Community Math Night Facilitator Guide

Spring 2019

West Virginia

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Image Sources: Pattern blocks: https://commons.wikimedia.org/wiki/File:Plastic_pattern_blocks.JPG

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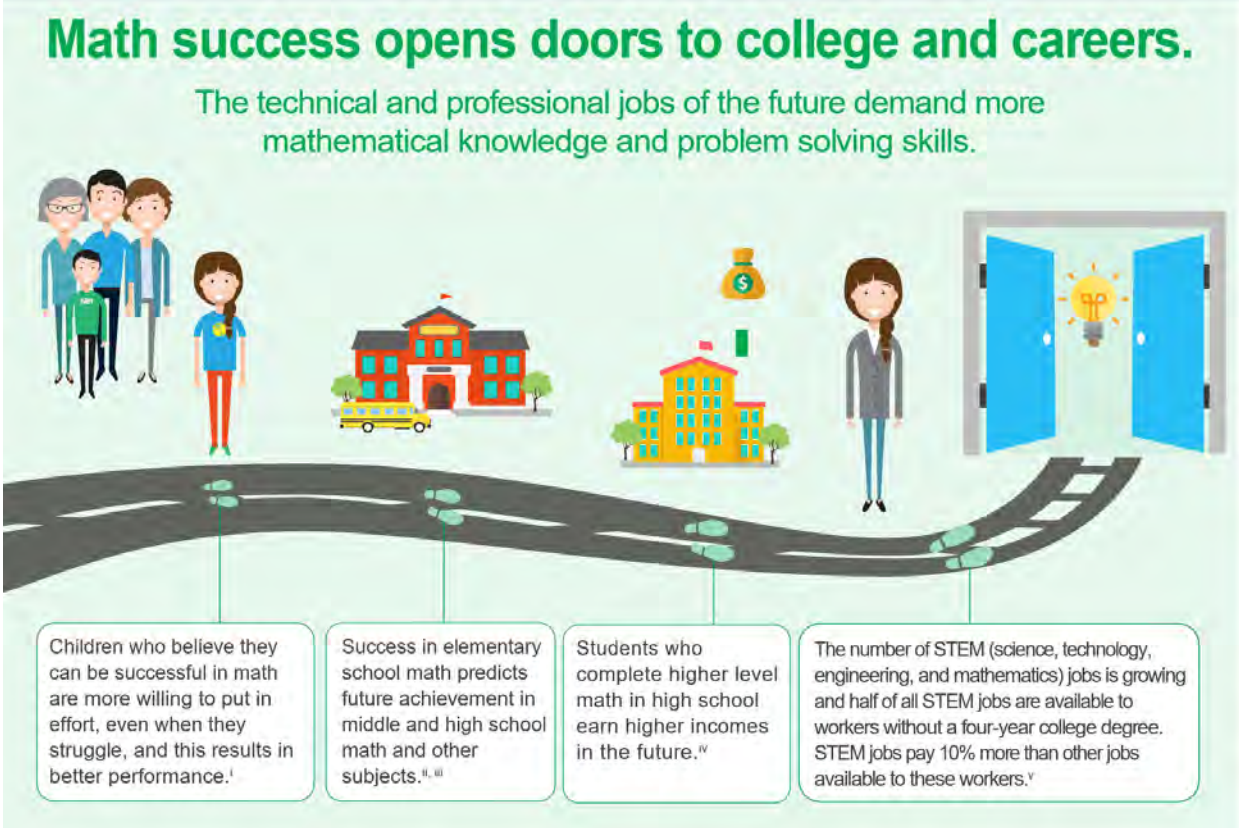
Contents

Overview

Children's early mathematics achievement is associated with a number of success factors later in life such as getting better grades in middle school, increased likelihood of high school graduation, and better career opportunities. At community math nights, educators, children, and family members can learn and talk about mathematics, helping family members participate in their child's learning and support their child's academic success.[1] Community math night activities can create a shared understanding of the math concepts and raise expectations for math knowledge and achievement, which promote children's success in school.[2]

The *Community Math Night Facilitator Guide* provides all the instructions and materials needed for your community math night. It is organized by activity, and for each activity you will find the purpose, a list of linked materials, and facilitator instructions. As you review the guide, you'll learn about building a strong foundation in math in elementary school, the value of engaging families in children's math learning, and math instructional strategies that are based in research.



[1] Garcia, E., & Weiss, E. (2017). *Education inequalities at the school starting gate: Gaps, trends, and strategies to address them*. Washington, DC: Economic Policy Institute

[2] DeFlorio, L., & Beliakoff, A. (2015). Socioeconomic status and preschoolers' mathematical knowledge: The contribution of home activities and parent beliefs. *Early Education and Development, 26*(3), 319–341. https://eric.ed.gov/?id=EJ1053641

Math Night at a Glance

Complete the table below as an at-a-glance guide for your math night.

Date: **Location:**

Time	Activity	Location	Facilitator(s)
	Welcome and goals (15 min)		
	Math attitudes and growth mindset (15 min)		
	Math stations (70 min)		
	Introduction (10 min)		
	Geometry (15 min)		
	Operations and algebraic thinking (15 min)		
	Numbers and operations in base 10 (15 min)		
	Measurement and data (15 min)		
	Wrap-up (15 min)		

Materials at a Glance

Facilitation Materials

(In chronological order—found throughout facilitator guide)

- Slide deck to guide presentations
- Folder for each family containing:
  - Family letter
  - 4 raffle tickets
  - Feedback survey
  - "Supporting Your Child in Developing Math Skills for Future Success" infographic
- Stamps for tickets
- Geometry glossary poster
- Instructions for each station
- Handouts for parents/facilitators with questions to prompt students to explain what they're doing, to scaffold the activity, and to prompt for additional solutions/strategies
- Printed outlines to be fill in with blocks
- Pattern blocks
- Pattern block key
- Rhombus game board
- Small mirrors
- Large paper cutout of the pattern blocks for folding (to show symmetry)
- Calculators, pencils, erasers, and scratch paper
- Cards with numbers and dice from 0–10
- Dice
- Markers
- Blank index cards
- Cards with groups of items
- Cards with numbers from 0–24 and the 4 operations
- Calculators (not provided)
- Multiplication table
- Deck of cards (without Queens and Kings)
- Set of measuring cups and spoons
- Set of bowls for mixing
- Wooden spoons for mixing
- Ingredients for playdough (flour, oil, pitcher with water, salt, food coloring)

Ideas for Raffle Prizes

- Pattern Blocks Set
- Game: Tiny Polka Dot
- Book: *The Grapes of Math*
- Book: *Math for All Seasons*
- Book: *Tiger Math*
- Book: *The Girl with A Mind for Math*
- Book: *3x4*
- Book: *One Big Pair of Underwear*
- Book: *Which one doesn't belong?*
- Book: *Numbed!*
- Book: *Just the Right Size*

Welcome and Goals 15 minutes

Facilitator(s): _____

Purpose

Welcome families and present information on the importance of mathematics.

Materials

- Introduction slides
- Folder for each family containing:
  - Family letter
  - 4 raffle tickets
  - Feedback survey
  - "Supporting Your Child in Developing Math Skills for Future Success" infographic

Background

Children's early mathematics achievement is associated with a number of success factors later in life such as getting better grades in middle school, increased likelihood of high school graduation, and better career opportunities. At community math nights, educators, children, and family members can learn and talk about mathematics, helping family members participate in their child's learning and support their child's academic success.[3] Community math night activities can create a shared understanding of the math concepts and raise expectations for math knowledge and achievement, which promote success in school.[4]

Facilitator Notes

1. As families come in to the event, give each family a number 1–4. These numbers will tell them which station to start with.
2. Welcome families, students, and other community members to the event.
3. Introduce yourself and what your role is and tell the participants that the activities will start when everyone is finishing dinner.
4. Announce that while the participants are enjoying dinner, you would like them to think about their math learning. Ask them to introduce themselves to the others at their table and say which of the books on the screen (slide 3) they think reflects them as a math learner. Read each of the book titles on the screen and ask them to discuss.

[3] Garcia, E., & Weiss, E. (2017). *Education inequalities at the school starting gate: Gaps, trends, and strategies to address them*. Washington, DC: Economic Policy Institute

[4] DeFlorio, L., & Beliakoff, A. (2015). Socioeconomic status and preschoolers' mathematical knowledge: The contribution of home activities and parent beliefs. *Early Education and Development, 26*(3), 319–341. https://eric.ed.gov/?id=EJ1053641

5. As families finish dinner, walk them through the agenda slide (slide 4), and let them know that you will get started in 5 minutes.
6. Now that families are focused on the presenter, begin with the question “Why math”? (slide 5). Follow the script on the slide.
7. Walk participants through the notes on why math is important and reference the infographic slides 6 and 7. Walk through each slide and narrate the text.

Math Attitudes and Growth Mindset 15 minutes

Facilitator(s): _____

Purpose

Engage families in understanding how a having growth mindset helps children succeed in math.

Materials

- Math attitudes slides

Background

Research suggests that math attitudes and math skills can be reciprocal—positive attitudes about math promote math achievement, which in turn encourages even more positive attitudes down the road.[5] However, adults often hold negative attitudes and beliefs about math. When family members say, "I don't like math," they can affect children's feelings about and success in math.[6]

Fortunately, there are ways family members and educators can help children develop positive math attitudes. One way is by building a growth mindset. Having a growth mindset means that a person believes that he/she can increase his/her knowledge with effort and hard work.[7] The math attitudes and growth mindset activity for this community math night highlights phrases family members may have used or describe how they may feel about math. The activity is intended for family members to reflect on how they feel and talk about math with their children, encouraging them to take on a more positive attitude toward math.

Facilitator Notes

1. Have math station facilitators or other teachers sit with participants while you pull up the "Math attitudes" (slide 8) and introduce the topic (notes on slide).
2. Describe to families that adult reactions can impact their children's math achievement (notes on slide 9).
3. Present the difference between growth mindset and fixed mindset (slide 10) and walk through examples of feedback (slides 11-13).
4. (Optional) Ask participants to share with an elbow partner about a time when they struggled with something but through hard work were able to increase their abilities and succeed.

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[5] Ma, X. (1997). Reciprocal relationships between attitude toward mathematics and achievement in mathematics. The Journal of Educational Research, 90(4), 221-229.

[6] Regional Education Laboratory, Northwest. (2017). Growth Mindset in Math. Presented to Washington STEM Partnership. Retrieved from https://ies.ed.gov/ncee/edlabs/regions/northwest/news/math-attitudes-training-series.asp

[7] Dweck, C. S. (2006). Mindset: The new psychology of success. New York, NY: Random House.

5. Remind participants that the take-home message about mindset is that adults can influence children's math attitudes and achievement (slide 14). It is better to praise children's effort and problem solving rather than simply correct solutions or praise a child's intelligence.

Math Stations 1 hour, 15 minutes

Introduction to Stations 5 minutes

Facilitator(s): _____

Purpose

Provide instructions and norms for participating in the math stations.

Materials

- Math stations slides

Facilitator Notes

1. Tell participants they will visit four stations around the room (slide 16) and let them know that each station will focus on a different area of math and have three activities geared toward different grade levels. When they complete a station, the station facilitator will stamp the ticket and the children can submit the tickets for the raffle.
2. Provide tips for family members on participating in the stations (slide 17).
3. When families come in, they should have received a number from 1 to 4, which will tell them which station to start at. If there are families with students in different grade bands, they should go to the same station. Families can start at the table for the younger child and go to the table for the older child after finishing the activity and there is time. Or, if they prefer, they can split up the children so that the children try out the activities to their corresponding grade levels.
4. Say that you will ring a bell every 15 minutes to remind them to go to the next station.
5. Direct them to their first station.
6. They should then return to the main room/gym/cafeteria for the wrap-up and raffle.

Station 1: Geometry

Facilitator(s): _____

Purpose

Families and children will engage in activities aligned with the West Virginia standards for geometry.

Materials

- Materials for each activity
- Geometry glossary poster
- Stamps for tickets

Facilitator Notes

1. Direct families to the different tables, based on students' grade level.
2. When they are done with the activity at the table, stamp their tickets to enter the raffle.

Background

The geometry station activities use pattern blocks: geometric manipulatives that include an equilateral triangle, a 60-degree rhombus, a 30-degree rhombus, a trapezoid, a hexagon, and a square. Pattern blocks help students learn by building foundational understanding from concrete experiences before moving into abstract reasoning.[8] According to Stein & Bovalino,[9]

> Manipulatives can be important tools in helping students to think and reason in more meaningful ways. By giving students concrete ways to compare and operate on quantities, such manipulatives as pattern blocks, tiles, and cubes can contribute to the development of well-grounded, interconnected understandings of mathematical ideas.

You can use pattern blocks with children to practice naming shapes, describing and comparing shape attributes and composing and decomposing shapes.[10] They are also a great tool for encouraging students to work collaboratively, verbalize mathematical thinking, and discuss mathematical ideas and concepts.

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[8] Heddens, J. W. (1986). Bridging the gap between the concrete and the abstract. *The Arithmetic Teacher, 33*, 14–17. Reisman, F. K. (1982). *A guide to the diagnostic teaching of arithmetic (3rd ed.).* Columbus, OH: Merrill. Ross, R. & Kurtz, R. (1993). Making manipulatives work: A strategy for success. *The Arithmetic Teacher, 40*, 254–258.

[9] Stein, M. K., & Bovalino, J. W. (2001). Manipulatives: One piece of the puzzle. *Mathematics Teaching in Middle School*, *6*(6), 356–360.

[10] Reed, K. E., & Young, J. M. (2017). *Games for young mathematicians: About the math in pattern block puzzles*. Waltham, MA: Education Development Center, Inc. http://ym.edc.org/

Table 1a: Grades K–1: Fill in the Shapes

Facilitator(s): _____

Purpose

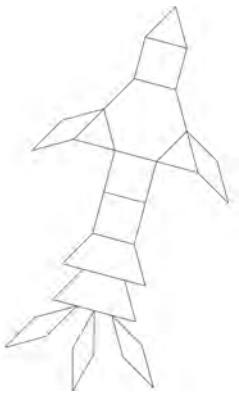
Students and families use pattern blocks to compose and decompose shapes and make composite shapes.

Materials

- Instructions and parent prompts
- Printed outlines to be filled in with blocks
- A container of pattern blocks

Facilitator Notes

1. Have students/families use pattern blocks to compose and decompose shapes and make composite shapes.
2. Show parents how they can use the prompts, model asking questions (e.g., Can you fill in the same outline but with different shapes? Why?) and point out the geometry glossary poster.
3. Model using the correct vocabulary for shapes, but do not correct families if they use color names instead.



