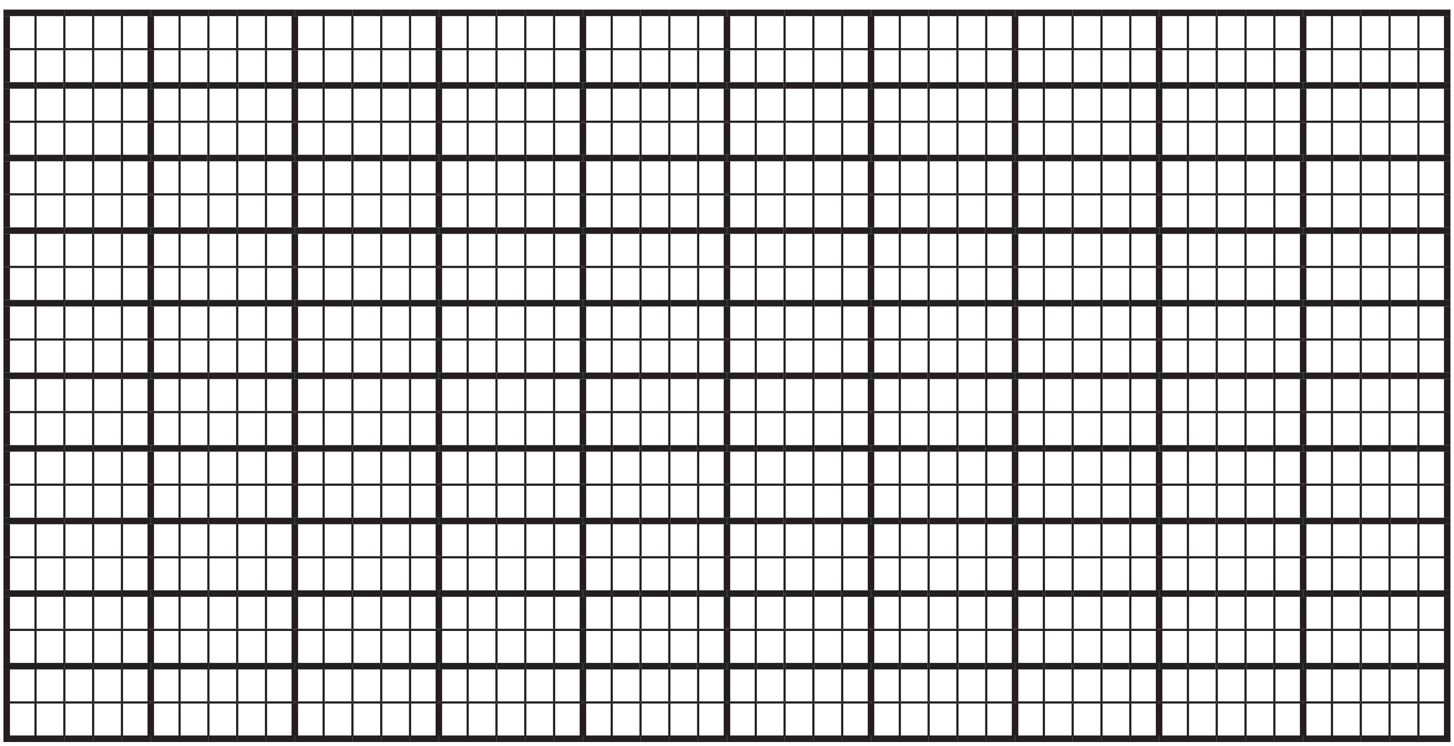
Decimal 2: _______________

_______________ + _______________ = [ ]

PLAYER 2



Decimal 1: _______________



Decimal 2: _______________

_______________ + _______________ = [ ]

Pieces of Eight

Building Fluency: coordinates and compare decimals

Materials: pair of dice, gameboard, paper

Number of Players: 2-4

Directions:

1. Each player rolls dice and chooses coordinate on the grid.
   Example: if the player rolls a 1 and 3, the player may choose, (1, 3) or (3, 1).
2. After each player is on a coordinate, they compare numbers.
3. The player with the 8 in the place with the largest value wins the round. In case of a tie the player with the largest number wins.
4. Play 10 rounds.
5. The player who wins the most rounds wins the game.

Variation/Extension: Students can record the value of the eight and total the 10 rounds, student with the highest sum wins or lowest sum wins.

6	284.935	453.829	359.842	259.348	895.432	935.428
5	245.893	529.438	389.452	594.832	485.392	423.985
4	948.325	942.385	843.529	938.425	824.593	284.953
3	823.459	538.924	325.984	829.534	532.984	593.824
2	982.453	954.823	342.958	583.249	935.248	358.294
1	423.589	498.235	358.924	394.285	459.238	834.529
	1	**2**	**3**	**4**	**5**	**6**

Race to 10 or Bust

Building Fluency: efficient mental strategies when adding and subtracting decimals. Students may begin to see that strategies that work well with whole numbers, work equally well with decimal, for example, 3.8 + 0.6 is the same as 3.8 + 0.2 + 0.4.

Materials: die and recording sheet

Number of Players: 2

Directions:

1. The player rolls the number cube and calls out the number.
2. Each player individually chooses whether to use the number as ones or as tenths. Once a decision has been made, it cannot be changed.
   Example: The roller rolls 5. Player 1 may record it as 5 ones (5) or as 5 tenths (0.5).
3. The players record their choice in the appropriate column and keeps a cumulative total in the 'Total' column on their recording sheet.
4. Play continues in this way for eight rounds.
5. The player who scores 10 or is closet to (but not beyond) 10 is the winner.

Variation/Extension: Students could change the total number – 100 or use a dice (0-9). Number of rounds could also be changed – more or less. Once students understand how this game works they can create their own table in their math notebook instead of using recording sheet. Additional recording sheets have been included for your convenience.

PLAYER 1

ONES	TENTHS	TOTAL

PLAYER 2

ONES	TENTHS	TOTAL

PLAYER 1

ONES	TENTHS	TOTAL

ONES	TENTHS	TOTAL

ONES	TENTHS	TOTAL

PLAYER 2

ONES	TENTHS	TOTAL

ONES	TENTHS	TOTAL

ONES	TENTHS	TOTAL

Race to 1 or Bust

Building Fluency: add decimals

Materials: die and recording sheet

Number of Players: 2

Directions:

1. Each player takes their turn rolling the die.
2. After the roll, every player places the digit rolled in any box of their grid. This must be done before next roll.
3. Once the table is totally completed, add up the decimals to find the winner.

Variation/Extension: Once students understand how this game works they can create their own recording table in their math notebook instead of using recording sheet. Teachers may modify the game by changing the number of rows in the table. Additional recording sheets have been added for you convenience.

PLAYER 1

TENTHS	HUNDREDTHS
TOTAL:	TOTAL:

TENTHS	HUNDREDTHS
TOTAL:	TOTAL:

PLAYER 2

TENTHS	HUNDREDTHS
TOTAL:	TOTAL:

TENTHS	HUNDREDTHS
TOTAL:	TOTAL:

PLAYER 1

TENTHS	HUNDREDTHS
TOTAL:	TOTAL:

TENTHS	HUNDREDTHS
TOTAL:	TOTAL:

TENTHS	HUNDREDTHS
TOTAL:	TOTAL:

TENTHS	HUNDREDTHS
TOTAL:	TOTAL:

PLAYER 2

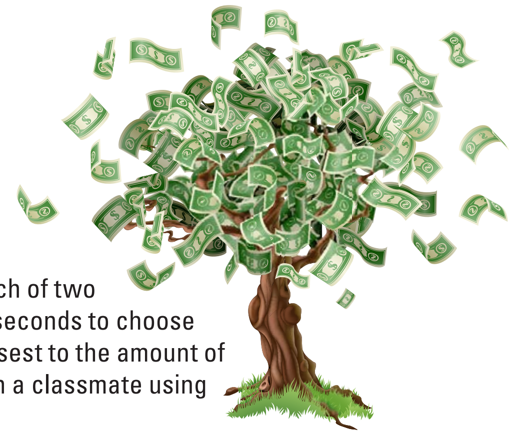
TENTHS	HUNDREDTHS
TOTAL:	TOTAL:

TENTHS	HUNDREDTHS
TOTAL:	TOTAL:

TENTHS	HUNDREDTHS
TOTAL:	TOTAL:

TENTHS	HUNDREDTHS
TOTAL:	TOTAL:

Shopping Spree



Building Fluency: adding and subtracting decimals

Materials: timer, recording sheet and price tag sheet

Number of Players: 2

Directions: Karla likes to watch a game show called "Shopping Spree". On the show, each of two contestants is given a certain amount of money to spend. Then each contestant has 30 seconds to choose from a list of prizes whose costs are given. The winner is the contestant who comes closest to the amount of money they are given to spend without going over. Play the game "Shopping Spree" with a classmate using the list of prizes and costs on the next page.

1. Decide who will be Contestant 1 and who will be Contestant 2.
2. As Contestant 1 chooses price tags, Contestant 2 records the choices. Example: Scooter $5,535.89
3. Then switch places and let Contestant 2 choose while Contestant 1 records.
4. After both contestants have chosen their price tags, add the costs and determine who came the closest without going over.
5. Remember, you have 30 seconds to make your choices.

Variation/Extension: Change the amounts for the two contestants. Do you think the game could be unfair depending upon the amounts for the contestants to spend? Explain your thinking. Use the sales catalogs and create your own Shopping Spree.

CONTESTANT 1: $16,789.50	CONTESTANT 2: $20,005.99

Camera
$148.90

Car
$15,599.49

Stereo
$999.99

RV
$15,675.35

TV
$788.25

Scooter
$5,535.89

DVD
$357.45

Bike
$350.50

Microwave
$455.65

Bedroom Suite
$1,209.70

Cellphone
$217.25

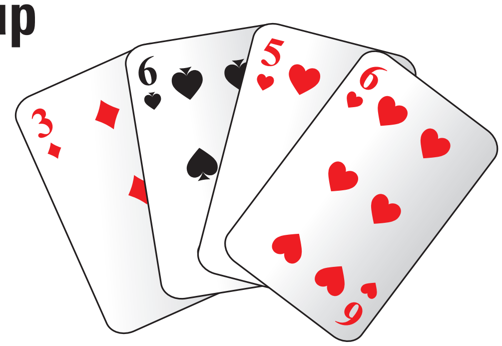
Jewelry
$9.876.95

Vacation
$5,995.65

Refrigerator
$899.95

Boat
$10,785.50

Multiplication Mix-up



Building Fluency: multiply multi-digit whole numbers

Materials: deck of cards, calculator

Number of Players: 2

Directions:

1. Remove the face cards from a deck of playing cards. The ace represents one and all other cards carry their numerical values.
2. Deal each player three cards.
3. Each player must use two of the cards to make a two digit number.
4. The third card will be the multiplier.
   Example, if a player draws a 1, 5, and 8, he could use the 1 and the 5 to make the two digit number 51 and multiply by 8 for a total of 408.
5. The player with the largest product gets the cards.

Variation/Extension: Students may want to create their own recording table in their math notebook to record their equations showing the standard algorithm or strategy used to solve the equation. Students may also want to use a calculator to check their work.