West Virginia Standards

Kindergarten

M.K.22 Compose simple shapes to form larger shapes (e.g., “Can these two triangles, with full sides touching, join to make a rectangle?”).

First grade

M.1.20 Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape and compose new shapes from the composite shape. Instructional Note: Students do not need to learn formal names such as, “right rectangular prism.”

M.1.21 Partition circles and rectangles into two and four equal shares, describe the shares using the words *halves*, *fourths*, and *quarters* and use the phrases *half of*, *fourth of*, and *quarter of*. Describe the whole as two of or four of the shares and understand for these examples that decomposing into more equal shares creates smaller shares.

Table 1b: Grades 2–3: Rhombus Challenge

Facilitator(s): _____

Purpose

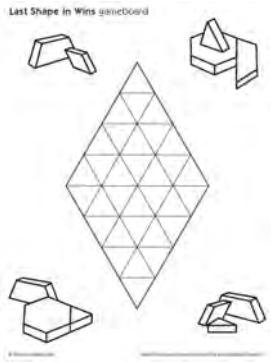
Students and families use pattern blocks to play a game in which they practice building and analyzing 2-D shapes to develop foundations for area, volume, and geometry in later grades.

Materials

- Instructions and parent prompts
- Rhombus game board
- Opaque bag with pattern blocks

Facilitator Notes

1. In the game, players use four different types of pattern blocks to fill in a rhombus-shaped board game. The game will engage players of different ages and allow students to develop and demonstrate strategies along with their parents.
2. The game can be played by one to four people, but it's best played in pairs.
3. Show parents how they can use the prompts, model asking questions (e.g., Are there shapes you can't use? Why?) and point out the geometry glossary poster.
4. Model using the correct vocabulary for shapes, but do not correct families if they use color names instead.



West Virginia Standards

Second grade:

M.2.26	Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc.; describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.

Third grade:

Cluster	**Reason with shapes and their attributes.**
M.3.24	Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.
M.3.25	Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. For example, partition a shape into 4 parts with equal area, and describe the area of each part as ¼ or the area of the shape.

Table 1c: Grades 4–5: Symmetric Mosaics

Facilitator(s): _____

Purpose

Students and families make a mosaic using pairs of pattern blocks, paying attention to the different attributes of the mosaics, such as the number of parallel and perpendicular lines, types of angles, and lines of symmetry.

Materials

- Instructions and parent prompts
- Handouts and pattern block key
- Container of pattern blocks
- Small mirrors
- Large paper cutout of the pattern blocks for folding (to show symmetry)

Facilitator Notes

1. Help families read the instructions and answer their questions.
2. Show parents how they can use the prompts, model asking questions, and point out the geometry glossary poster.
3. Model using the correct vocabulary for shapes, but do not correct families if they use color names instead.
4. Support students and families with the following prompts:
   - What is symmetry? (Point to the glossary; offer them a small mirror; have them fold a paper shape).
5. Encourage students and parents to express different reasons for how and why they created the mosaic the way they did.
6. Demonstrate how to use the mirrors to check for symmetry.
7. If applicable, explain that some shapes have rotational symmetry (a shape has rotational symmetry when it still looks the same after some rotation).

West Virginia Standards

Fourth grade:

M.4.27	Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines or the presence or absence of angles of a specified size. Recognize right triangles as a category and identify right triangles.
M.4.28	Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

Fifth grade:

Cluster	**Classify two-dimensional figures into categories based on their properties.**
M.5.25	Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category (e.g., all rectangles have four right angles and squares are rectangles, so all squares have four right angles).
M.5.26	Classify two-dimensional figures in a hierarchy based on properties.

Station 2: Operations and Algebraic Thinking

Facilitator(s): _____

Purpose

Students and families engage in activities aligned with the West Virginia standards on operations and algebraic thinking.

Materials

- Materials for each activity
- Calculators, pencils, erasers, and scratch paper
- Stamps for tickets

Background

The mathematics we teach from preschool to middle school forms the foundation for algebra. According to the National Mathematics Advisory Panel, the fundamentals of algebra are conceptual understanding, computational fluency, and problem-solving skills, and these three aspects are mutually reinforcing, not competing.[11]

From an early age, children observe number patterns and relationships and use these observations to derive facts.[12] This understanding becomes the basis for arithmetic operations and number composition and builds a foundation for higher order mathematical thinking and algebra preparedness.[13][14] The Operations and Algebraic Thinking station activities are designed to support students' conceptual understanding of numbers and operations and build fluency in arithmetic facts. They allow students to work with numbers and operations in different ways, use strategies that support conceptual understanding and fluency, and consider whether their solution is reasonable.

Facilitator Notes

1. Direct families to the different stations, based on students' grade level.
2. When they are done, stamp their tickets to enter the raffle.

[11] National Mathematics Advisory Panel. (2008). *Foundations for success: The final report of the National Mathematics Advisory Panel.* Washington, DC: U.S. Department of Education.

[12] Thompson, F. I. (Ed.). (2008). *Teaching and learning early number.* McGraw-Hill Education (UK).

[13] Boaler, J. (2015). Fluency without fear: Research evidence on the best ways to learn math facts. *Reflections*, *40*(2), 7–12.

[14] Woodward, J. (2006). Developing automaticity in multiplication facts: Integrating strategy instruction with timed practice drills. *Learning Disability Quarterly*, 29(4), 269–289.

Table 2a: Grades K–1: Flip the Cards Game[15]

Facilitator(s): _____

Purpose

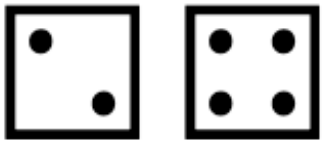
Students and families practice recognizing numbers/numerals, ordering numbers, and adding single digit numbers.

Materials

- Instructions and parent prompts
- Cards with numbers and dice from 0–10
- Dice

Facilitator Notes

1. Help families read the instructions.
2. Show parents how they can use the prompts and model asking questions.
3. You may need to help the families be patient as the children lay out the cards in order or add the numbers.



West Virginia Standards

Kindergarten

Cluster	**Understand addition as putting together and adding to and understand subtraction as taking apart and taking from.**
M.K.10	Decompose numbers less than or equal to 10 into pairs in more than one way by using objects or drawings, and record each decomposition by a drawing or equation (e.g., 5 = 2 + 3 and 5 = 4 + 1).
M.K.11	For any number from 1 to 9, find the number that makes 10 when added to the given number by using objects or drawings, and record the answer with a drawing or equation.
M.K.12	Fluently add and subtract within 5.

First grade

Cluster	**Represent and solve problems involving addition and subtraction.**
M.1.1	Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions (e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem).

[15] Source: Abridged version of Two Numbers game, http://ym.edc.org/2numbers/

Table 2b: Grades 2–3: Many Ways of Counting

Facilitator(s): _____

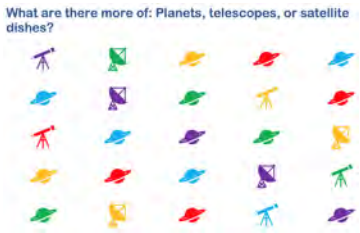
Purpose

Students and families use grouping strategies to find the total number of items on a variety of cards.

Materials

- Instructions and parent prompts
- Counters to support grouping strategies
- Markers
- Blank index cards
- Cards with groups of items

Facilitator Notes



1. Have each family take one of the cards and ask them to answer the prompt.
2. Let families know there are many different strategies they can use to efficiently count the number of objects in the array, by grouping the items. They don't have to simply count one by one.
3. Once they have tried several strategies, they should get a new array.
4. Show parents how they can use the prompts and model asking questions.
5. Listen to how they support their children in finding new counting strategies for each array.
6. Offer counters if you see students having trouble or to support their grouping strategies.
7. Offer hints if you think students are ready for more complex counting or grouping strategies.
8. Support students if they seem ready to make their own array.

West Virginia Standards

Second grade

Cluster	**Work with equal groups of objects to gain foundations for multiplication.**
M.2.4	Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.

Third grade

Cluster	**Represent and solve problems involving multiplication and division.**
M.3.1	Interpret products of whole numbers, e.g., interpret 5•7 as the total number of objects in 5 groups of 7 objects each (e.g., describe context in which a total number of objects can be expressed as 5•7).
M.3.3	Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities (e.g., by using drawings and equations with a symbol for the unknown number to represent the problem).

Table 2c: Grades 4–5: 24!

Facilitator(s): _____

Purpose

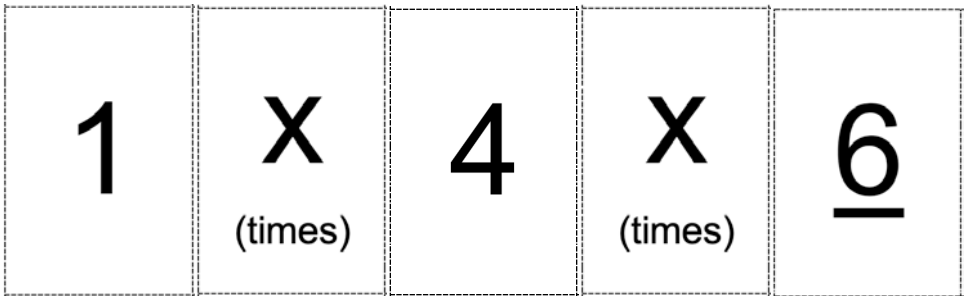
Students and families will play the game 24! in which they combine numbers and operations to see who can produce 24 with one or more operations.

Materials

- Instructions and parent prompts
- Cards with numbers from 0–24 and the four operations
- Calculators
- Multiplication table
- Pencils, erasers, and scratch paper

Facilitator Notes

1. Help families read the instructions,
2. Show parents how they can use the prompts and model asking questions.
3. You may need to offer an example for how to make number sentences that equal 24.



West Virginia Standards

Fourth grade

Cluster	**Use the four operations with whole numbers to solve problems.**
M.4.3	Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Fifth grade

Cluster	**Write and Interpret numerical expressions.**
M.5.1	Use parentheses, brackets, or braces in numerical expressions and evaluate expressions with these symbols.

Station 3: Numbers and Operations in Base 10

Facilitator(s): _____

Purpose

Students and families engage in activities aligned with the West Virginia standards on numbers and operations in base 10.

Materials

- Materials for each activity
- Stamps for tickets

Background

The Numbers and Operations in Base 10 station activities develop place value understanding and build computational fluency, both of which support students in solving multistep and complex problems, as such reasoning requires a high cognitive load and challenges working memory.[16] The National Council of Teachers of Mathematics defines computational fluency as

> 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*. The computational methods that a student uses should be based on mathematical ideas that the student understands well, including the structure of the base-ten number system, properties of multiplication and division, and number relationships.[17]

This definition of fluency emphasizes conceptual understanding of the base 10 system and a flexible use of strategies over memorization and recall. Studies find that place value instructional activities that emphasize conceptual problem-solving, rather than transmission of rules and procedures, support a stronger understanding of place value.[18]

Facilitator Notes

1. Direct families to the different stations, based on students' grade level.
2. When they are done, stamp their tickets to enter the raffle.

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[16] Star, J. R., Caronongan, P., Foegen, A., Furgeson, J., Keating, B., Larson, M. R., Lyskawa, J., ... Zbiek, R. M. (2015). *Teaching strategies for improving algebra knowledge in middle and high school students (NCEE 2014-4333).* Washington, DC: National Center for Education Evaluation and Regional Assistance (NCEE), Institute of Education Sciences, U.S. Department of Education.

[17] National Council of Teachers of Mathematics (2000). *Principles and standards for school mathematics* (Vol. 1). National Council of Teachers of Mathematics: Reston, VA.

[18] Fuson, K., Wearne, D., Hiebert, J., Murray, H., Human, P., Olivier, A., ...Fennema, E. (1997). Children's conceptual structures for multidigit numbers and methods of multidigit addition and subtraction. *Journal for Research in Mathematics Education*, 130–162.

Table 3a: Grades K–1: Race to 100 Game

Facilitator(s): _____

Purpose

Students and families practice combining and recombining in base 10.

Materials

- Instructions
- Base 10 blocks
- Dice
- Handout with questions to prompt students to explain what they're doing, to scaffold the activity, and to prompt for additional solutions/strategies

Facilitator Notes

1. Help families read the instructions. Answer any questions to clarify the task.
2. Show parents how they can use the prompts and model asking questions.
3. As it comes up, use mathematically correct vocabulary such as "regrouping" or "trading" if you hear families use the terms "borrowing" and "carrying."

West Virginia Standards

Kindergarten:

Cluster	**Work with numbers 11–19 to gain foundations for place value.**
M.K.13	Compose and decompose numbers from 11 to 19 into ten ones and some further ones by using objects or drawings, and record each composition or decomposition by a drawing or equation (e.g., 18 = 10 + 8); understand that these numbers are composed of ten ones (one ten) and one, two, three, four, five, six, seven, eight, or nine ones.

First grade

Cluster	**Understand place value.**
M.1.10	Understand the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases: a. 10 can be thought of as a bundle of ten ones — called a “ten.” (e.g., A group of ten pennies is equivalent to a dime.) b. The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight or nine ones. c. The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight or nine tens (and 0 ones).
Cluster	**Use place value understanding and properties of operations to add and subtract.**
M.1.12	Add within 100, including adding a two-digit number and a one-digit number and adding a two-digit number and a multiple of 10, 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. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones, and sometimes it is necessary to compose a ten.

Table 3b: Grades 2-3: Broken Calculator

Facilitator(s): _____

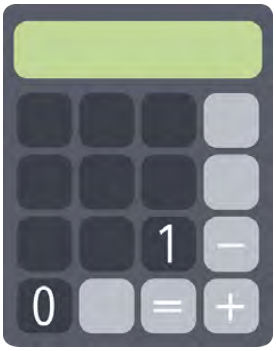
Purpose

Students and families create solutions to a variety of math challenges that require understanding of place value and the operations of addition and subtraction.

Materials

- Instructions and parent prompts
- 4 four-operation calculators (add, subtract, multiply, divide)
- Scratch paper and pencils

Background



Broken calculator was invented in the 1980s by Judah Schwartz (a math education professor, then at MIT) to address some math teachers' increased worry that using calculators in math class would prevent students from developing their math facts. This game uses the calculator and flips the way questions are asked: Instead of asking what 5*8 is, it asks how you can get the product 40 by using different combinations of operations. The challenges in this math station were designed to engage students in practicing place value. There have been many versions of this broken calculator program, and you can find many of them online.[19]

Facilitator Notes

1. Help families read the instructions.
2. Show parents how they can use the prompts and model asking questions.

West Virginia Standards

Third grade

Cluster	**Use place value understanding and properties of operations to perform multidigit arithmetic.**
M.3.11	Fluently add and subtract within 1,000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction.

Fourth grade

Cluster	**Use place value understanding and properties of operations to perform multidigit arithmetic.**
M.4.9	Fluently add and subtract multidigit whole numbers using the standard algorithm.

[19] Source: http://faculty.salisbury.edu/~jabergner/Adept%20course/summer%2008/Number%20and%20OP%20Day%201/brokencalcarticle.pdf

Table 3c: Grades 4–5: Multiplication Card Game

Facilitator(s): _____

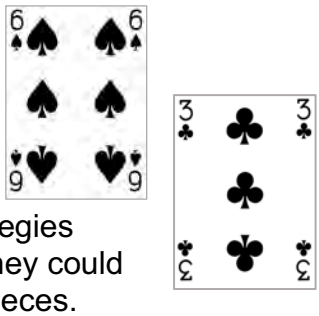
Purpose

Students and families practice building fluency with multiplication facts.

Materials

- Deck of cards (without Queens and Kings)
- Scratch paper and pencils
- Multiplication table

Facilitator Notes



1. Help families read the instructions.
2. Show parents how they can use the prompts and model asking questions.
3. If students get stuck on a multiplication, suggest they use strategies based on number sense rather than the multiplication table. They could use a piece of paper to break the problem down into smaller pieces.

West Virginia Standards

Fourth grade

Cluster	**Use place value understanding and properties of operations to perform multidigit arithmetic.**
M.4.9	Fluently add and subtract multidigit whole numbers using the standard algorithm.
M.4.10	Multiply a whole number of up to four digits by a one-digit whole number, multiply two two-digit numbers, using strategies based on place value and the properties of operations and illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

Fifth grade

Cluster	**Perform operations with multidigit whole numbers and with decimals to hundredths.**
M.5.8	Fluently multiply multidigit whole numbers using the standard algorithm.

Station 4: Measurement and Data

Facilitator(s): _____

Purpose

Students and families engage in activities aligned with the West Virginia standards on measurement and data.

Materials

- Materials for each station
- Stamps for tickets
- Calculators, pencils, erasers, and scratch paper

Background

Measurement is a key competency in the development of mathematical and scientific thinking from preK through middle school and is fundamental to STEM education.[20] Through completing measurement tasks, children learn to compare magnitudes and observe changes, and these skills bridge the areas of number sense and geometry[21]. The Measurement and Data station activities are designed to build measurement competencies through real-world tasks. Math tasks that present problems or tasks in contexts that are personally and socially meaningful to students are most effective for engaging them and generating interest and curiosity in the tasks. Developing connections between mathematics and the real world is a strategy that can be particularly effective for students who are underperforming or are generally underrepresented in STEM.[22] Given that measurement tasks such as cooking or building are pervasive in our everyday lives, the strategy of using real-world context and application is especially effective.

Facilitator Notes

1. Direct families to the different stations, based on students' grade level.
2. When they are done, stamp their passports to enter the raffle.

[20] Barrett, J. E., Clements, D. H., & Sarama, J. (Eds.). (2017). *Children's measurement: A longitudinal study of children's knowledge and learning of length, area, and volume*. National Council of Teachers of Mathematics, Inc.

[21] Sarama, J., & Clements, D. H. (2009). *Early childhood mathematics education research: Learning trajectories for young children*. Routledge.

[22] National Council of Teachers of Mathematics. (2014). *Principles to action: Ensuring mathematical success for all*. Reston, VA: National Council of Teachers of Mathematics.

Table 4a: Grades K–1: No-Bake Playdough

Facilitator(s): _____

Purpose

Students and families will compare and use different measuring tools as they put together ingredients to make playdough.

Materials

- Multiple measuring cup and tablespoon sizes
- Ingredients for playdough

Facilitator Notes

1. Support parents as they go through the activity, particularly when they order the tools they will use for measuring (spoons and cups) by size.
2. Show parents how they can use the prompts and model asking questions, such as "How do you know that the tablespoon is bigger than the half tablespoon?" (e.g., because I see the half spoon looks smaller, or because I can use two half tablespoons to fill up one tablespoon).
3. This recipe may not work exactly as intended, as it depends on the ingredients. If the playdough doesn't come out just right, help them by measuring small quantities of oil and water (don't just add splashes of the wet ingredients). That way, the families can suggest changes to the recipe for the next person.

West Virginia Standards

Kindergarten

M.K.15 **Directly compare two objects with a measurable attribute in common to see which object has "more of" or "less of" the attribute and describe the difference.**

First grade

Cluster **Measure lengths indirectly and by iterating length units.**

M.1.15 Order three objects by length and compare the lengths of two objects indirectly by using a third object.

M.1.16 Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. Instructional Note: Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.

Second grade

Cluster **Measure and estimate lengths in standard units.**

M.2.17 Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.

Table 4b: Grades 2–3: No-Bake Playdough

Facilitator(s): _____

Purpose

Students and families will build up the right amount of ingredients for their playdough recipes by using smaller measuring tools (i.e., they will need to use ¼ cups to build up 1 cup of flour).

Materials

- Multiple measuring cup and tablespoon sizes
- Ingredients for playdough
- Paper and pencil for calculations

Facilitator Notes

1. Support families as they go through the activity, particularly when they are building up the total amounts of ingredients with the smaller measuring tools.
2. Show parents how they can use the prompts and model asking questions, such as "How will you know that you have the right amount of flour for this recipe?" (e.g., because I know that four $\frac{1}{4}$ are one cup).
3. This recipe may not work exactly as intended, as it depends on the ingredients. If the playdough doesn't come out just right, help them by measuring small quantities of oil and water (don't just add splashes of the wet ingredients). That way, the families can suggest changes to the recipe for the next person.

West Virginia Standards

Third grade

Cluster	**Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.**
M.3.17	Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units (e.g., by using drawings, such as a beaker with a measurement scale) to represent the problem.

Fourth grade

Cluster	**Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.**
M.4.19	Know relative sizes of measurement units within a system of units, including the metric system (km, m, cm; kg, g; l, ml), the standard system (lb, oz), and time (hr, min, sec). Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit.

Fifth grade

Cluster	**Convert like measurement units within a given measurement system.**
M.5.18	Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m) and use these conversions in solving multistep, real-world problems.

Wrap-up and Next Steps 15 minutes

Facilitator(s): _____

Purpose

Conclude the community math night.

Materials

- Feedback survey
- Raffle tickets

Facilitator Notes

1. Thank participants for engaging in the activities.
2. Explain that there are many activities family and community members can participate in with children outside school to encourage interest in math and support learning. A few examples are:
   - For young children, count objects around the house and ask, How many in all?
   - Talk about and compare shapes of everyday objects.
   - Use spatial language (under, over, higher, lower, closer, farther).
   - Play card games and board games that require math, including ones you make yourself.
   - Read picture books about math.
3. Distribute the feedback survey to participants and instruct them on where to return it. Provide 5 minutes for participants to complete the survey before announcing raffle winners.
4. Call out raffle winners and distribute prizes.

Table Handouts

The following sheets will be pre-printed for the workshop. They should be printed in card stock or laminated.

Table 1a: Fill in the Shapes

Instructions

1. Grab an outline.
2. Use the pattern blocks to fill in the outline.
3. For fun, take the same outline as your partner and see how you fill it out differently.

Players:
One or more.

Goal:
Fill in the shapes.

Family Prompts

Ask any of the following questions as you read the instructions and play the game:

- What shape is this? (Point to any of the pattern block shapes.)
- How many sides does it have? How many corners?
- How many [triangles, hexagons, parallelograms, trapezoids] are there in this drawing?
- Can you use other shapes to fill in the [hexagon, square, trapezoid]?
- How many other ways can we fill in this outline? Or how many shapes can be replaced with other shapes?

Table 1b: Rhombus Challenge

Instructions

1. Each player takes out 3 pattern blocks.
2. The youngest player goes first.
3. On your turn, place one of the pattern blocks on the rhombus board, then grab another pattern block from the bag (so you always have 3 pattern blocks).
4. If there are pattern blocks with shapes that don't fit, trade them.
5. The goal of the game is to fill up the board with pattern blocks.
6. The winner is the player who fills in the last pattern block.

Players:
One or more.

Goal:
Be the player who completes the rhombus.

Family Prompts

Ask any of the following questions as you read the instructions and play the game:

- What shapes can we use to play the game? What shapes are left? Why?

- Which of your three pieces will work best this turn?
- Let's play again.

Table 1c: Symmetric Mosaics

Instructions

Players:
One or more.

Goal:
Make the most lines of symmetry.

1. Roll the die.
2. Find the number in the Pattern Block Key and take **2 pattern blocks.**
3. Repeat 2 more times, taking 2 pattern blocks each time.
4. Make a design with all your shapes.
   Try to have at least one line of symmetry.
   A line of symmetry is the line that divides the design into two identical parts.
5. Count the number of lines of symmetry. Whoever has more lines of symmetry wins.
6. For fun, use the same blocks and try a new design.

Family Prompts

Ask any of the following questions as you read the instructions and play the game:

- What is the name of this shape? (Possible responses: parallelogram, hexagon, quadrilateral, triangle, trapezoid)
- How do you know if this shape has a line of symmetry? Show me.
- Is there another line of symmetry?
- Do you want to try another design?
- Let's play again.

Table 2a: Flip the Card Game

Instructions

Players:
One or more.

Goal:
Flip all cards over

1. Place the cards 0–10 face up, in order, in front of all the players.
2. The youngest person goes first.
3. During your turn, roll a pair of dice.
4. Flip one or two cards: You can use each of the numbers rolled on the dice or the sum of the numbers.
   For example, if you roll a 5 and 2, you can flip the 7 or the 5 and 2.
5. If you roll **doubles**, flip over the zero. If you have already flipped the zero, take an extra turn.
6. Whoever turns over the last card, wins.
7. For fun, you can make new rules before a new game. For example, if you roll numbers that have already been flipped, you have to flip them back.

Family Prompts

Here are some suggestions for you, as you play the game:

- Help your children as they place the cards in order, but don't do it for them.
- Help your children use the rolls strategically. For example, if they roll a 2 and 4 ask: do you want to flip over the 2 and 4 or the 6?
- Ask: What roll do you hope you get?
- Ask: Who do you think is going to turn over all their cards first?

Table 2b: Many Ways of Counting

Instructions

1. Take one card and respond to the prompt.
2. All players explain how they know they got the right answer.
3. See if there is another way of grouping the items to double-check your answer.
4. For fun, create a new card for other players to count.

Players:
One or more.

Goal:
Use different strategies to count.

Family Prompts

As you read the instructions and play the game:

- Ask your children **first** for the answer.
- Ask them to explain how they got their answers.
- Ask them how else they could figure it out.
- Share how you counted so that you can compare strategies.
- Some children will simply count each item, and that's OK.
- Encourage children to group, so they don't have to count each item.
- Use the dry erase markers to explain your grouping strategies or help count the objects.

Table 2c: 24!

Instructions

1. Shuffle the deck of number cards and deal five number cards to each player.
2. Place the cards face up so everyone can see each other's cards.
3. Set the remaining cards in the center. Set the operations cards in center face up.
4. On your turn, use your cards to make 24 by using any operations cards you need: You can add, subtract, multiply, and divide as many times as you need.
5. If you can't make 24, you can exchange one or more number cards and wait until the next turn.
6. The person with the most points at the end of the round (when all the number cards have been used) wins.

Players:
Two or more.

Goal:
Make 24 using the numbers you have in your hand.

Scoring

Use 5 cards: 10 points

Use 2–4 cards: 5 points

Use 1 card: 1 point

Family Prompts

As you read the instructions and play the game:

- Help deal the cards.
- Let your children lead, but offer hints if you see they are stuck—for example, if they are having trouble using division or multiplication.
- It's OK to help them or have them help you if you are stuck (or pretend to be stuck).

Table 3a: Race to 100 Game

Instructions

Players:
Two or more.

Goal:
Earn enough 10 and 1 units to exchange for a 100 unit square.

1. Players take turns rolling two dice.
2. At the start of a turn, roll a pair of dice.
3. Add the dots and collect that number of units.
4. When you get 10 units, you can exchange them for a 10 bar.
5. If you **roll a double**, you get a free 10 bar along with the sum of the roll.
6. When you have ten 10 bars, exchange them for a 100 square and win.

Family Prompts

As you read the instructions and play the game:

- Help your children when they get 10 or more units so they can exchange them for a 10 bar.
- This game helps children understand the base 10 system we use for counting.
- Ask them to play again if the game is short.

Table 3b: Broken Calculator

Instructions

1. In this game, you pretend that certain keys on the calculator don't work and solve math problems that way.
2. Why didn't we provide answers? Because there are so many! Plus, once you get one answer, you'll see that you were correct or incorrect immediately on the calculator. If by some chance you didn't find one correct path, then try again — that's why you have a calculator! :)

Players:
One or more.

Goal:
Make various numbers on a calculator without using certain keys.

Family Prompts

As you read the instructions and play the game:

- Be patient with your children and yourself.
- If your children are stuck, offer hints like: Can you combine the 1 and 0 in a way to help you? What operation can we use?
- Ask your children to share their solutions and then ask the questions in the game.
- Ask them if they can do it another way.

Table 3c: Multiplication Card Game

Instructions

1. Set the deck face down in the middle of the table.
2. Each player takes two cards and multiplies the numbers on the cards.
3. All players then say the product (the result of the multiplication) out loud.
4. The player with the largest product wins.
5. The winner takes all the cards.
6. If a player gives the wrong product, he/she loses the hand.
7. If the products are the same, the cards stay on the table and the players do another round.
8. The game is over when all the cards are used. The player with the most cards wins.

Players: Two to four players.

Goal:
Have the greater product of the two cards.

Jacks=0 Aces=1

Family Prompts

As you read the instructions and play the game:

- Shuffle the cards.
- If your children get stuck on a multiplication, give them some time and tools like the multiplication table to find the right product.

Table 4a: No-Bake Playdough

Instructions

Materials

Ingredients	Tools
Water: $\frac{1}{2}$ cup	Big bowl
Food coloring: 5–10 drops	Small bowl
Cooking oil: 1 tablespoon	Measuring cups
Salt: $\frac{1}{4}$ cup	Measuring spoons
Flour: 1 cup	Wooden spoon for mixing

Recipe

1. Measure and pour the wet ingredients (water, food coloring and oil) into the **small** mixing bowl.
2. Measure the dry ingredients (flour and salt) into the **large** bowl and mix them together.
3. Add the wet ingredients into the dry ingredients. Start mixing.
4. If the mixture is still dry, add $\frac{1}{2}$ tablespoon of oil at a time.
5. Pour the mixed ingredients onto the table and knead the ingredients together until a soft dough is formed.
6. If you want to bring it home, place the dough in a resealable plastic bag to keep fresh.