Double Dutch Treat

Building Fluency: add and divide whole numbers

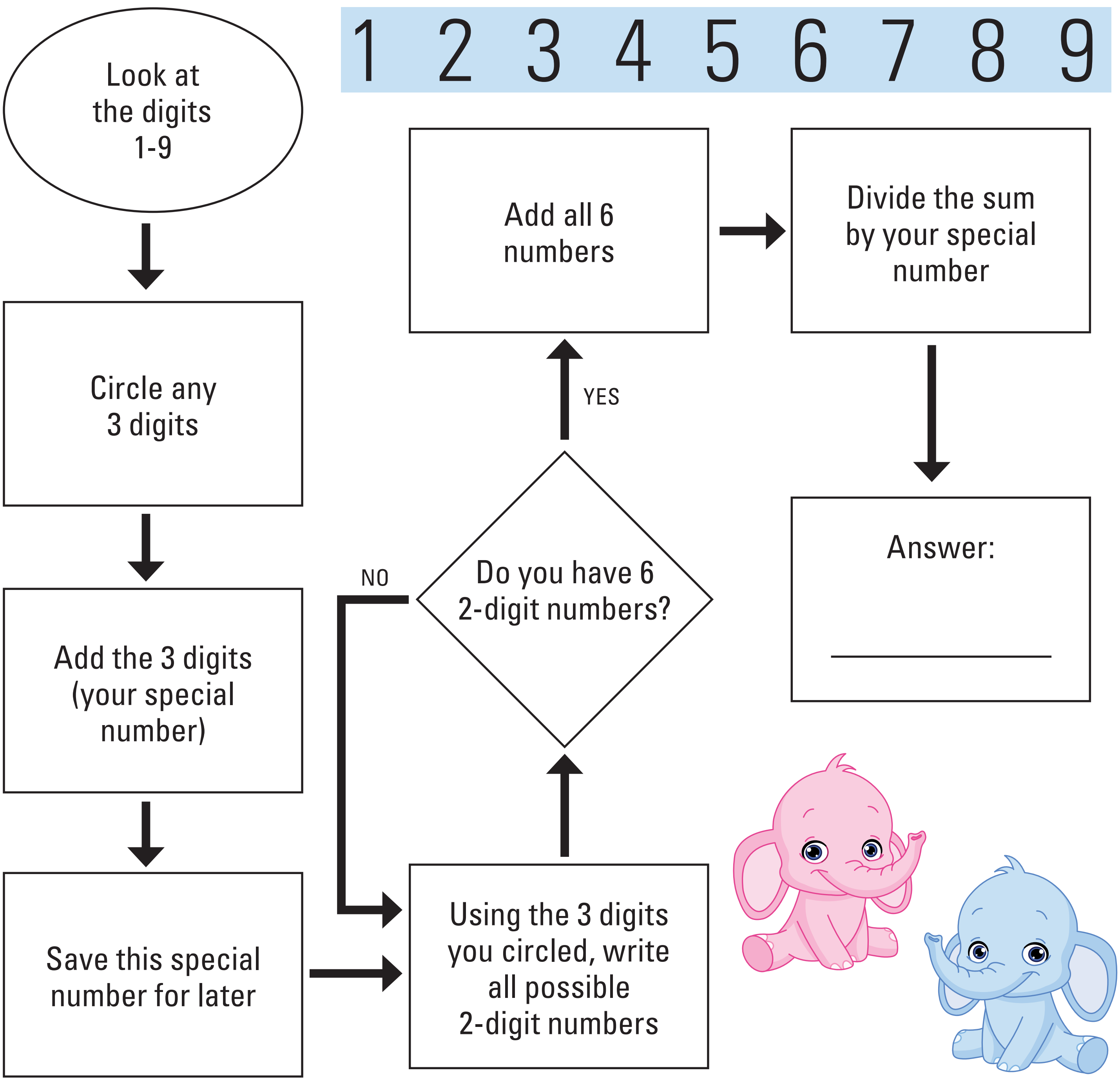
Materials: game board

Number of Players: 2

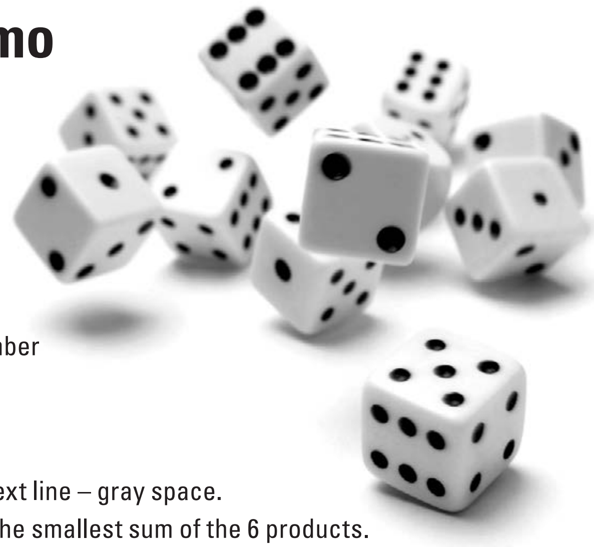
Directions:

1. Follow the steps laid out on the game board.
2. What do you notice?

Variation/Extension: Students may want to record their work in their math notebook. Students create their own version of this game, result ending with an even number or odd numbers etc…



Decimal Dynamo



Building Fluency: adding and multiplying decimals

Materials: 4 dice and recording sheet, calculator

Number of Players: 2

Directions:

1. Roll 4 die (or one die 4 times). Use these numbers to create a 2-digit number and a whole number with a decimal.
   Example: [6] [4] [2] [5] 62 and 5.4 or 46 and 2.5
2. Record the numbers you create for each round.
3. Multiply these numbers and record the product for each round on the next line – gray space.
4. At the end of 6 rounds, add the products. The winner is the player with the smallest sum of the 6 products.

Variation/Extension: The winner with the greatest sum. Students may need to use a calculator to check their work.

PLAYER 1

________ **X** ________	
Round 1 Product →	
________ **X** ________	
Round 2 Product →	
________ **X** ________	
Round 3 Product →	
________ **X** ________	
Round 4 Product →	
________ **X** ________	
Round 5 Product →	
________ **X** ________	
Round 6 Product →	
TOTAL OF ALL PRODUCTS ________	

PLAYER 2

________ **X** ________	
Round 1 Product →	
________ **X** ________	
Round 2 Product →	
________ **X** ________	
Round 3 Product →	
________ **X** ________	
Round 4 Product →	
________ **X** ________	
Round 5 Product →	
________ **X** ________	
Round 6 Product →	
TOTAL OF ALL PRODUCTS ________	

Race to the Finish Line

Building Fluency:

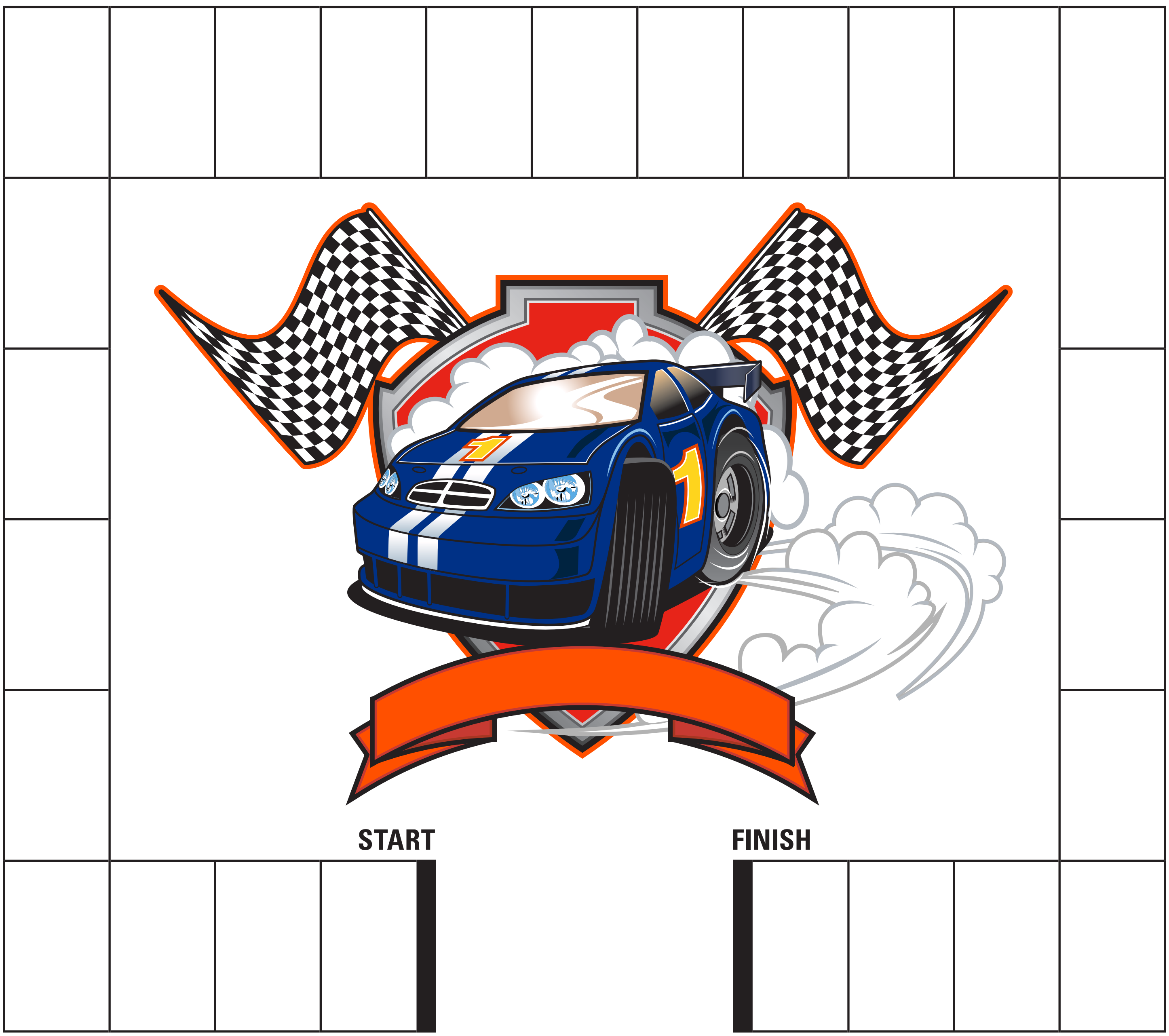
Materials: gameboard, gamemarker, die and game cards, piece of paper, answer slip

Number of Players: 2

Directions:

1. Players place marker on the starting space.
2. Player 1 gets cards 1-12 with answer slip 1 and Player 2 gets cards 13-24 with answer slip 2.
3. Place game cards face down. Players take turns drawing a card and answering the question.
4. If the answer is correct, the player rolls a die and moves forward that number of spaces.
5. Player that crosses the finish line first is the winner.

Variation/Extension: Student may want to create their own set of game cards or add to the set of cards. Additional blank cards have been added for your convenience.



1

Race to the Finish Line

Which of these is the most reasonable estimate for 0.6 x 0.5?

a. 30 b. 3 c. 0.3

2

Race to the Finish Line

Which of these is the most reasonable estimate for 16 ÷ 0.51?

a. 8 b. 30 c. 0.8

3

Race to the Finish Line

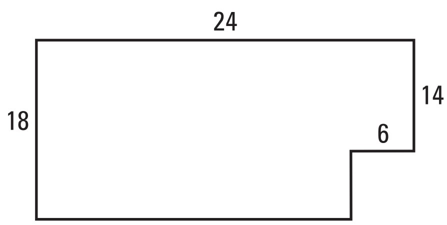
Which is the most reasonable estimate for 2.54 ÷ 0.5?

a. 50 b. 5 c. 0.5

4

Race to the Finish Line

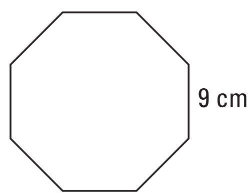
What is the perimeter of this figure?



5

Race to the Finish Line

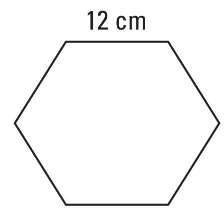
What is the perimeter of this regular octagon?



6

Race to the Finish Line

If the sides of this regular hexagon are halved, what is the perimeter?



7

Race to the Finish Line

Which of these is the most reasonable estimate for 109 x 0.4?

a. 400 b. 45 c. 405

8

Race to the Finish Line

Where should you place the decimal point in the middle number so that the 3 numbers are in order from *largest* to *smallest*?

110, 714, 42

9

Race to the Finish Line

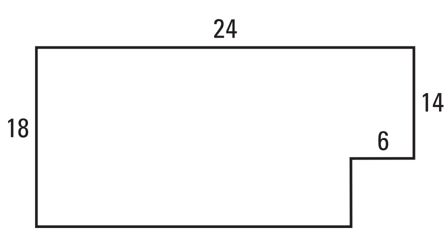
Which is the most reasonable estimate for 0.54 x 54?

a. 250 b. 25 c. 2.50

10

Race to the Finish Line

What is the area of this figure?



11

Race to the Finish Line

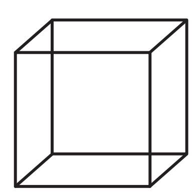
Where should you place the decimal point in the middle number so that the 3 numbers are in order from *smallest* to *largest*?

19.7, 514, 122

12

Race to the Finish Line

If the sides of a cube are doubled, how many vertices will it have?



ANSWER SLIP 1 **1.** C **2.** B **3.** B **4.** 84 **5.** 72 cm **6.** 72 cm **7.** B **8.** 71.4 **9.** B **10.** 408 **11.** 51.4 **12.** 8 Vertices

13

Race to the Finish Line

Which of these is the most reasonable estimate for 25 x 0.6?

a. 1.5 b. 15 c. 150

14

Race to the Finish Line

Where should you place the decimal point in the middle number so that the 3 numbers are in order from *largest* to *smallest*?

110, 714, 42

15

Race to the Finish Line

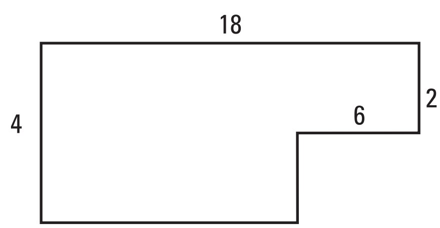
Which is the most reasonable estimate for 150.21 - 40.5?

a. 100 b. 110 c. 15

16

Race to the Finish Line

What is the area of this figure?



17

Race to the Finish Line

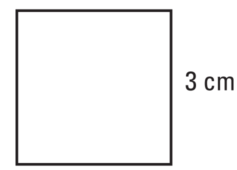
Where should you place the decimal point in the middle number so that the 3 numbers are in order from *smallest* to *largest*?

4, 615, 12.2

18

Race to the Finish Line

If the sides of this square are doubled, what is the perimeter?



19

Race to the Finish Line

Which of these is the most reasonable estimate for 38 x 0.8?

a. 30 b. 40 c. 3.8

20

Race to the Finish Line

Where would you place the decimal point in the middle number so that the 3 numbers are in order from *largest* to *smallest*?

10, 314, 2

21

Race to the Finish Line

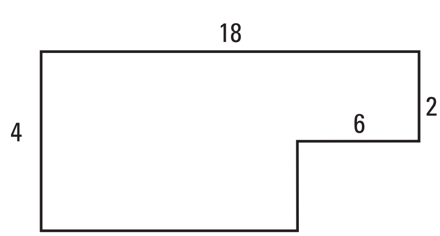
Which is the most reasonable estimate for 6.21 + 4.18?

a. 10 b. 100 c. 1

22

Race to the Finish Line

What is the perimeter of this figure?