Family Prompts

As you read the instructions and make the recipe together:

- Examine the tools you have.
- Order the measuring tools by size (smallest to largest or the other way around).
- Discuss the difference between 1 cup and 1 tablespoon. Which is bigger? How do you know?
- Let your children do the scooping and measuring. Show them how level off their measurements for accuracy.

Table 4b: Building up Ingredients for Playdough

Instructions

Materials

Ingredients	Tools
Water: $\frac{1}{2}$ cup	Big bowl
Food coloring: 10+ drops	Small bowl
Cooking oil: 1 tablespoon	$\frac{1}{4}$ cup
Salt: $\frac{1}{4}$ cup	$\frac{1}{4}$ and $\frac{1}{2}$ tablespoons
Flour: 1 cup	Wooden spoon for mixing

Recipe

1. Measure and pour the wet ingredients (water, food coloring and oil) into the **small** mixing bowl.
2. Measure the dry ingredients (flour and salt) into the **large** bowl and mix them together.
3. Add the wet ingredients into the dry ingredients. Start mixing.
4. If the mixture is still dry, add $\frac{1}{2}$ tablespoon of oil at a time.
5. Pour the mixed ingredients onto the table and knead the ingredients together until a soft dough is formed.
6. If you want to bring it home, place the dough in a resealable plastic bag to keep fresh.

Family Prompts

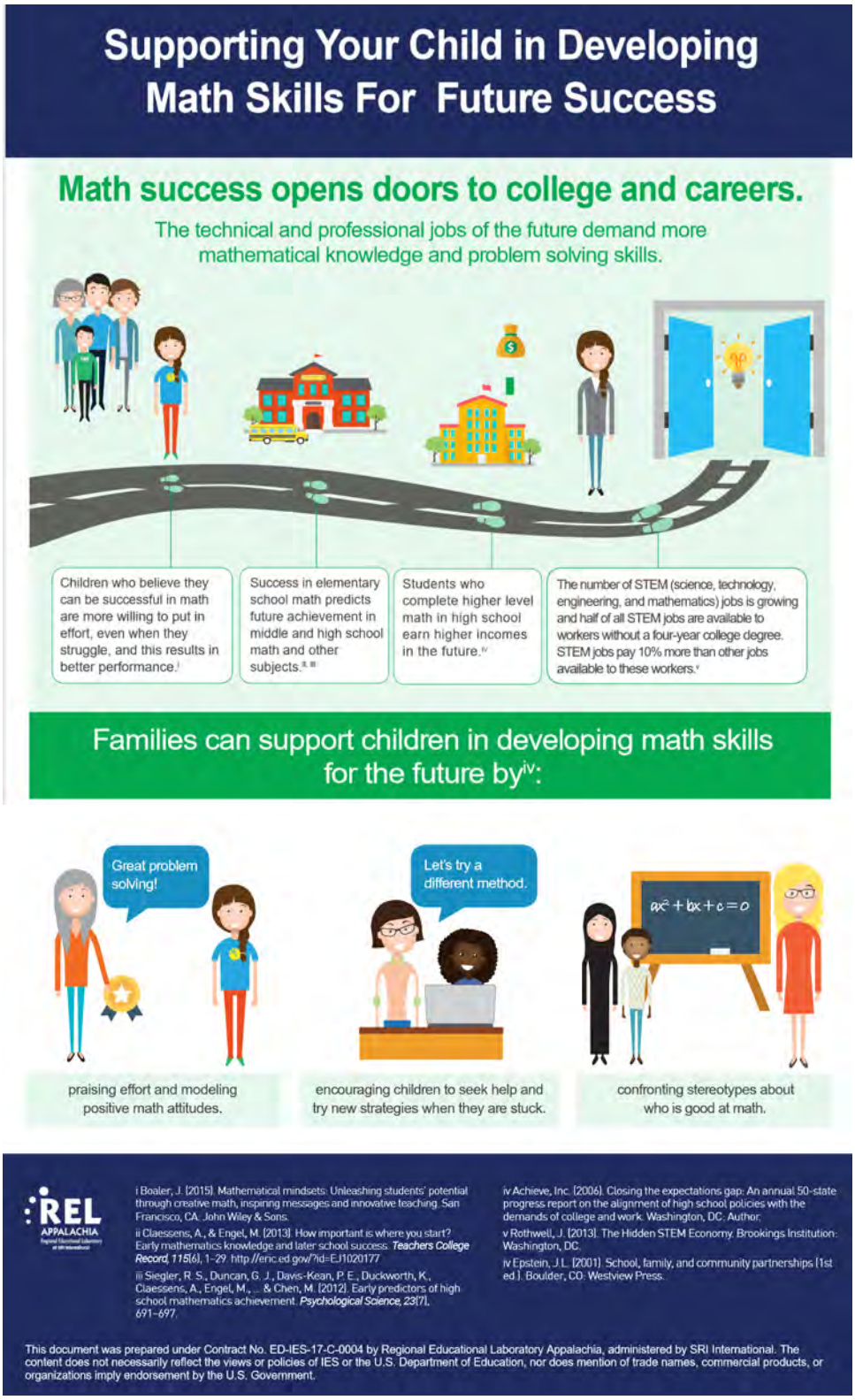
As you read the instructions and make the recipe together:

- Examine the tools you have.
- **Notice that you don’t have tools that are the exact size of the recipe.**
- Discuss how you can make 1 cup of flour with the tools you have.
- Let your students do the scooping and measuring. Show them how not to overfill their measurements for accuracy.

Math Night Parent Handouts

The following documents will be printed without headers so that each parent will receive a family letter and infographic.

Welcome and Goals



Take-Home Letter

Dear family,

Thank you for coming to support your young mathematicians' learning. The math seed you plant now will blossom and help them to succeed in life whatever path they choose.

We have chosen these games and activities so you can play them with your children. Sometimes you will lead, sometimes they will lead, but always you will be working together. Sometimes the activities may seem more like regular life than math class. We did that on purpose to show you how math really does relate to your daily life or fun activities that you want to do with your children anyway.

We encourage you to do math at home or wherever you are with your children. Every week make sure you are doing activities that involve math: count, sort, compare, measure, and make patterns and designs. For example:

- Ask your children to count things like tiles, packages, and cars.
- At least once a week play card games and board games.
- Sing songs together in the car or at home.
- Ask them to sort the cutlery into categories at home after doing the dishes.
- Look for patterns or shapes on your way to school or in the way food is organized in the supermarket.
- Involve your children in measuring when you cook.

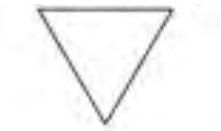
As you know, children love repetition, so you can probably do the same activities a few times before your child loses interest.

Please contact us if you have any questions!

Table Materials

The following handouts will be printed for the workshop, as they require special instructions for printing and cutting and color.

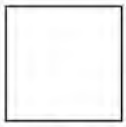
Geometry Glossary



Count the sides and the corners.

If there are three of each, it is a triangle.

If the sides are all the same length, then it is an equilateral triangle.



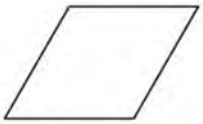
Count the sides and the corners.

If there are four of each, it is a quadrilateral.

If it has two pairs of parallel sides, then it is a parallelogram.

If it also has four equal angles, then it is a rectangle.

If the sides are also all the same length, then it is a square.



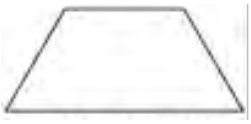
Count the sides, count the corners.

If there are four, it is a quadrilateral.

If it has two pairs of parallel sides, then it is a parallelogram.

Are the four angles equal? No? Then, it is not a rectangle.

Are the sides the same length? Yes? Then it is a rhombus.



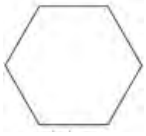
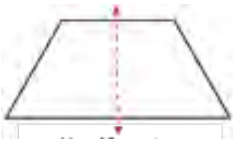
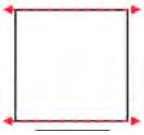
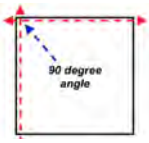
Count the sides, count the angles.

If there are four, it is a quadrilateral.

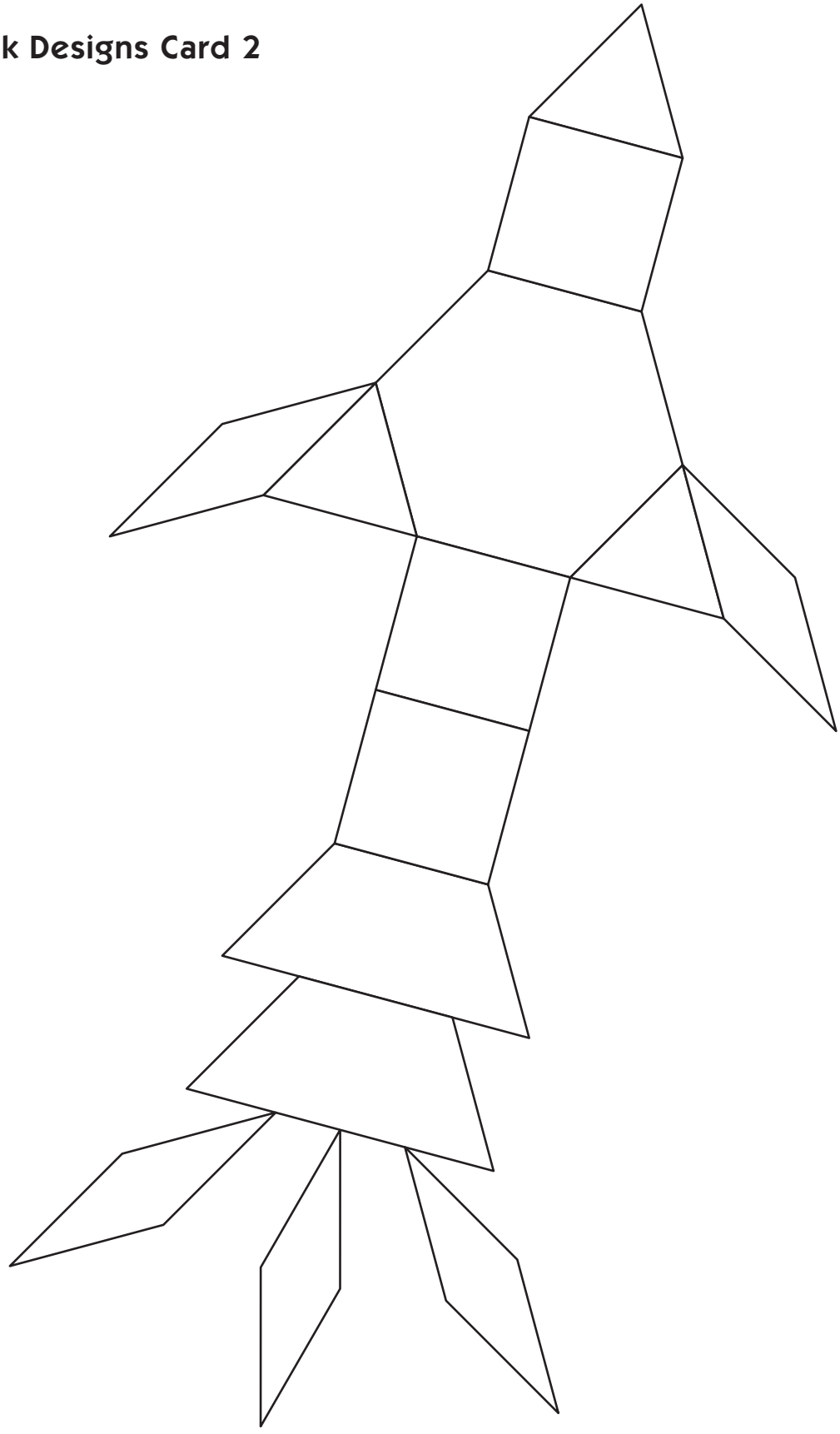
Does it have two pairs of parallel sides? Yes? Then it's a parallelogram.

Does it have only one pair of parallel sides? Yes? Then it is a trapezoid.

This is a special case called an isosceles trapezoid because the angles at the base are the same measurement.

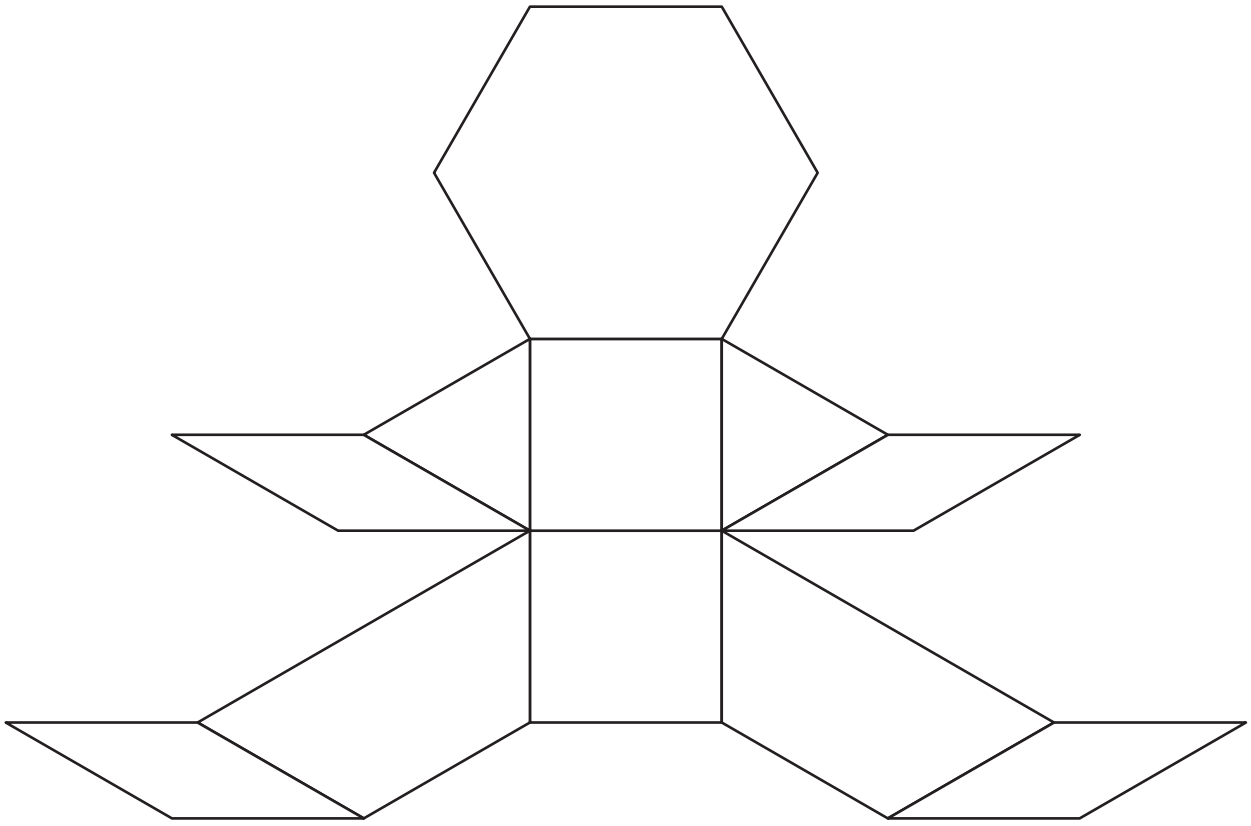
	Count the sides, count the angles. If there are six, it is a hexagon! If the sides are equal in length, it's a regular hexagon.
	When you fold a shape on a line of symmetry, the two parts match up exactly.
	If two lines don't cross and they seem like they'll never meet, then they are parallel. (You can also say two lines are parallel if the lines are always the same distance apart, no matter where you measure.)
	If two lines cross once and they make a "perfect corner," we call that a right angle or a 90 degree angle. We can also say that those two lines are perpendicular to each other.