23

Race to the Finish Line

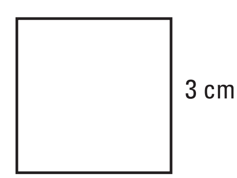
Where should you place the decimal point in the middle number so that the 3 numbers are in order from *smallest* to *largest*?

10, 6275, 100

24

Race to the Finish Line

If the sides of this square are doubled, what is the area?



ANSWER SLIP 2 **13.** B **14.** 71.4 **15.** 110 **16.** 60 **17.** 6.15 **18.** 24 cm **19.** B **20.** 3.14 **21.** A **22.** 44 **23.** 62.75 **24.** 36 cm^2

Parts of a Whole

Building Fluency: multiplication of whole number by a fractions

Materials: whole number die (1-6), fraction circle, and fraction cards or fraction die or spinner

Number of Players: 2

Directions:

1. Player rolls a standard whole number die, and spins the spinner.
2. The standard die represents the number of groups, and the spinner represents the fraction in each group. Example: A roll of 3 on the standard die, and spin $\frac{1}{4}$ on the spinner would be represented 3 groups with $\frac{1}{4}$.
3. Use fraction circles to help determine the product for each round.
4. If your result is 1 or more, you receive a star.
5. Play several rounds and count the stars you have collected.
6. The player with the most stars collected is the winner.

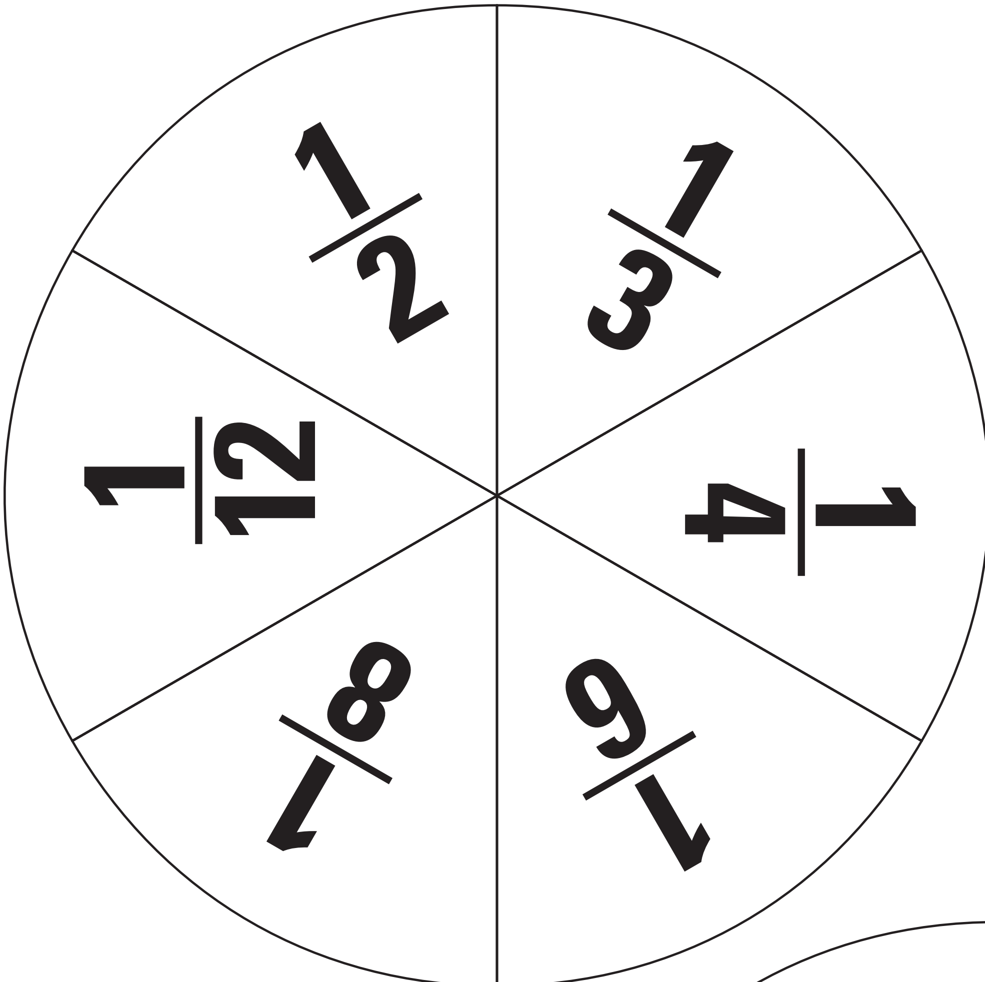
Variation/Extension: Student may want to modify fractions on spinner or use a die 0-9. A blank spinner and fraction circles are added for your convenience. Teacher may also want students to add the products. Students may want to write coordinating problems to fit each equation.