Pattern Block Designs Card 2



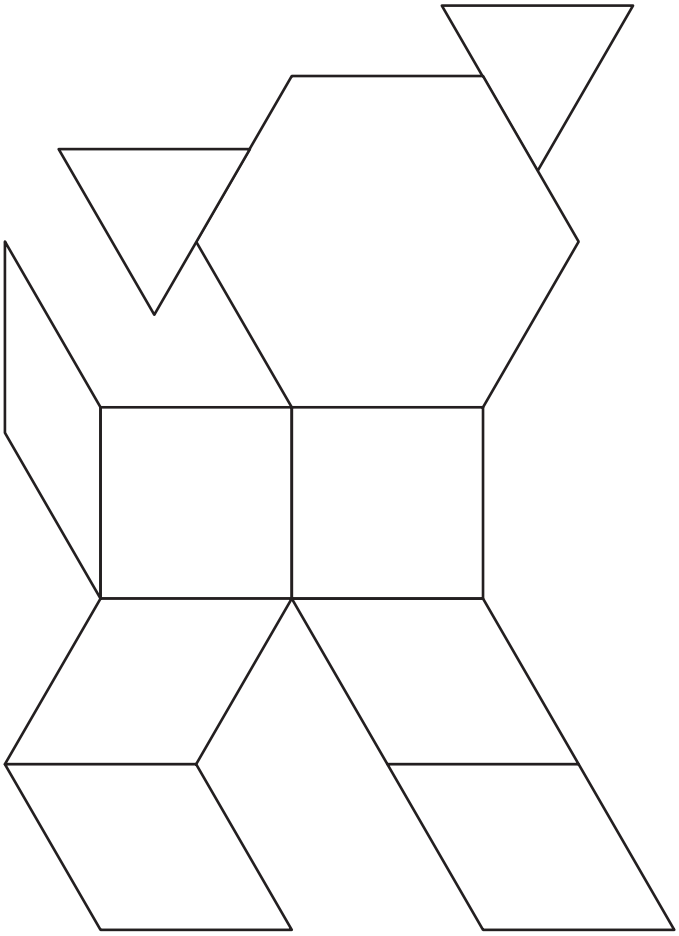
5...4...3...2...1...blast off!

Pattern Block Designs Card 3



block baby

Pattern Block Designs Card 4



perky pattern puppy

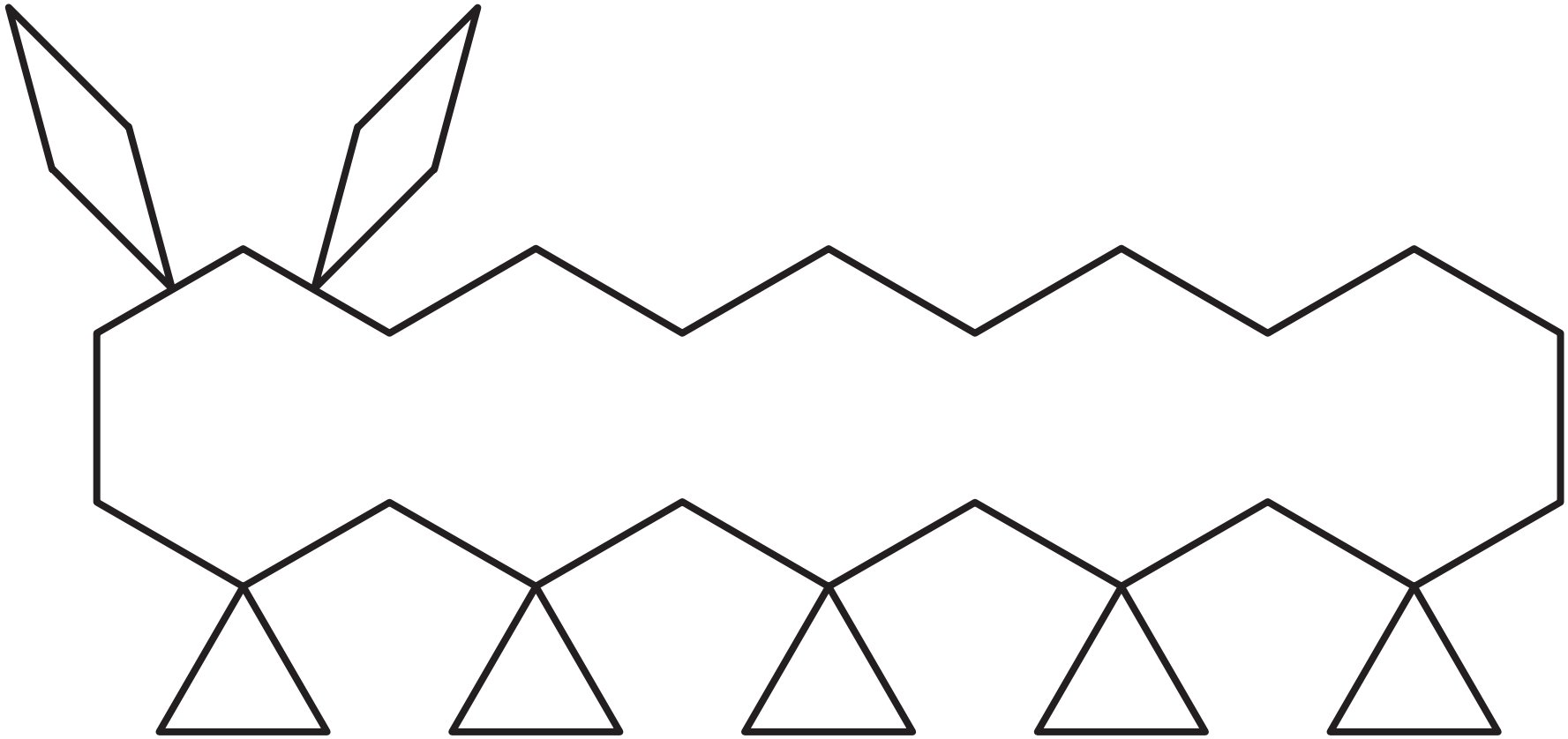
Snake

Table Materials

Reed, K. E., & Young, J. M. (2017). Games for Young Mathematicians: Pattern Animals. Waltham, MA: EDC, Inc.

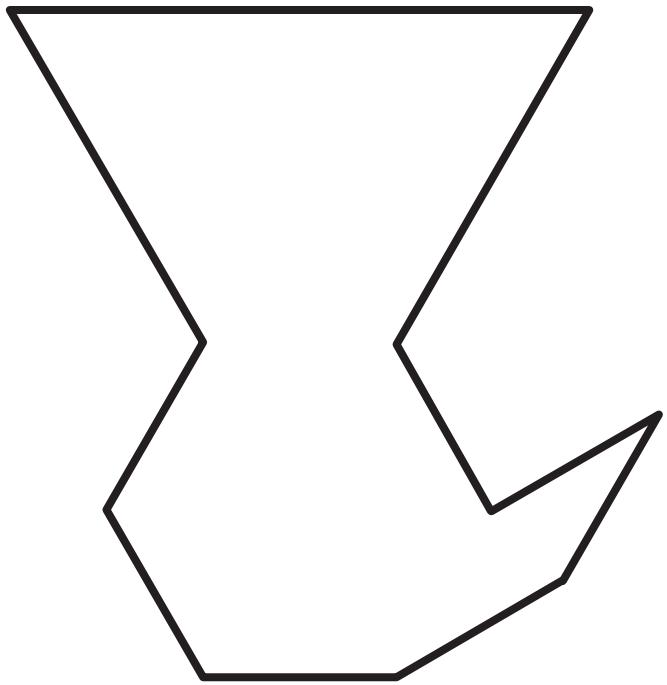
Caterpillar

Table Materials



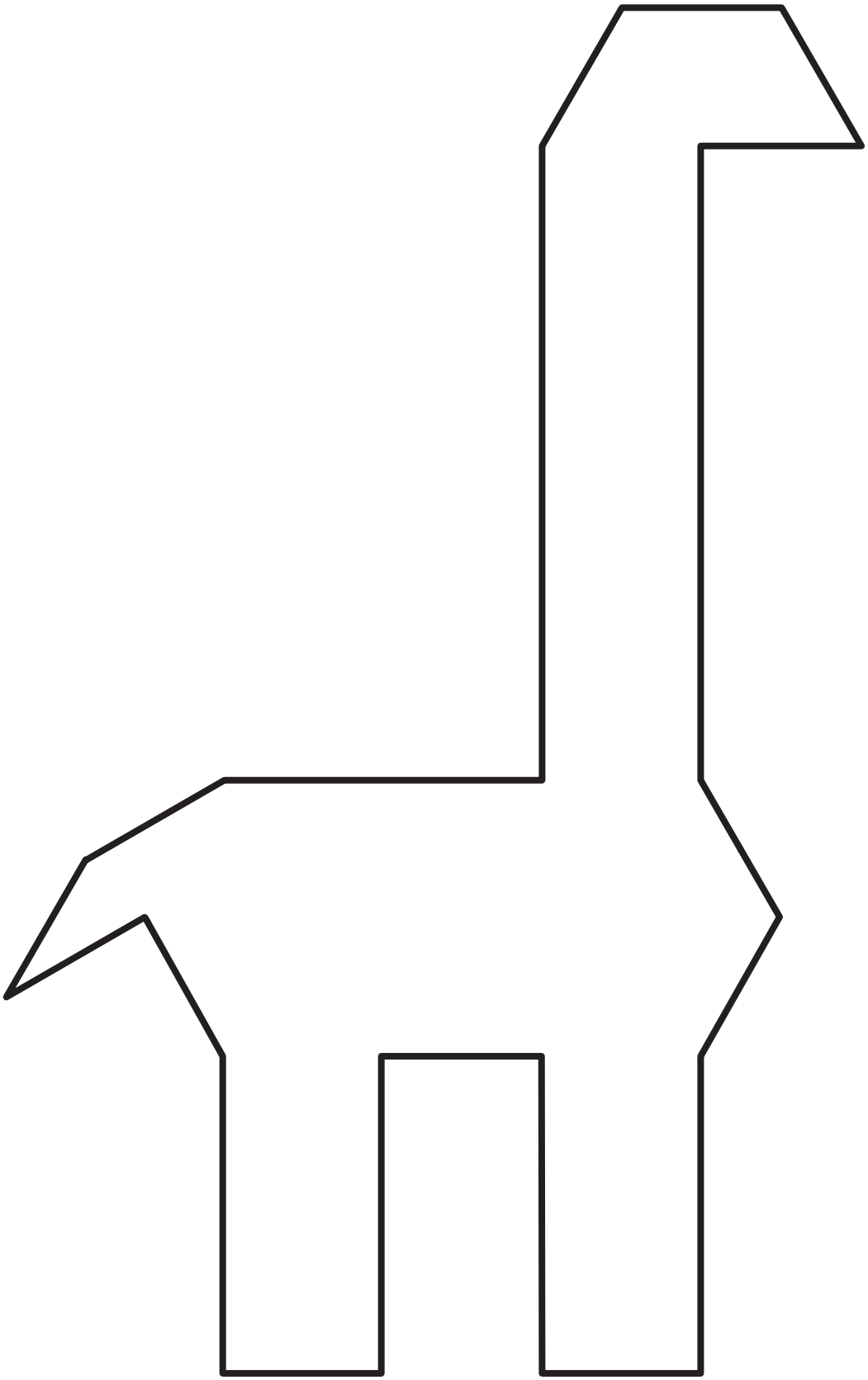
Reed, K. E., & Young, J. M. (2017). Games for Young Mathematicians: Pattern Animals. Waltham, MA: EDC, Inc.

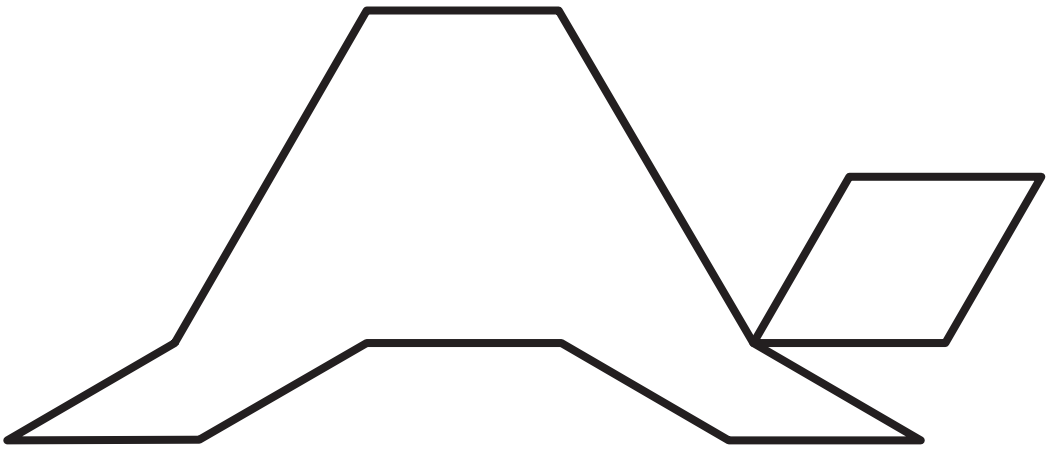
Cat



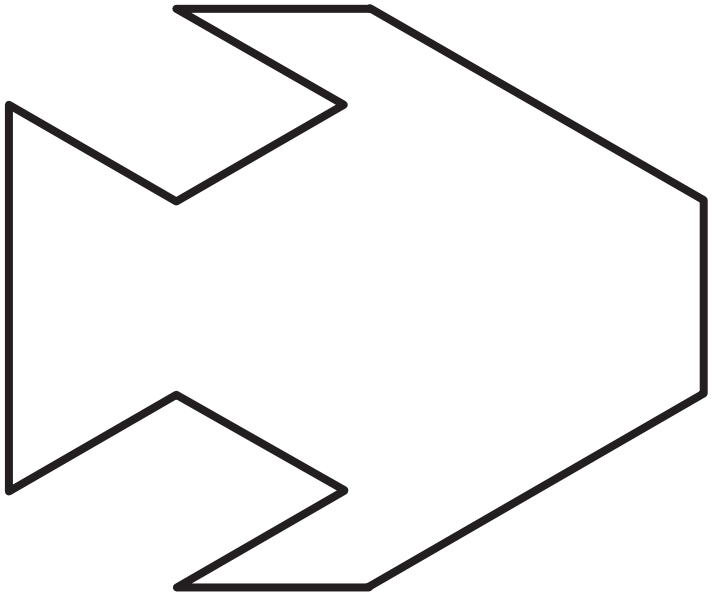
Reed, K. E., & Young, J. M. (2017). Games for Young Mathematicians: Pattern Animals. Waltham, MA: EDC, Inc.