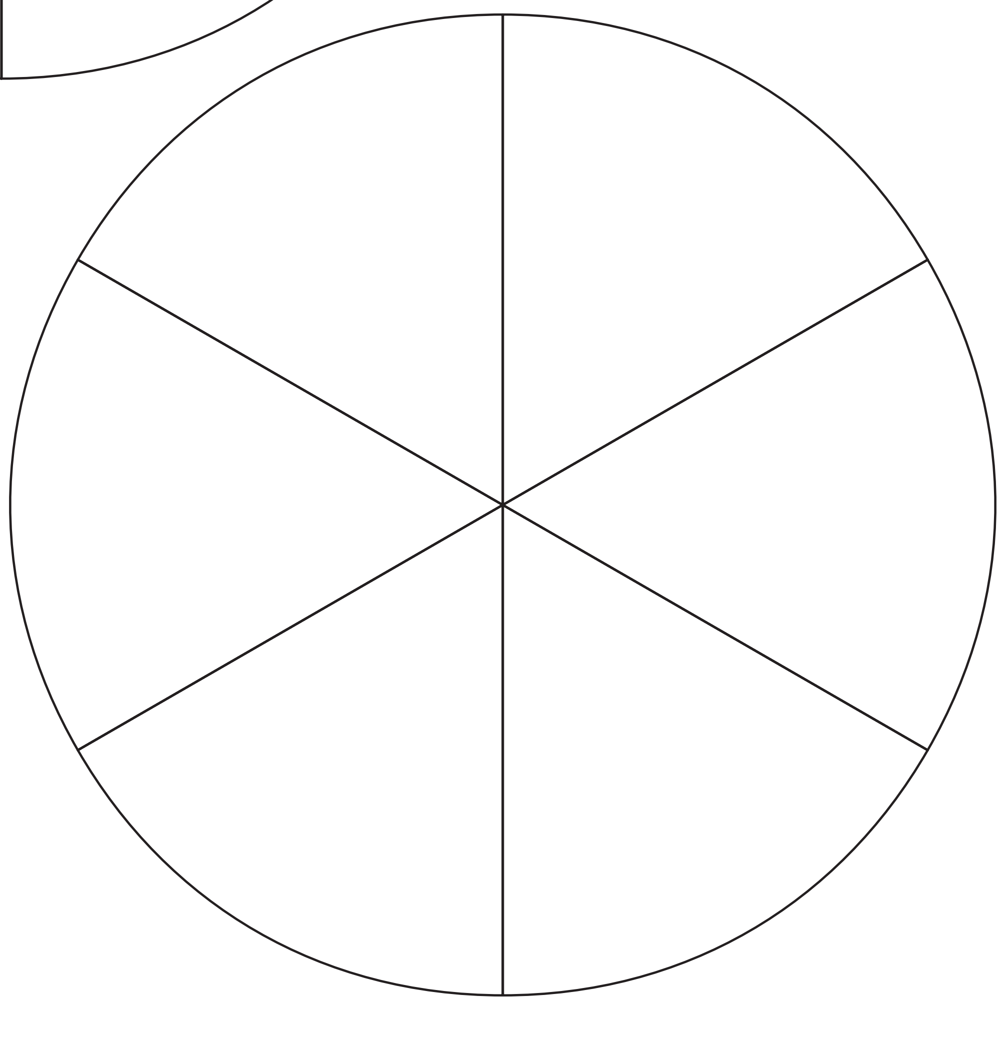
PLAYER 1

ROLL	SPIN	EQUATION

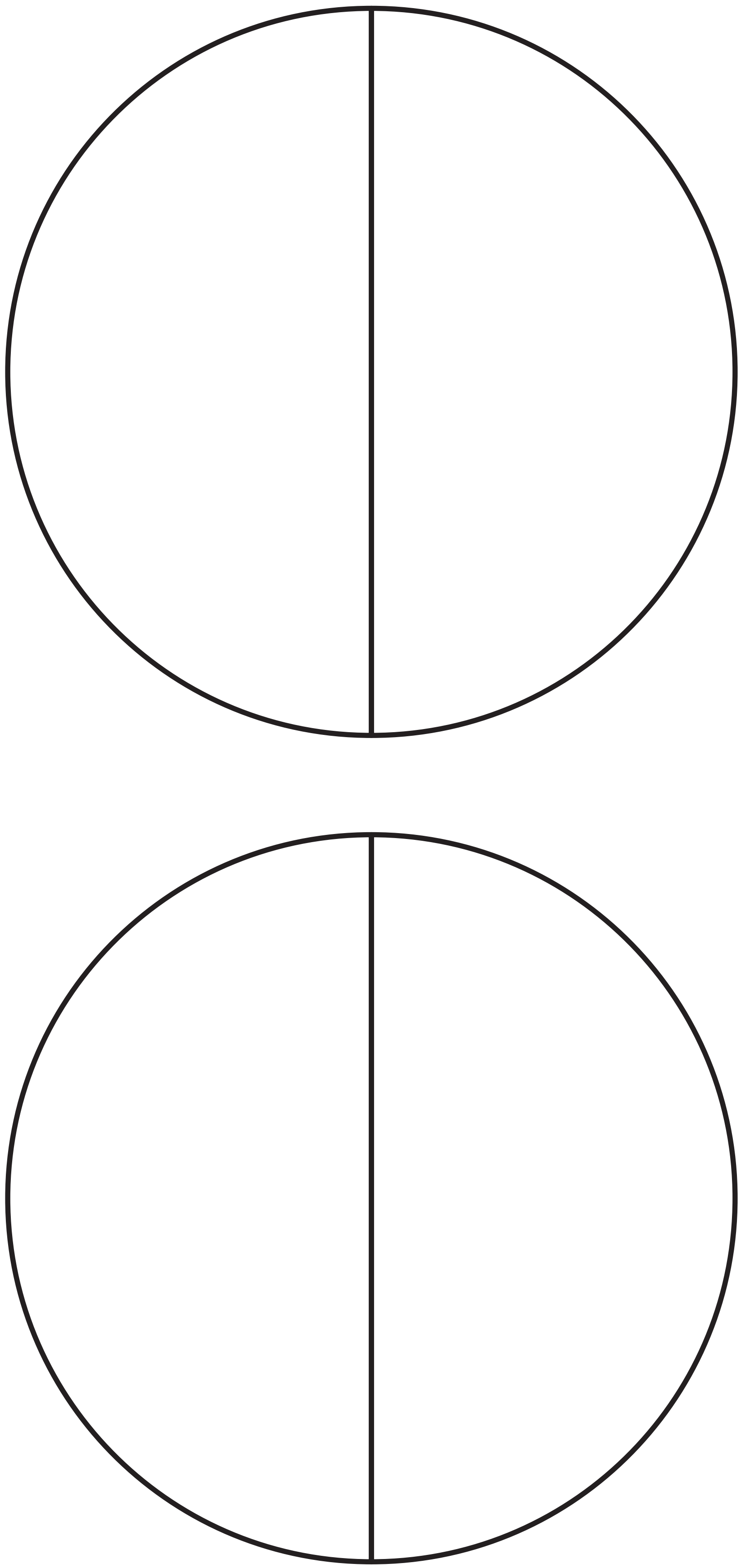
PLAYER 2

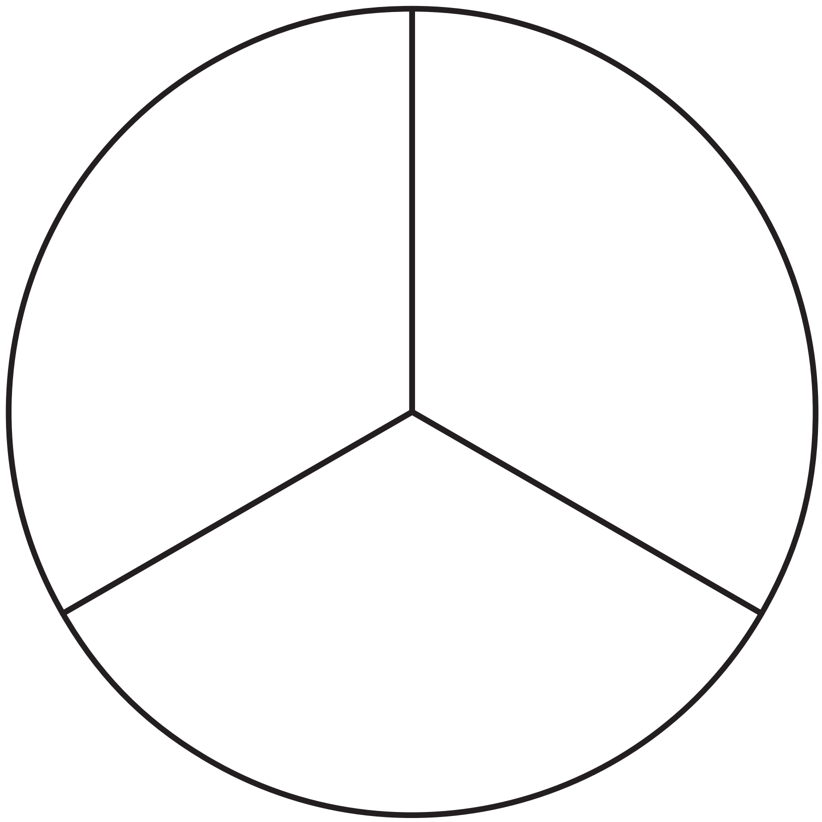
ROLL	SPIN	EQUATION

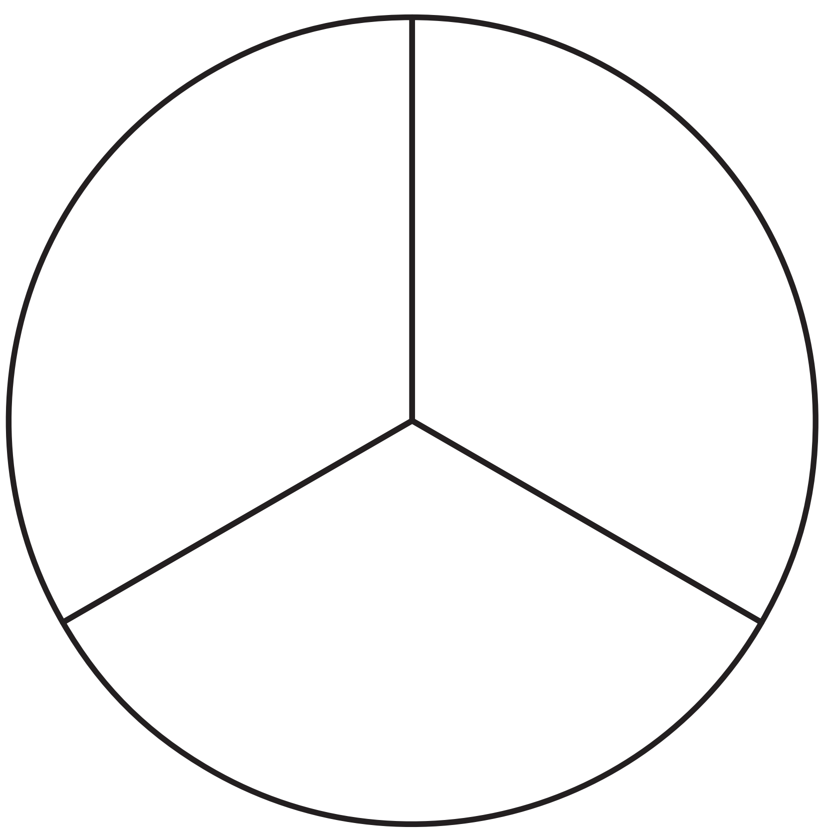

1/2
1/3
1/4
1/6
1/8
1/12

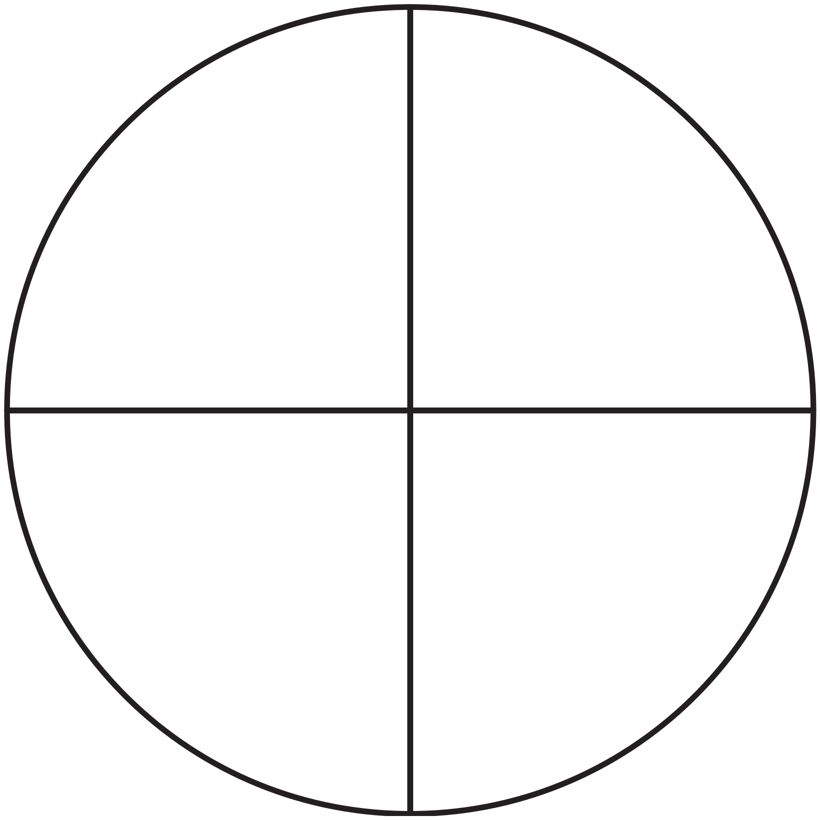


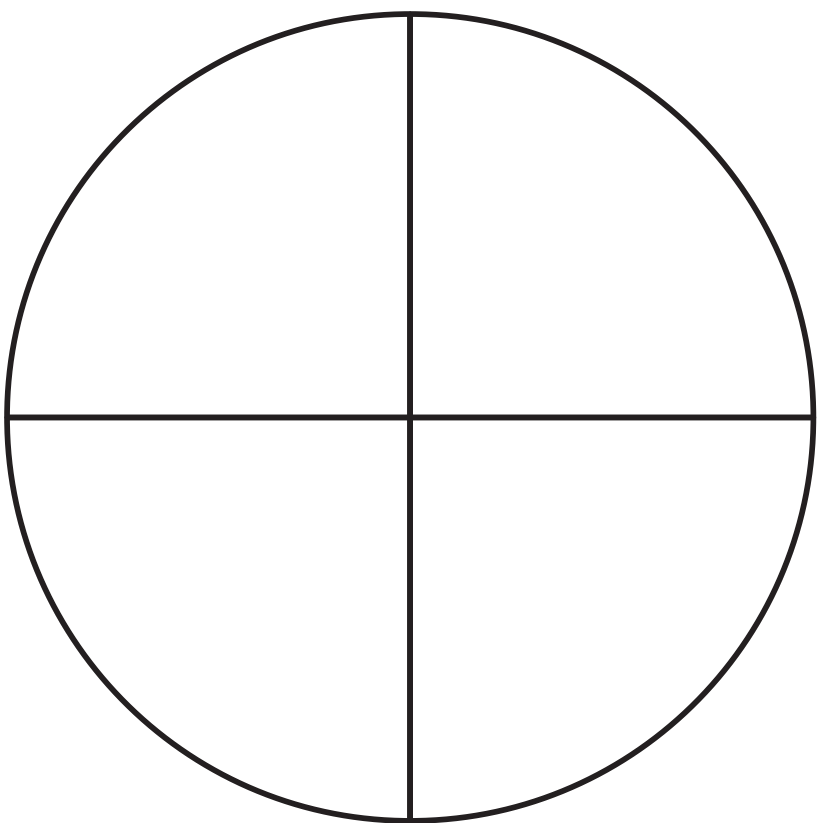
$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$
$\frac{1}{6}$	$\frac{1}{8}$	$\frac{1}{12}$
$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$
$\frac{1}{6}$	$\frac{1}{8}$	$\frac{1}{12}$
$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$
$\frac{1}{6}$	$\frac{1}{8}$	$\frac{1}{12}$

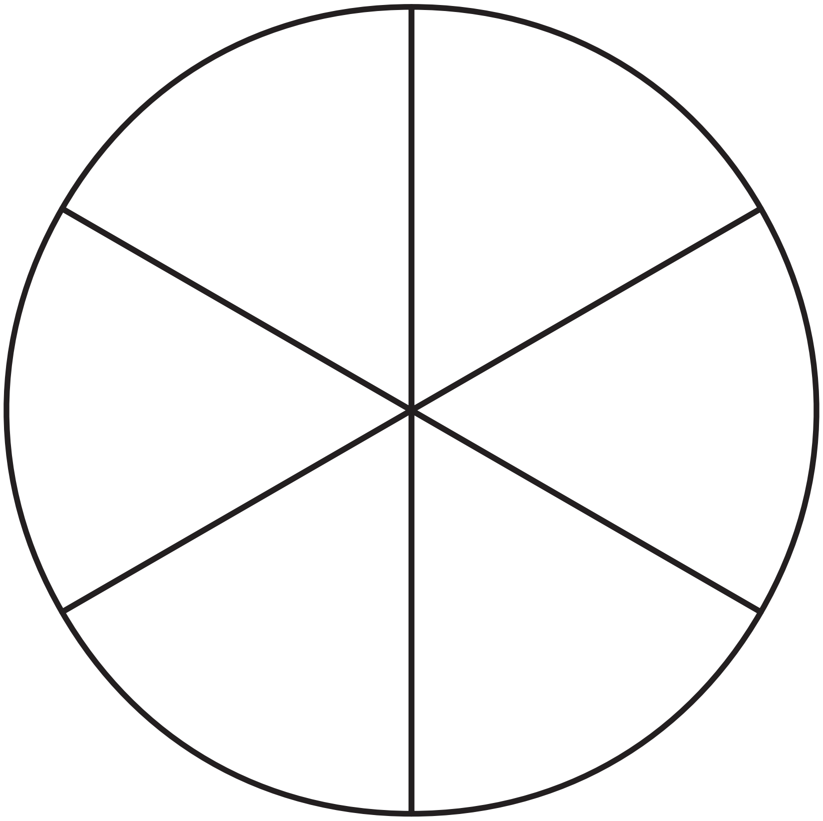


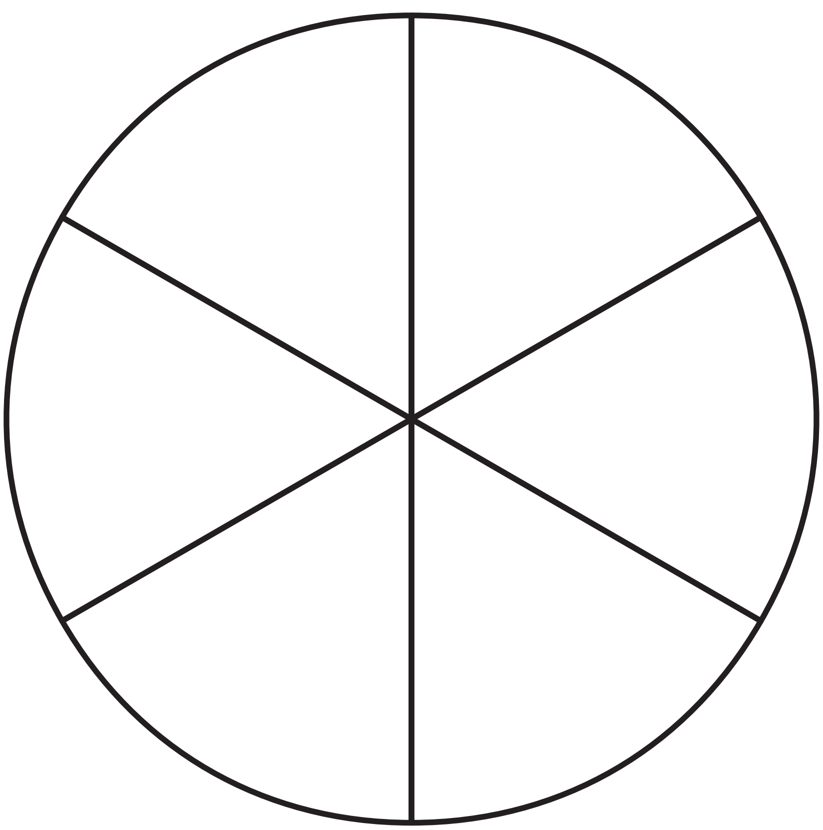


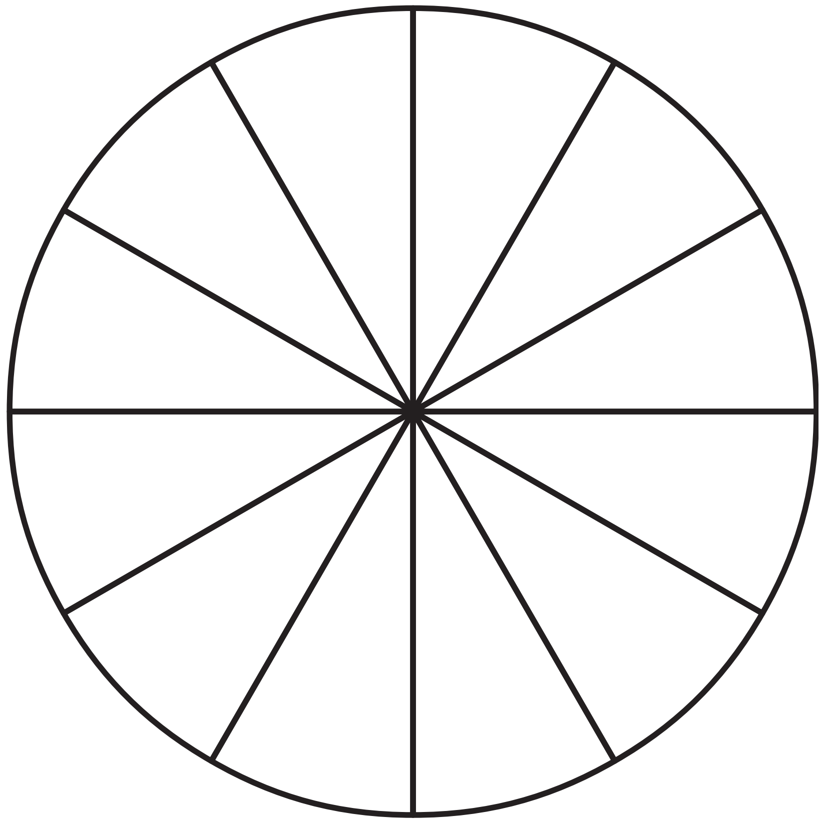


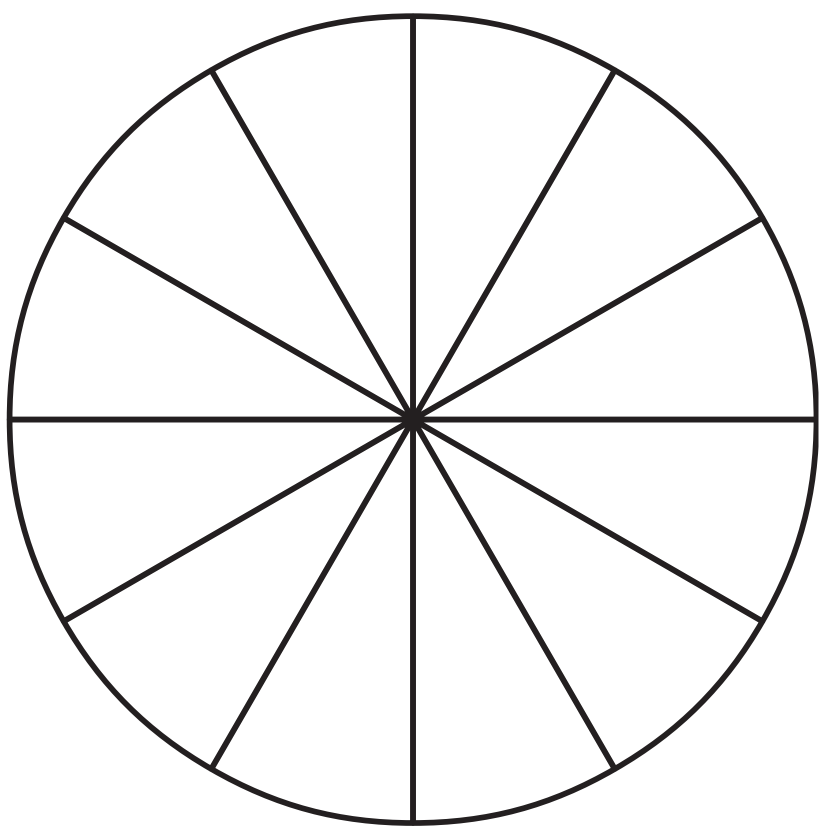


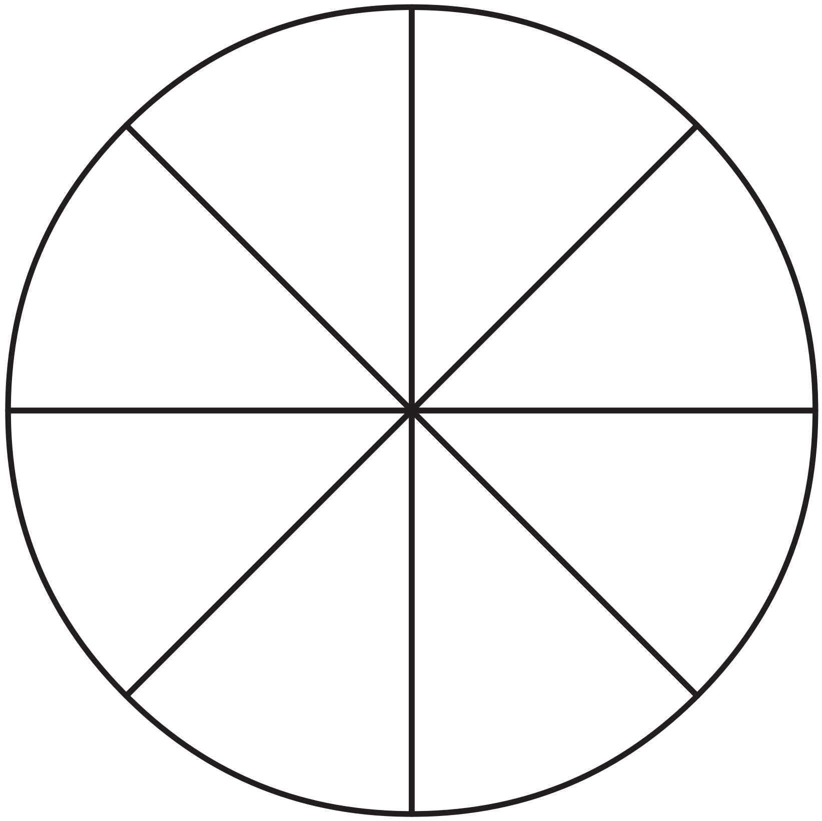


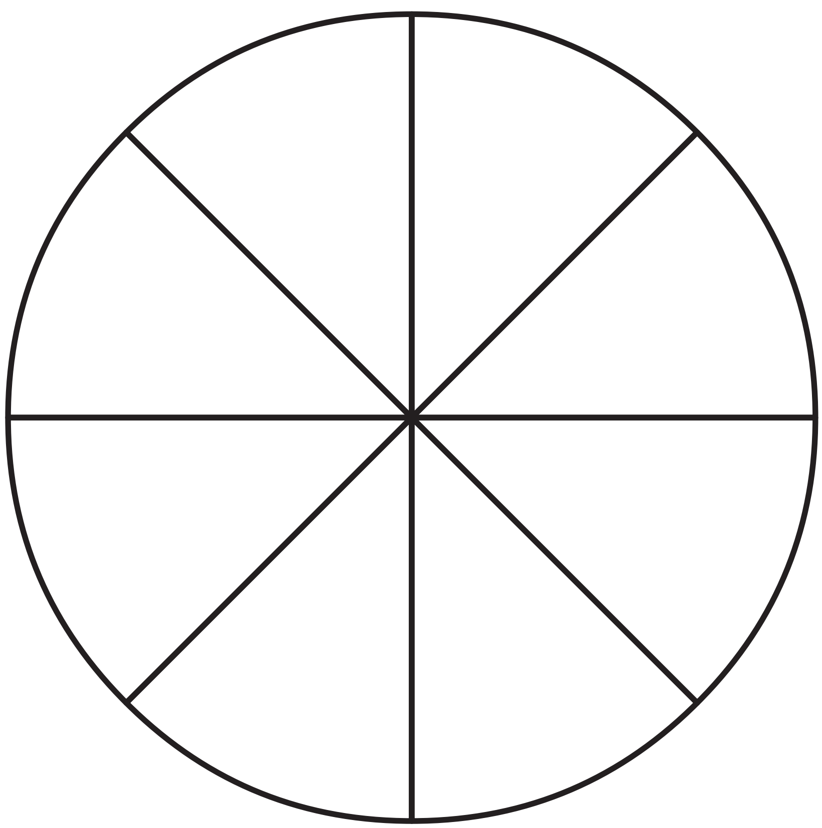




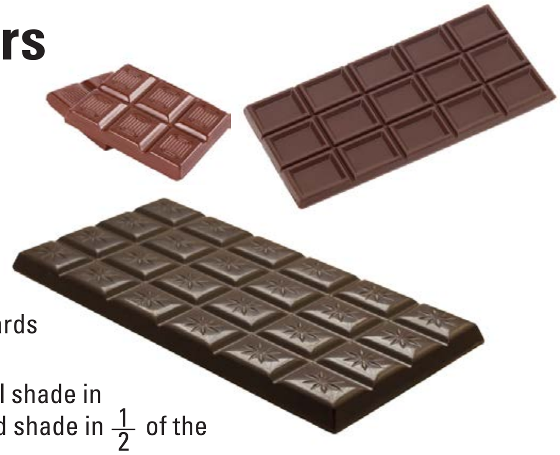








The Whole Matters



Building Fluency: multiply fractions

Materials: gameboard per person and fraction cards or fraction die or spinner

Number of Players: 2 or more

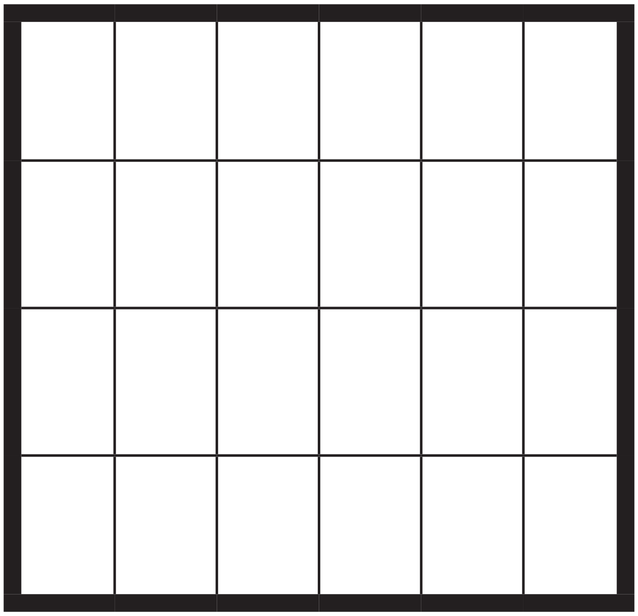
Directions:

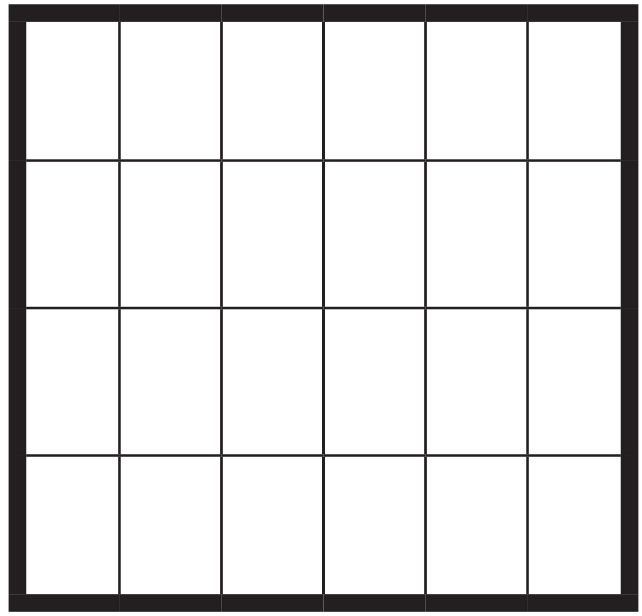
1. Give each player a game board (divided into 24 equal parts), and fraction cards or fraction die or spinner
2. The players take turns rolling their die. After each roll, the player rolling will shade in that fraction of their playing board. Example: if a player rolls $\frac{1}{2}$, they would shade in $\frac{1}{2}$ of the 24 boxes on the game board.
3. For all subsequent rolls, the fraction taken is of the amount remaining on the board after all previous rolls. Example: if a player has 12 boxes unshaded on his second roll, and they roll $\frac{1}{3}$, they would shade in 4 boxes, because $\frac{1}{3}$ of 12 is 4.
4. If you get a fraction that you are unable to divide, choose another fraction card.
5. The first player to have one unshaded box wins.

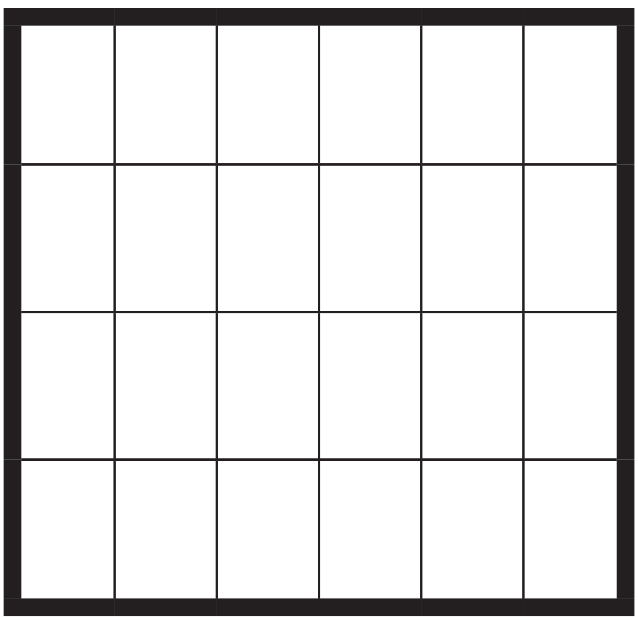
Variation/Extension: Students may change the fractions used, the gameboard, or the goal of the game. Additional game board are added for your convenience.