Giraffe

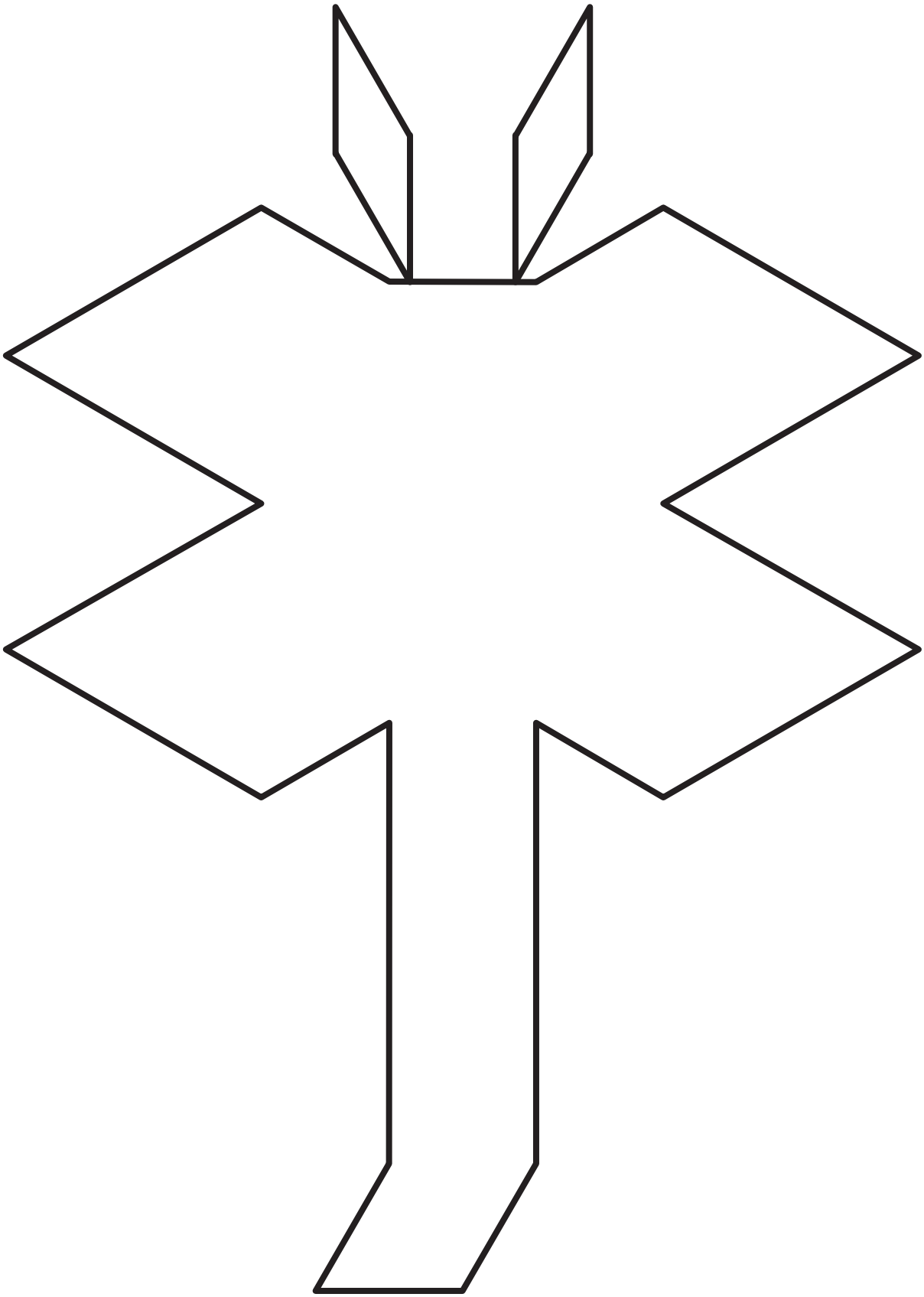




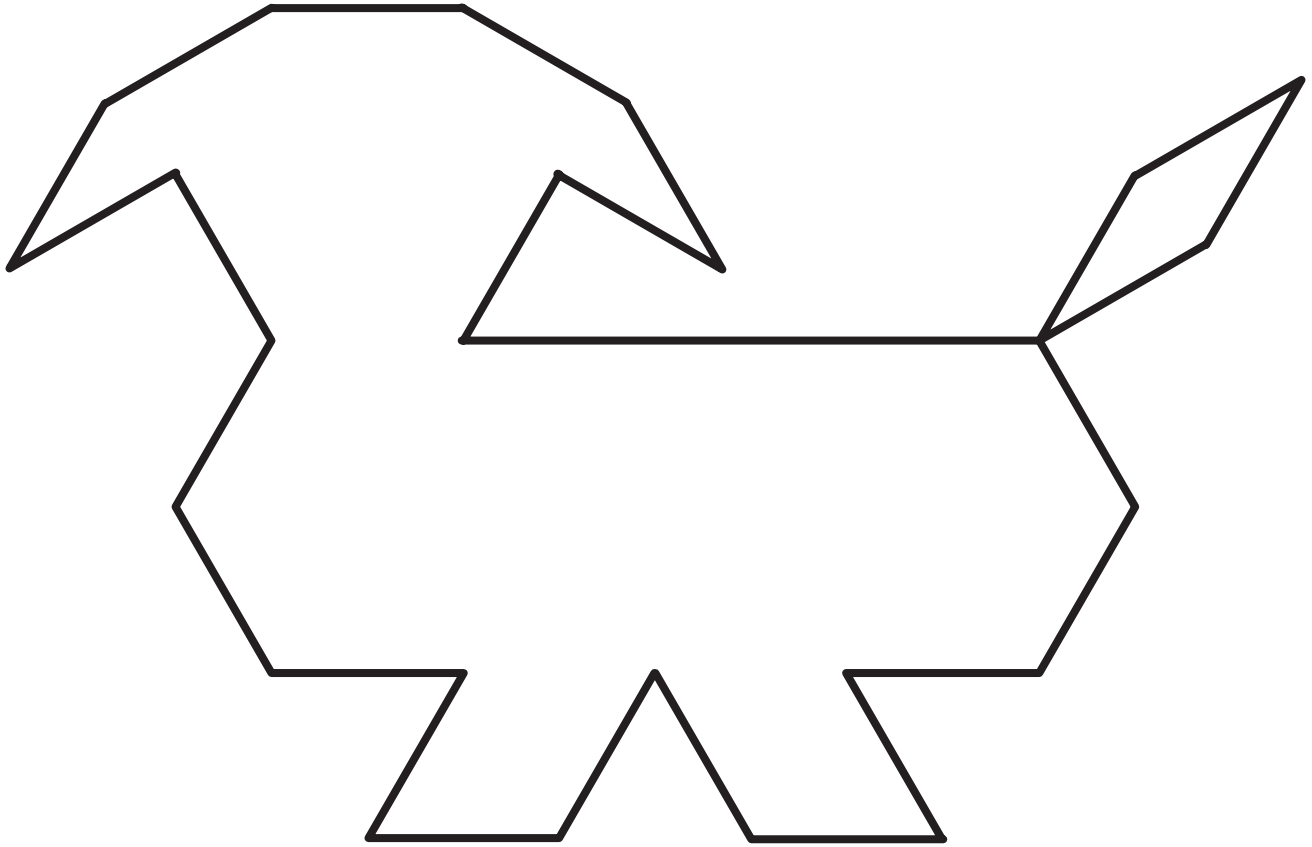
Fish



Dragonfly

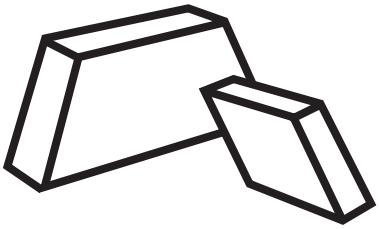


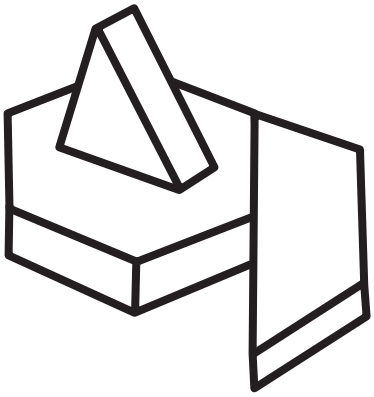
Dog

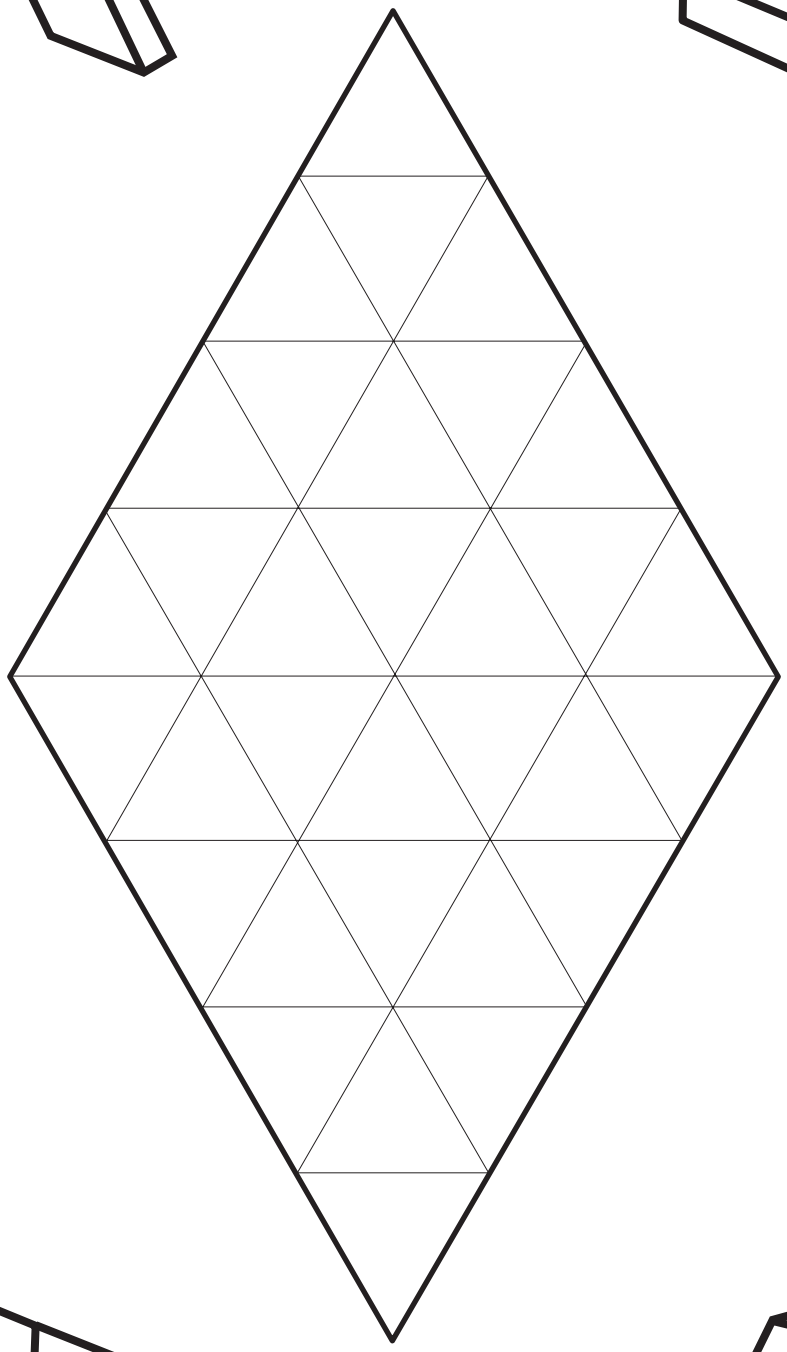


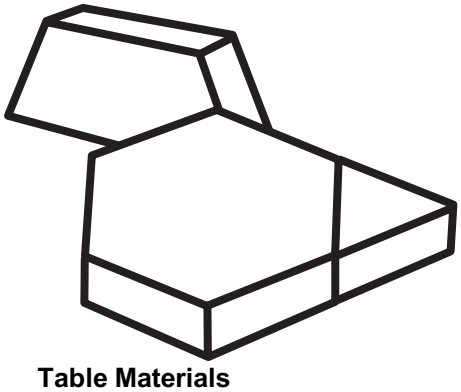
Reed, K. E., & Young, J. M. (2017). Games for Young Mathematicians: Pattern Animals. Waltham, MA: EDC, Inc.

Last Shape In Wins gameboard









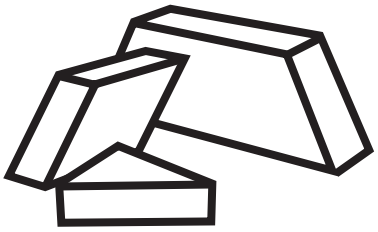
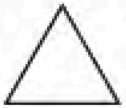
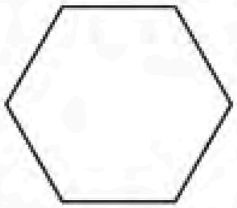
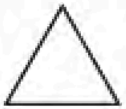
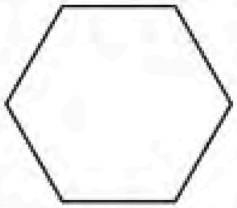


Table Materials

Pattern Block Key

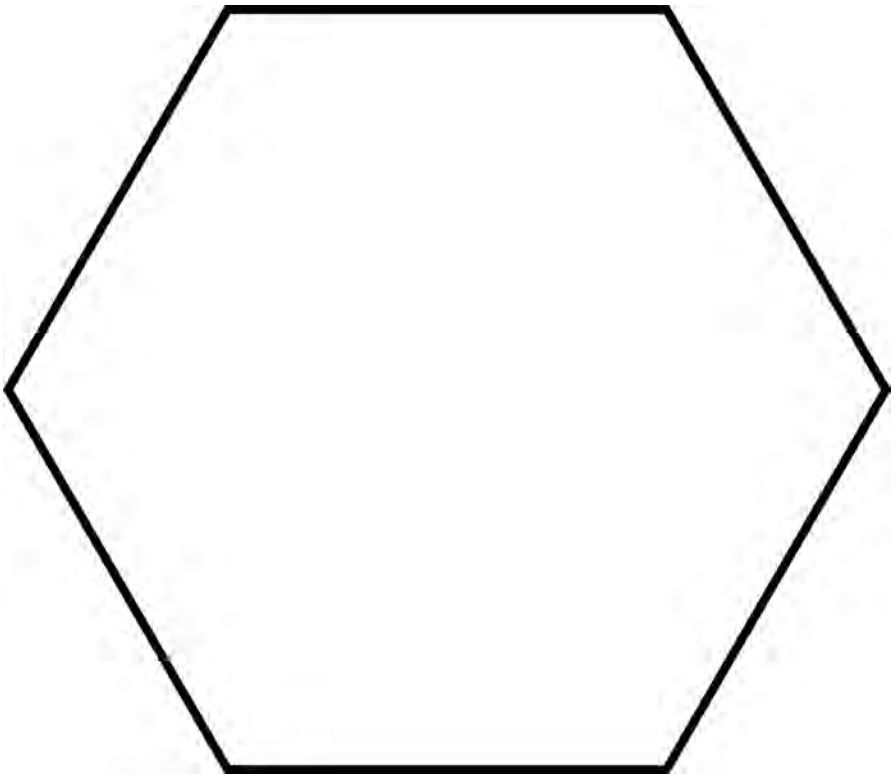
Number rolled	1	2	3	4	5	6
Take two of this block.						

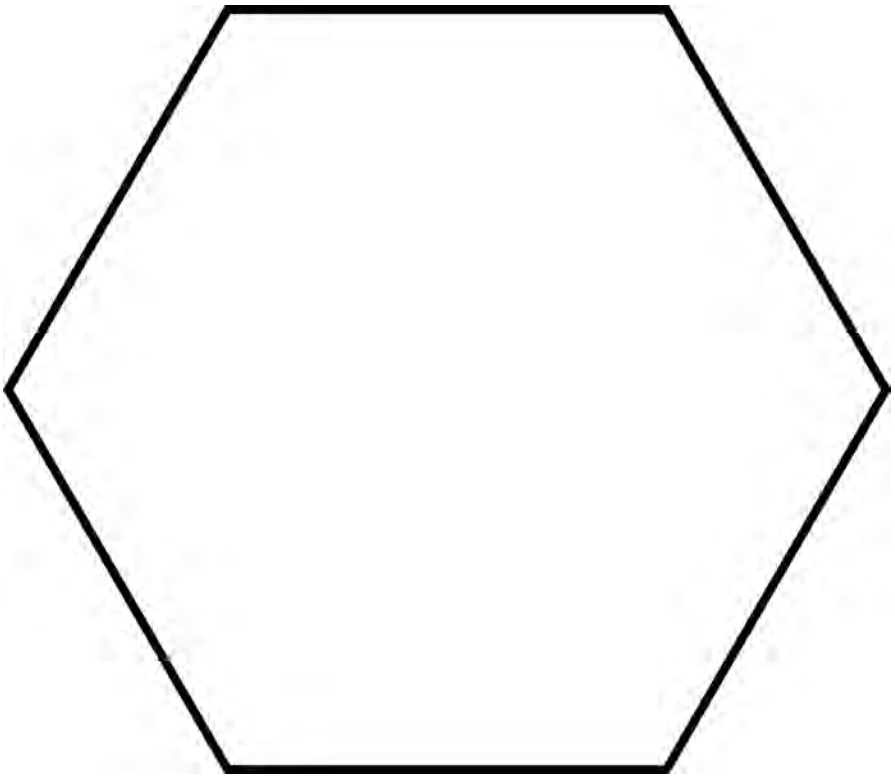
Pattern Block Key

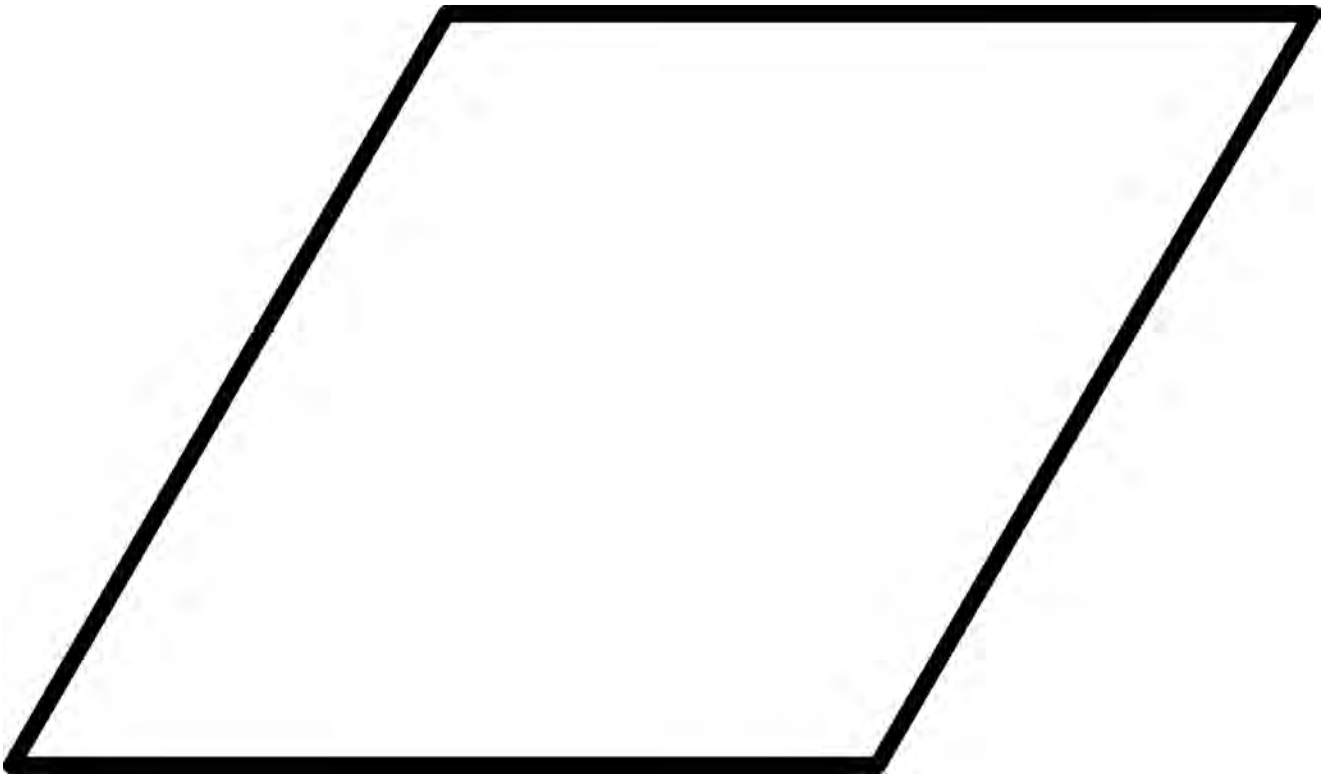
Number rolled	1	2	3	4	5	6
Take two of this block.						