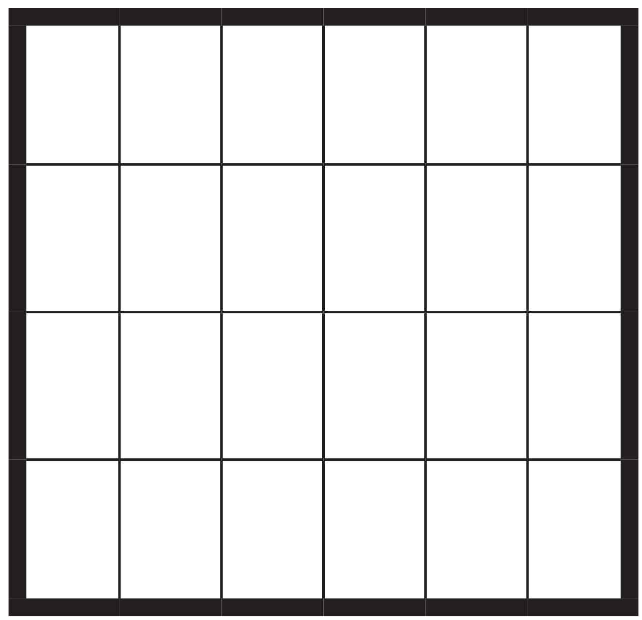
PLAYER 1

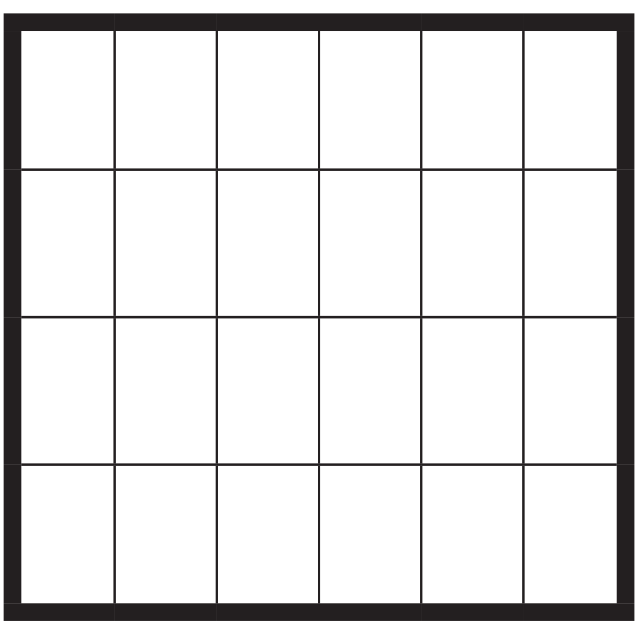
PLAYER 2

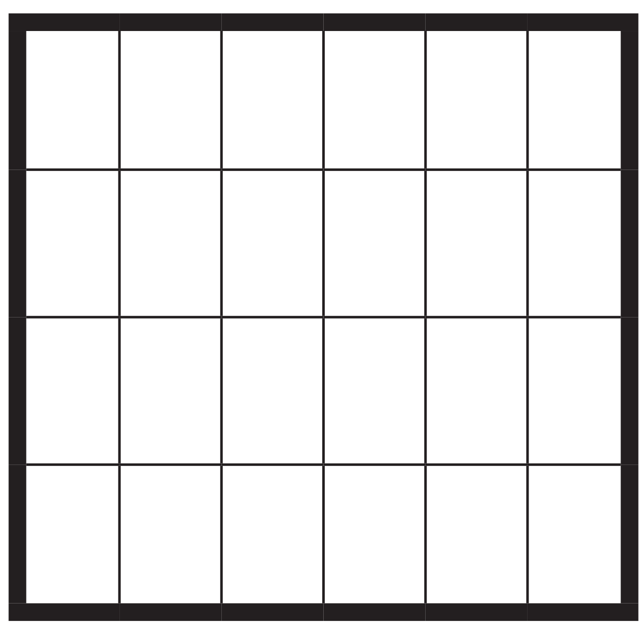


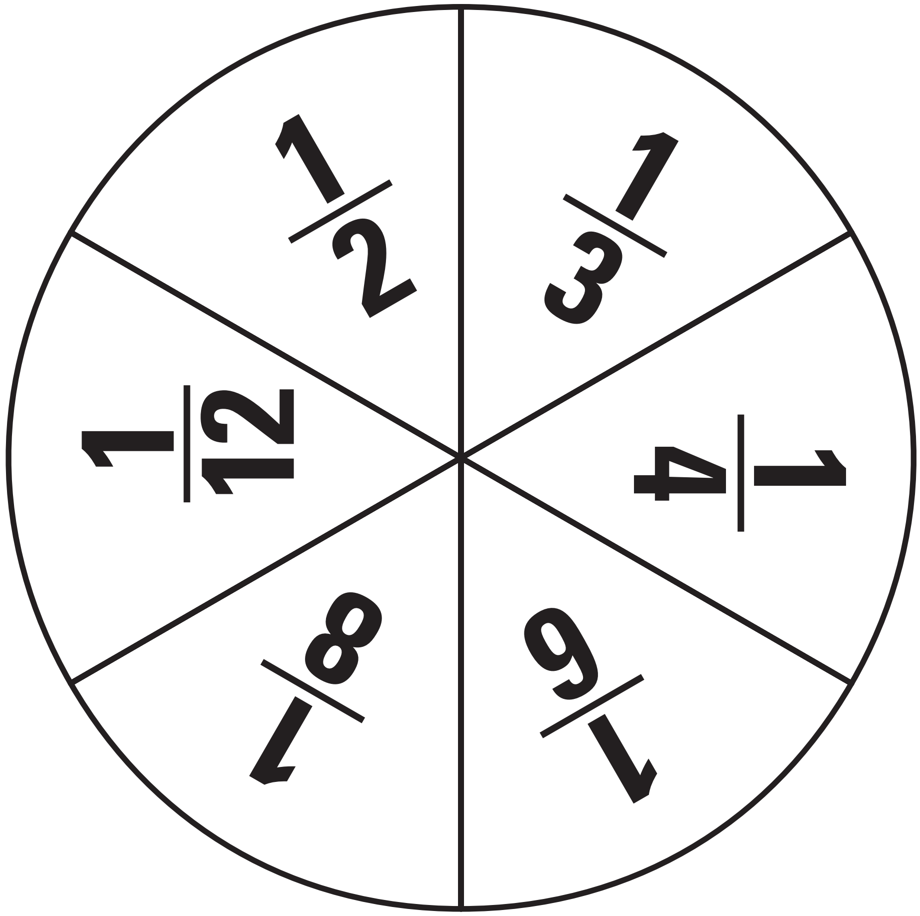


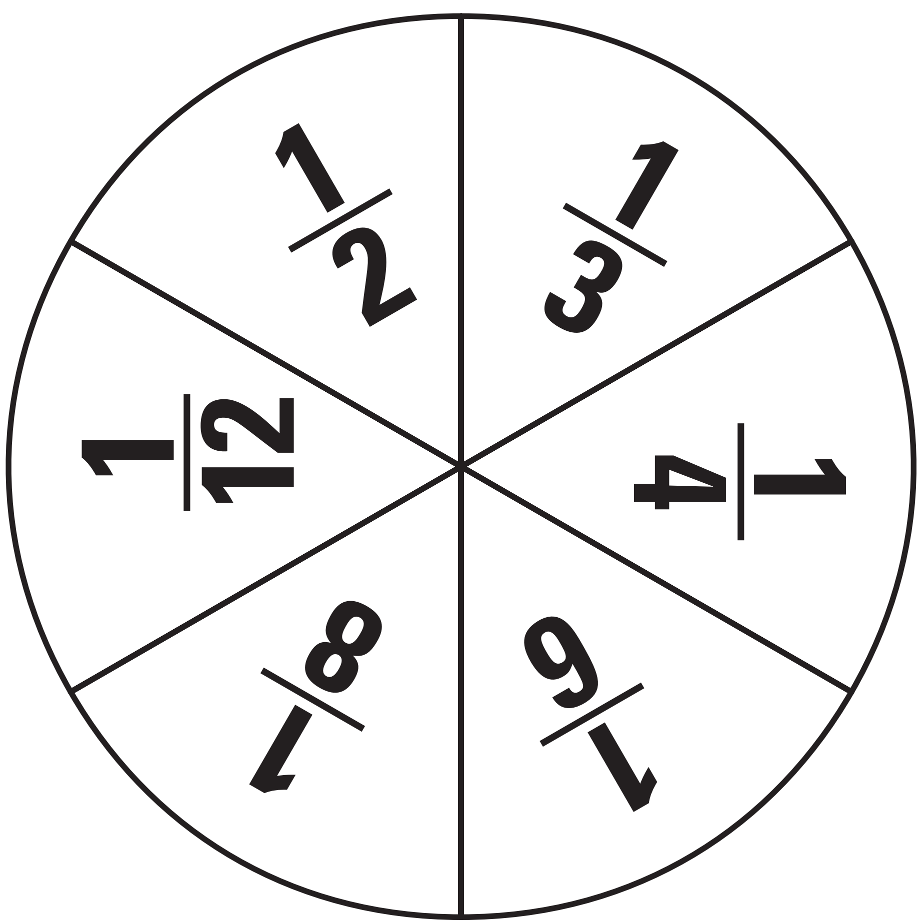









1/2
1/3
1/4
1/6
1/8
1/12


1/2
1/3
1/4
1/6
1/8
1/12

$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$
$\frac{1}{6}$	$\frac{1}{8}$	$\frac{1}{12}$
$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$
$\frac{1}{6}$	$\frac{1}{8}$	$\frac{1}{12}$
$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$
$\frac{1}{6}$	$\frac{1}{8}$	$\frac{1}{12}$

Greatest Product

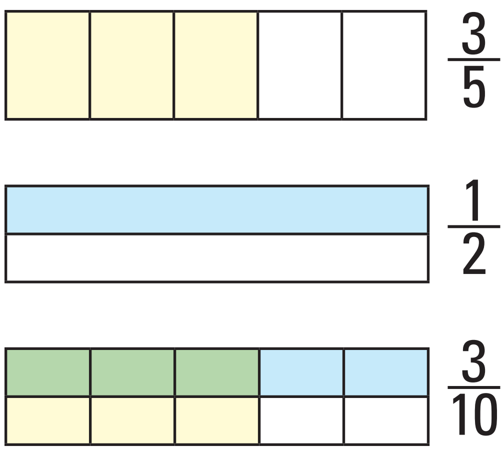
Building Fluency: multiply a fraction by a fraction

Materials: deck of cards; optional calculator with grid paper and colored pencils

Number of Players: 2 or more

Directions:

1. Use only the number cards from a deck of playing cards. Aces are worth one point each.
2. A fraction can be made by using two cards. One card is the numerator, and one card is the denominator.
3. Deal each player four number cards. Arrange the four cards to make a multiplication problem.
   Example: Let's say you were dealt [3], [1], [5], and [2] with these cards, you could make the fraction problem: $\frac{3}{5} \times \frac{1}{2}$
   (No fractions over one are allowed.)
4. Draw an area model to support your product.
   Example:



5. The player who forms the greatest product wins.
6. After you have played several rounds for the greatest product, play for the least product.

Variation/Extension: Student may want to record their work in their math notebook or use grid paper to create a model.

Allow students to create fractions over one – Why when multiplying a number by a fraction greater than 1 the results of the product is greater?

Another fun way to play the game is to allow the players to form their fractions first, and make their calculations before you say highest or lowest.

Color the Door

Building Fluency: equivalence

Materials: recording sheet per player, fraction cards or fraction die or spinner

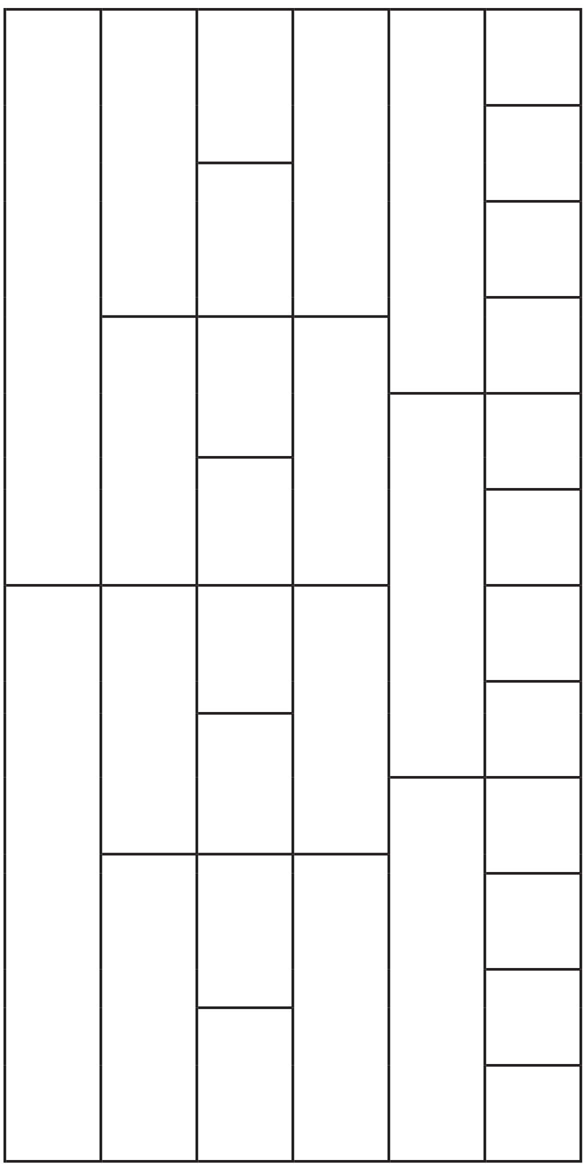
Number of Players: 2-4

Directions:

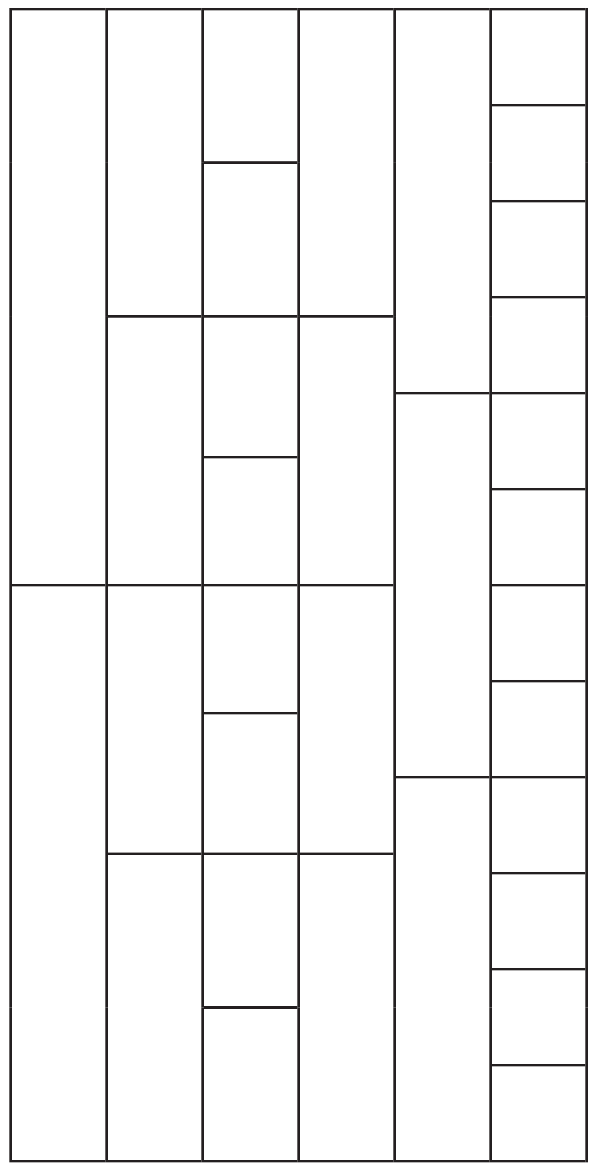
1. Each player takes turns drawing a card from the pile.
2. Player shades the door according to the value of the card drawn.
3. Players may shade in equivalent fractions if applicable.
4. If a player rolls a fraction, and not enough space is left on the front or back door for shading, the player loses their turn, and waits for the next roll of the die.
5. The first player to shade the front and back door wins.

Variation/Extension: Students can create their own door and fraction playing cards.

FRONT DOOR

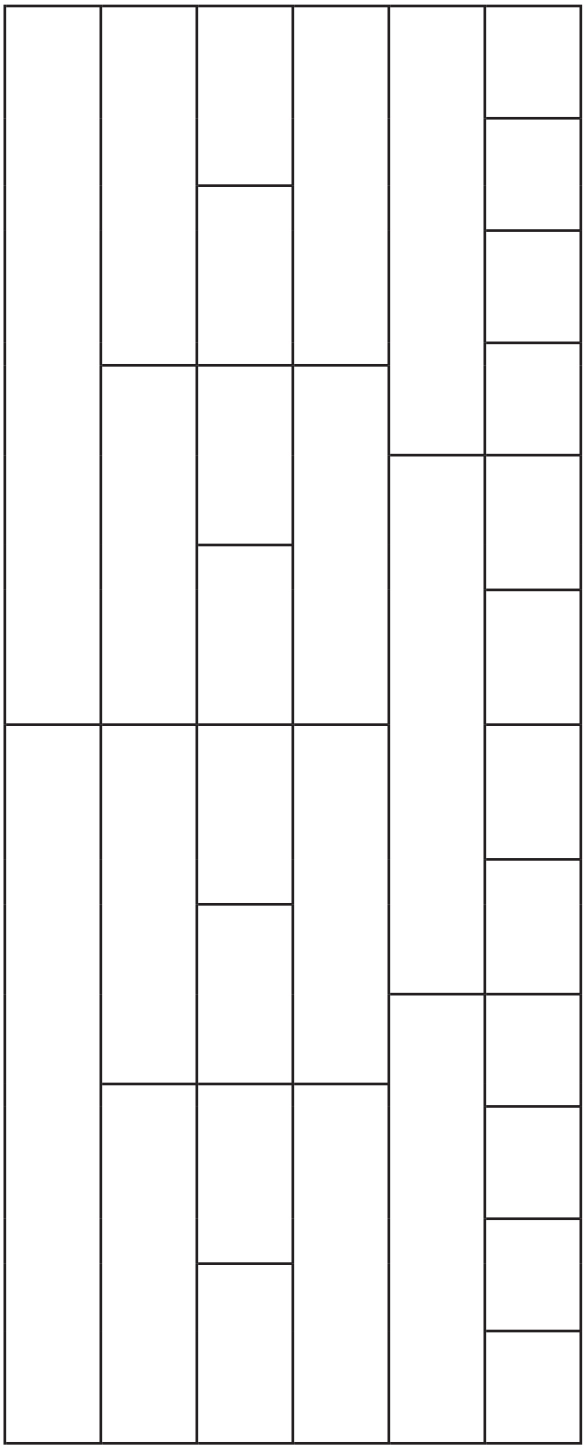


BACK DOOR

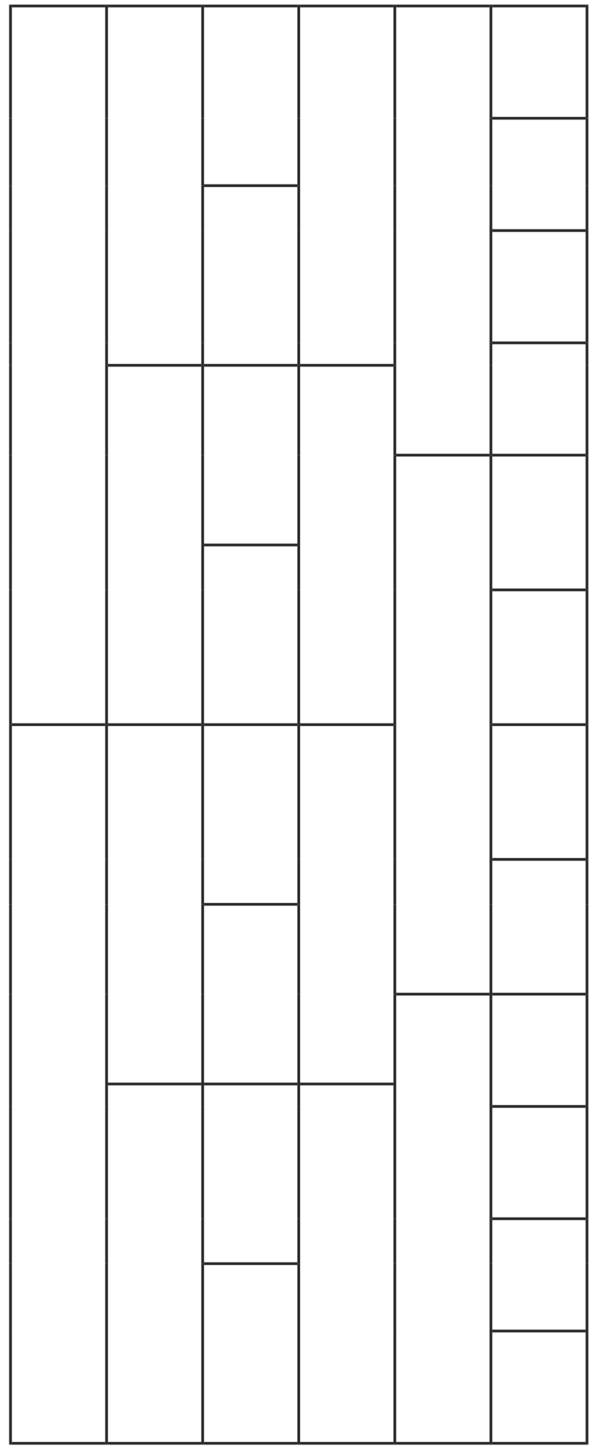


PLAYER ________________

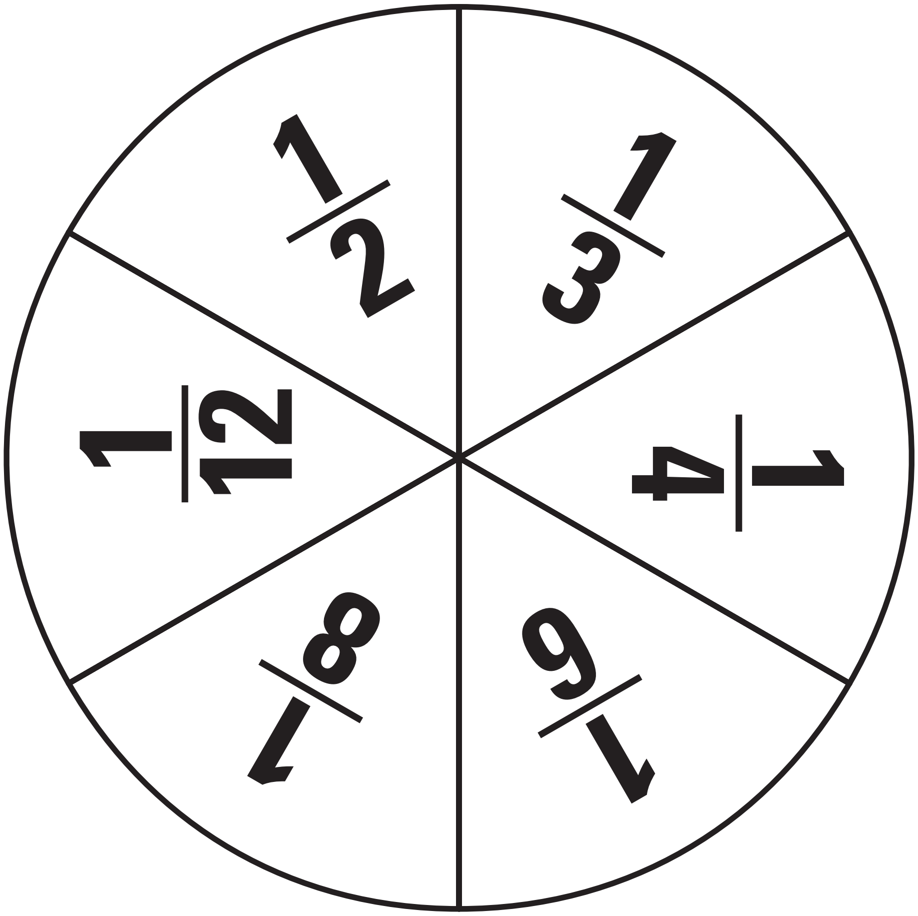
FRONT DOOR

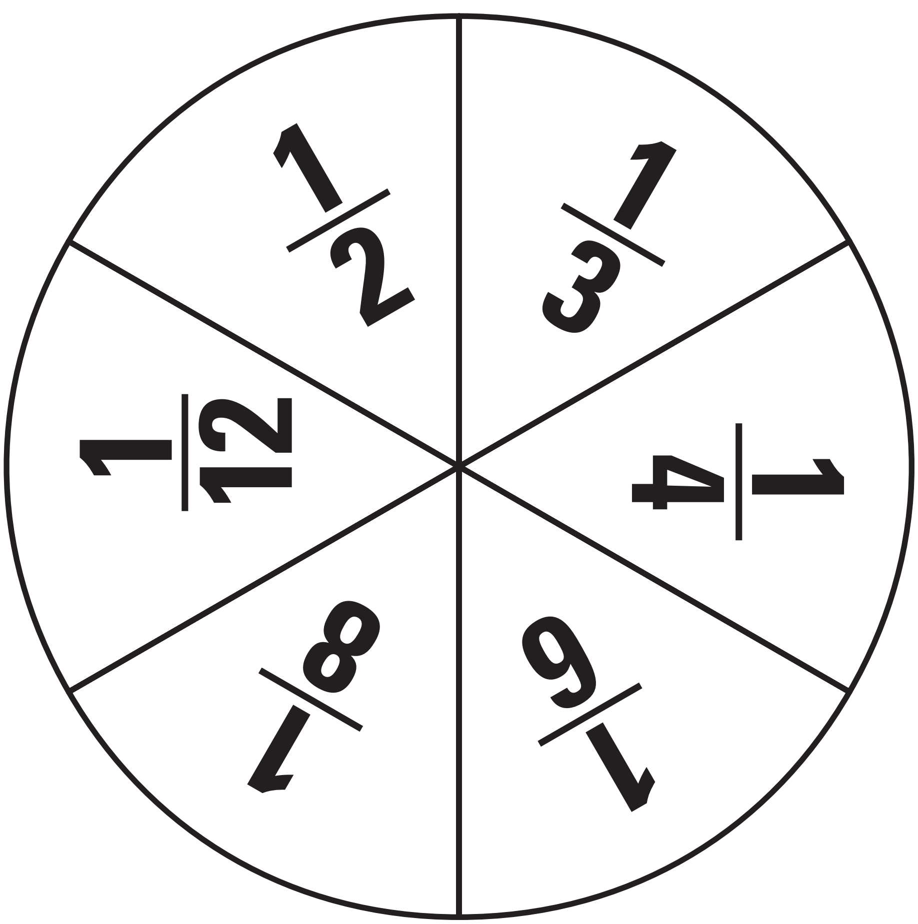


BACK DOOR



$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$
$\frac{1}{6}$	$\frac{1}{8}$	$\frac{1}{12}$
$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$
$\frac{1}{6}$	$\frac{1}{8}$	$\frac{1}{12}$
$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$
$\frac{1}{6}$	$\frac{1}{8}$	$\frac{1}{12}$


1/2
1/3
1/4
1/6
1/8
1/12


1/2
1/3
1/4
1/6
1/8
1/12

Rolling, Rolling, Rolling

Building Fluency: equivalence - review

Materials: gameboard, 10 markers of one color per person, and a pair of standard dice (1-6)

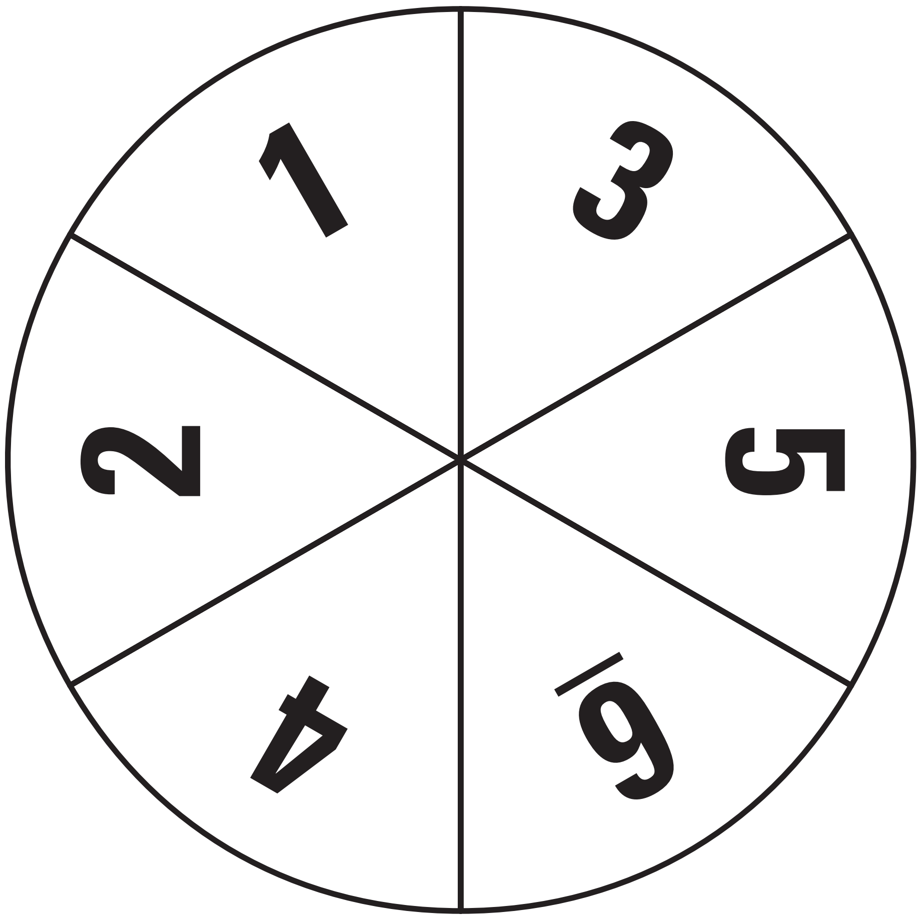
Number of Players: 2

Directions:

1. Each player needs 10 markers of one color.
2. Players take turns rolling 2 number cubes and making a fraction. The players may cover an equivalent fraction on the game board.
3. If a player rolls doubles, they may roll again and either cover the equivalent fraction rolled or remove an opponent's marker.
4. The first player to get 3 in a row in any direction wins.

Variation/Extension: Students may create their own fraction gameboards. Another way to modify the game is to change the die (1-9).

$\frac{4}{20}$	$\frac{12}{16}$	$\frac{6}{9}$	$\frac{12}{20}$	$\frac{6}{12}$
$\frac{20}{30}$	$\frac{12}{15}$	$\frac{8}{20}$	$\frac{20}{24}$	$\frac{12}{24}$
$\frac{3}{12}$	$\frac{3}{18}$	$\frac{4}{24}$	$\frac{5}{15}$	$\frac{4}{12}$
$\frac{7}{14}$	$\frac{4}{8}$	$\frac{9}{12}$	$\frac{5}{10}$	$\frac{3}{9}$
$\frac{10}{25}$	$\frac{8}{12}$	$\frac{15}{25}$	$\frac{12}{18}$	$\frac{9}{15}$


1
3
2
5
4
6

Packing Blocks

Building Fluency: volume

Materials: game cards, calculator

Number of Players: 2

Directions: Tami and Natasha make baby toys for a local toy manufacturer. They are packing some baby blocks made into a shipping box. The shipping box has a volume of 1536 cubic inches. The dimensions of the blocks they are packing in the box are given below.

They must pack all of the same sized blocks into one box. Tami and Natasha want to decide before they actually pack the box. Which blocks might fit into the box with no space left over? Can you help Tami and Natasha decide which blocks could be packed into each box?

1. Correctly match the "Dimension of Block" cards with the correct "Volume of Box" cards.
2. Then match the "Maximum Number of Blocks."
3. Students may need a calculator.
3. Match the cards to find which blocks can be packed into Tami and Natasha's box with no space left over, (no remainder)?

Variation/Extension: Students create their own set of cards.

Dimensions of Block 1 **6 in by 6 in by 6 in**	The Volume of Box **V = 125 cubic inches**	Maximum Number of Blocks **7 blocks**
Dimensions of Block 2 **5 in by 5 in by 5 in**	Maximum Number of Blocks **24 blocks**	The Volume of Box **V = 27 cubic inches**
Dimensions of Block 3 **4 in by 4 in by 4 in**	Maximum Number of Blocks **192 blocks**	The Volume of Box **V = 64 cubic inches**
Dimensions of Block 4 **3 in by 3 in by 3 in**	The Volume of Box **V = 8 cubic inches**	Maximum Number of Blocks **12 blocks**
Dimensions of Block 5 **2 in by 2 in by 2 in**	The Volume of Box **V = 216 cubic inches**	Maximum Number of Blocks **56 blocks**

Answer Key

The following Rows go toether.

Dimensions of Block 1 **6 in by 6 in by 6 in**	The Volume of Box **V = 216 cubic inches**	Maximum Number of Blocks **7 blocks**

Dimensions of Block 2 **5 in by 5 in by 5 in**	The Volume of Box **V = 125 cubic inches**	Maximum Number of Blocks **12 blocks**

Dimensions of Block 3 **4 in by 4 in by 4 in**	The Volume of Box **V = 64 cubic inches**	Maximum Number of Blocks **24 blocks**

Dimensions of Block 4 **3 in by 3 in by 3 in**	The Volume of Box **V = 27 cubic inches**	Maximum Number of Blocks **56 blocks**

Dimensions of Block 5 **2 in by 2 in by 2 in**	The Volume of Box **V = 8 cubic inches**	Maximum Number of Blocks **192 blocks**

Blackbeard's Treasure Box

Building Fluency: finding points on the first quadrant of the coordinate plane

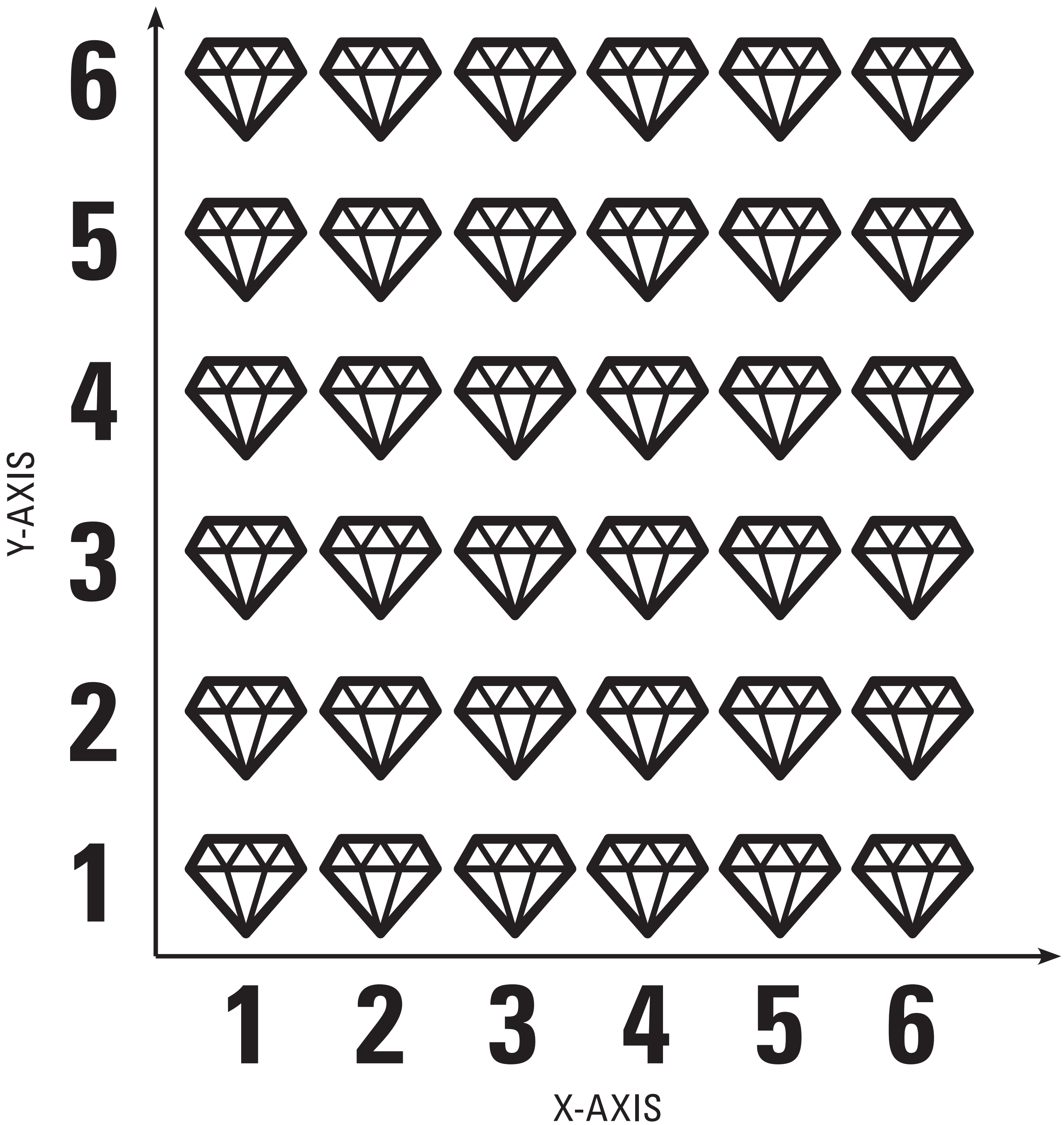
Materials: standard dice, 10 markers per player (players need different colors), and a gameboard

Number of Players: 2

Directions:

1. Players take turns rolling the cubes.
2. Players need to designate one cube for the y-axis and one cube for the y-axis.
   Example: if the x-axis cube is two and the y-axis cube is three, the player would cover the gem at (2, 3).
3. If a player tosses and the gem at that place is taken, the player loses that turn.
4. The first player to get four in a row wins.

Variation/Extension: Players may win by seeing who can cover four adjacent gems to form a box.



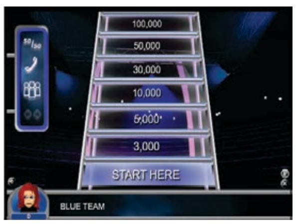
Online Games Available

Number and Operations in Base Ten

Place Value Decimal – That Quiz
www.thatquiz.org/tq-c/?-j84-l3-n35-p0%20

Building Fluency with Standard: NC.5.NBT.1

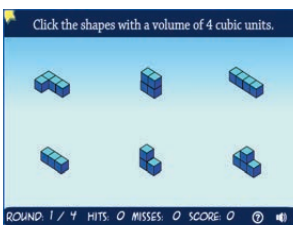
Number and Operations – Fractions



Multiplying Fractions Millionaire Game
www.math-play.com/Multiplying-Fractions-Millionaire/Multiplying-Fractions-Millionaire.html

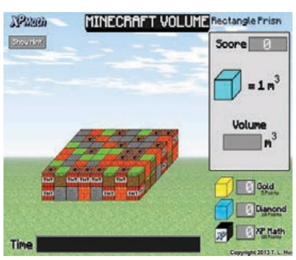
Building Fluency with Standard: NC.5.NF.4

Measurement and Data



Volume Shape Game
www.sheppardsoftware.com/mathgames/geometry/shapeshoot/VolumeShapesShoot.htm

Building Fluency with Standard: NC.5.MD.4



Mine Craft Volume
www.xpmath.com/forums/arcade.php?do=play&gameid=118

Building Fluency with Standard: NC.5.MD.4 and NC.5.MD.5

Geometry

Soccer Coordinates
http://www.xpmath.com/forums/arcade.php?do=play&gameid=90

Building Fluency with Standard: NC.5.G.1