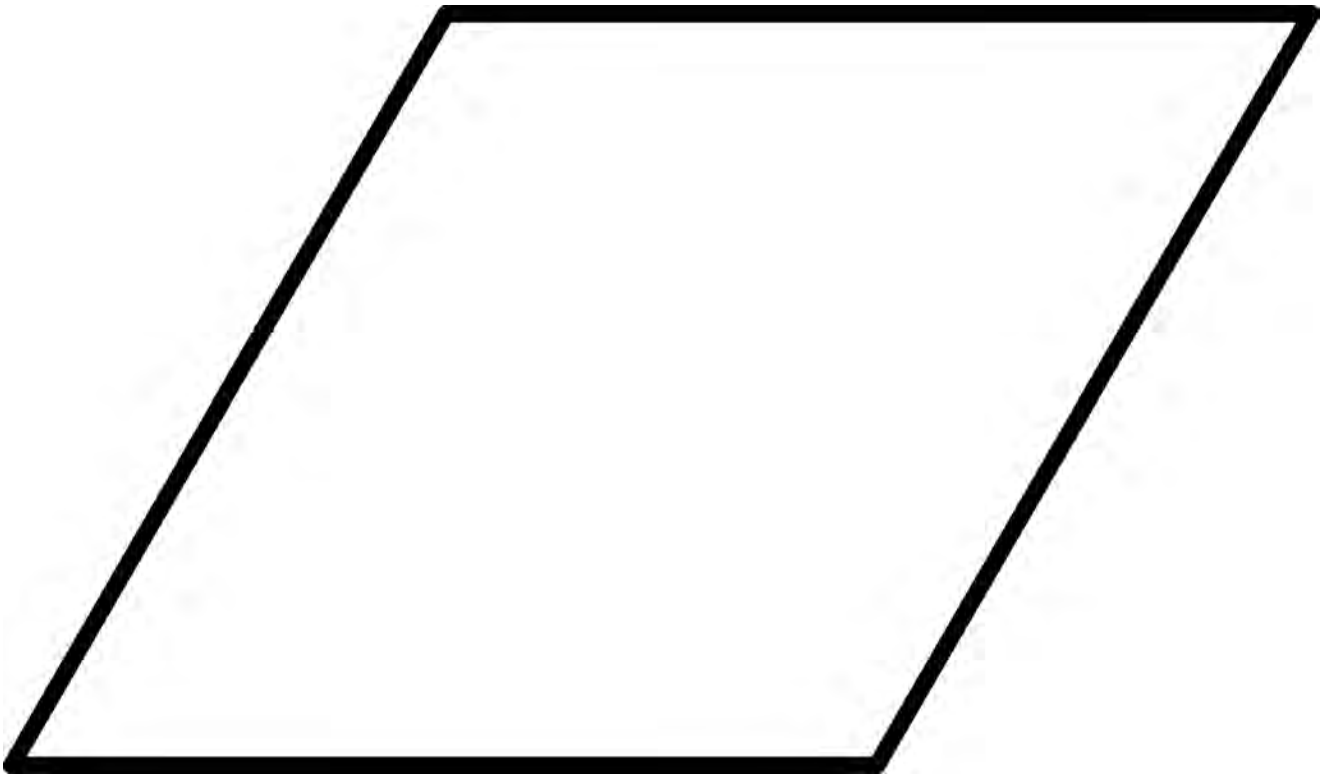
Player _____

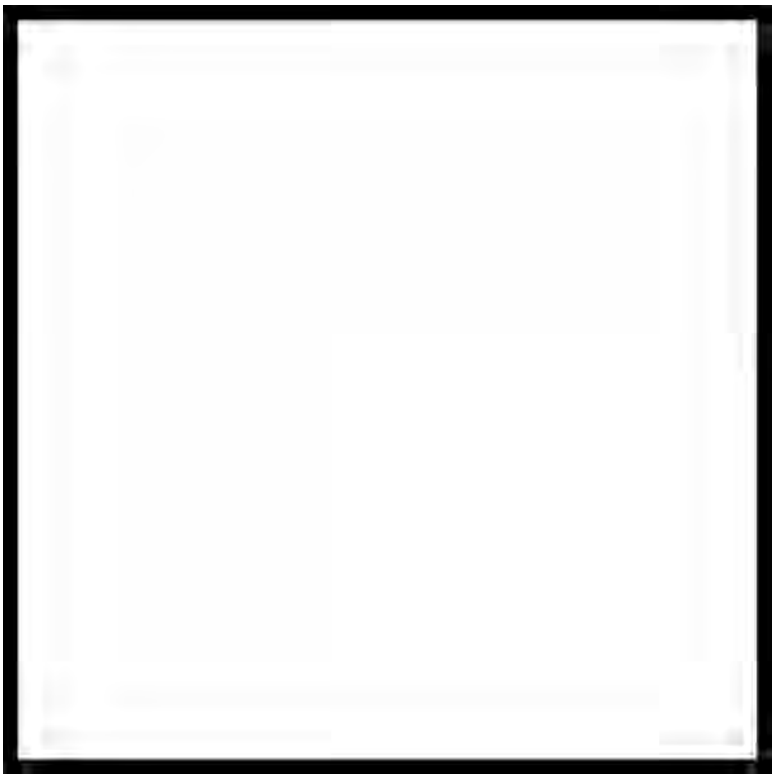
Lines of symmetry	

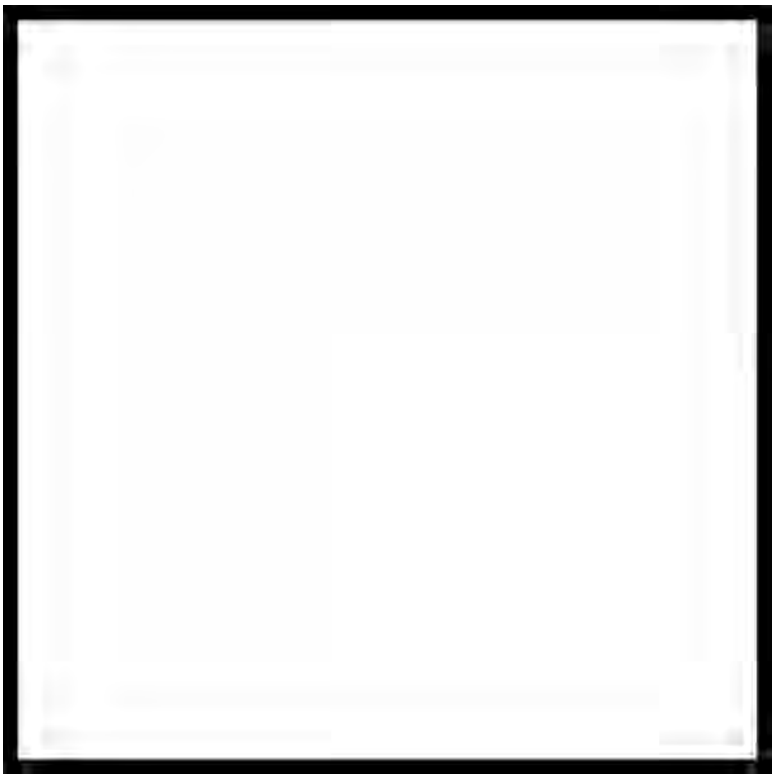


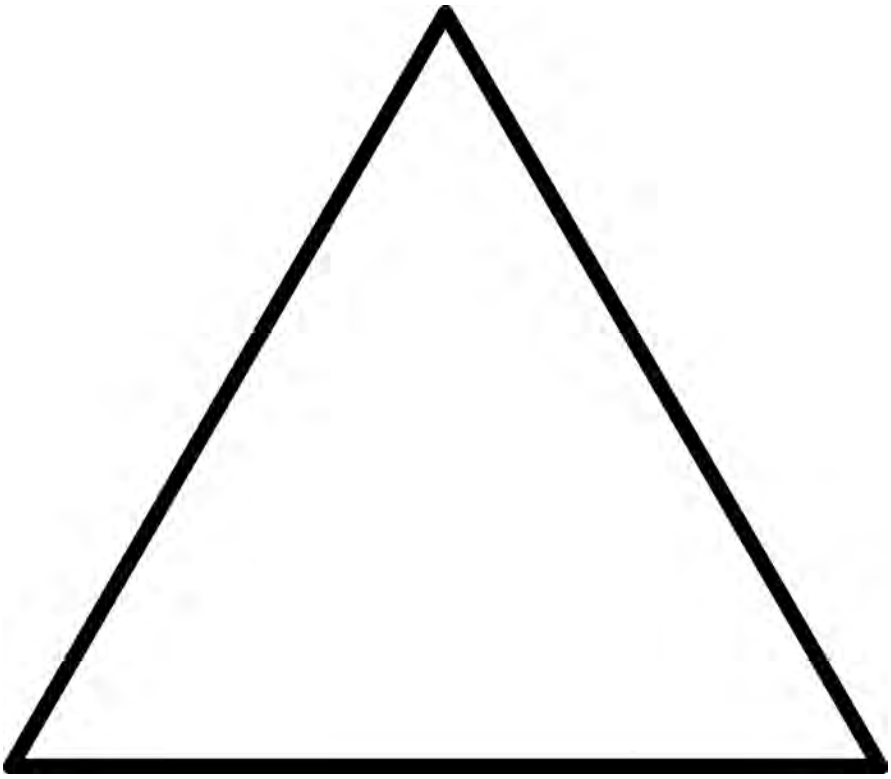


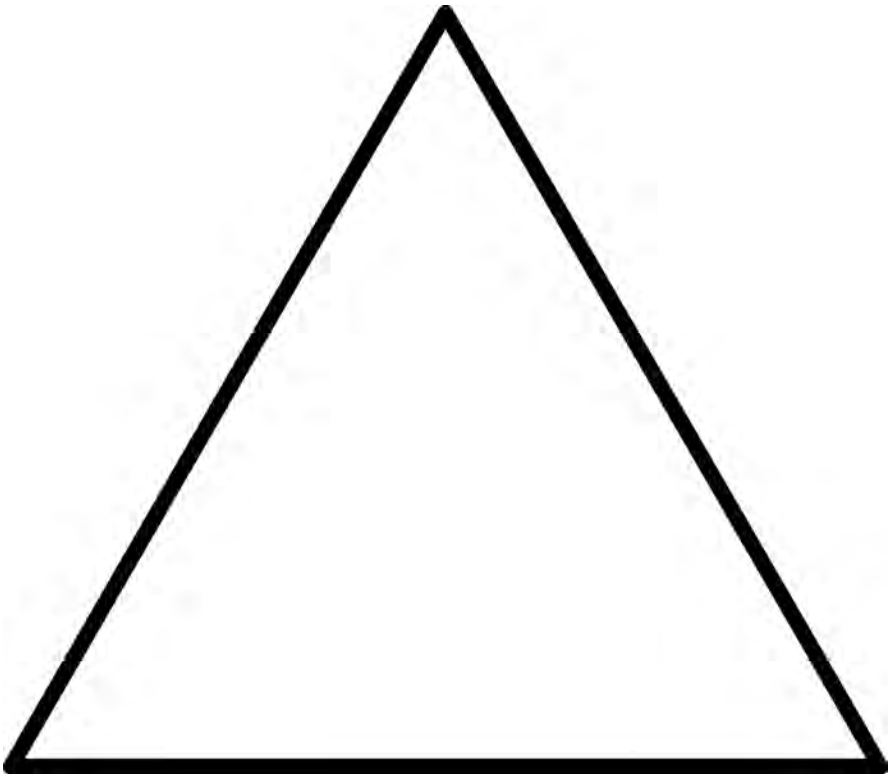


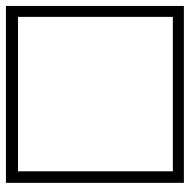
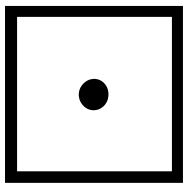
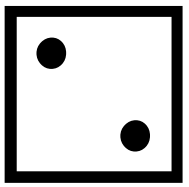
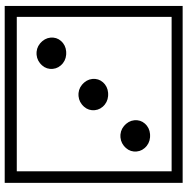
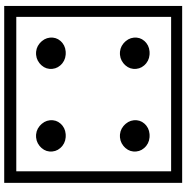
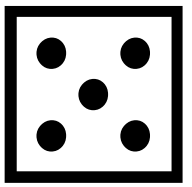
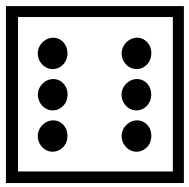
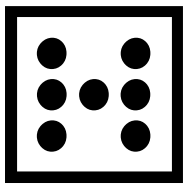
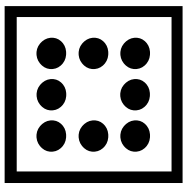
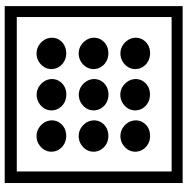
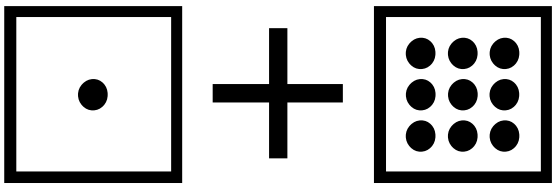




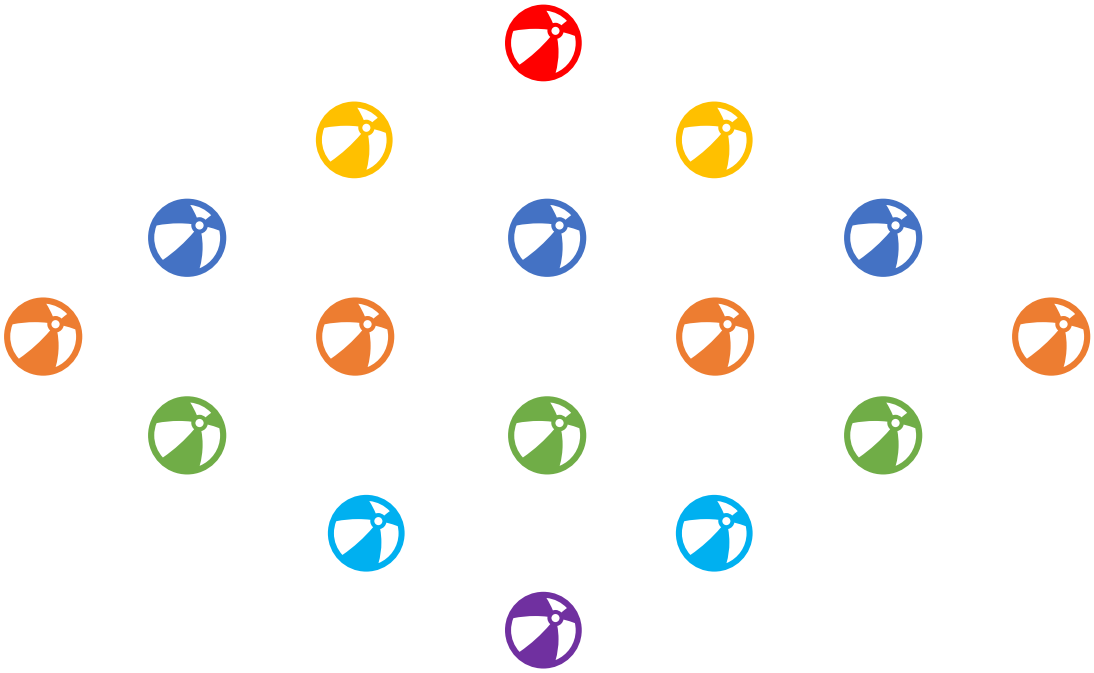






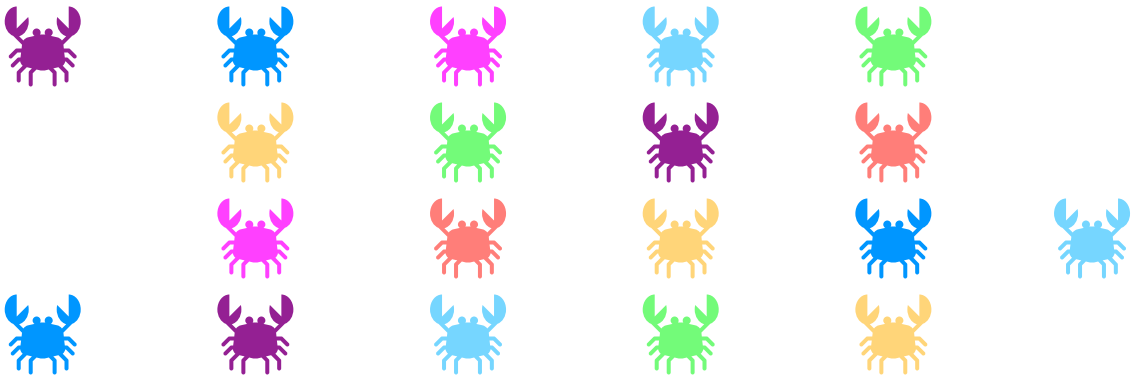
0	1	2	3	4	5
					
6	7	8	9	10	
					

How many balls in the playground?

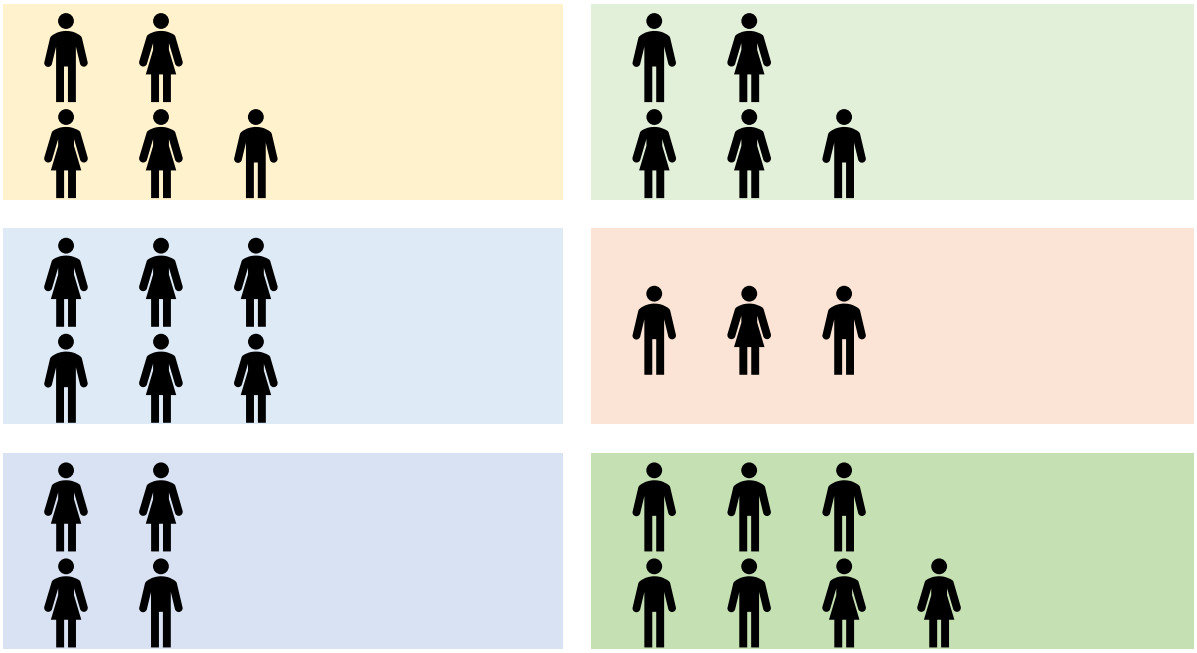


How many owls in the barn?

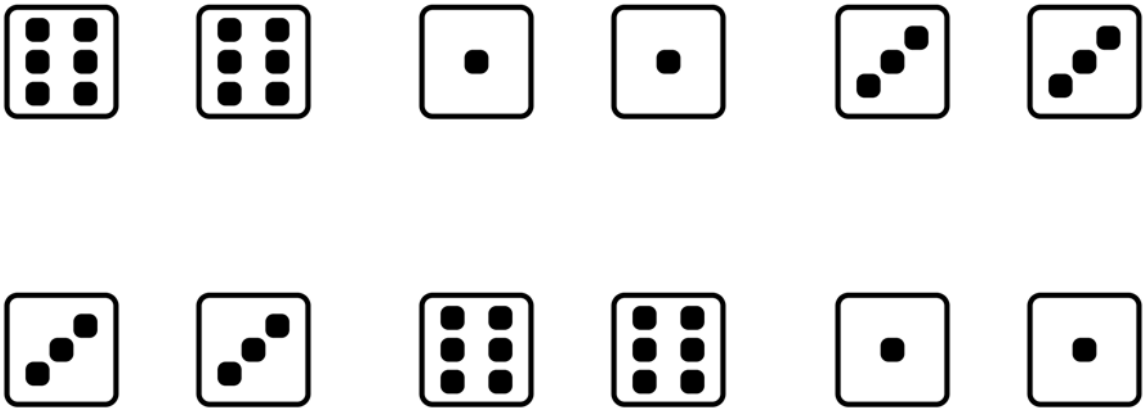
How many crawfish do you see?



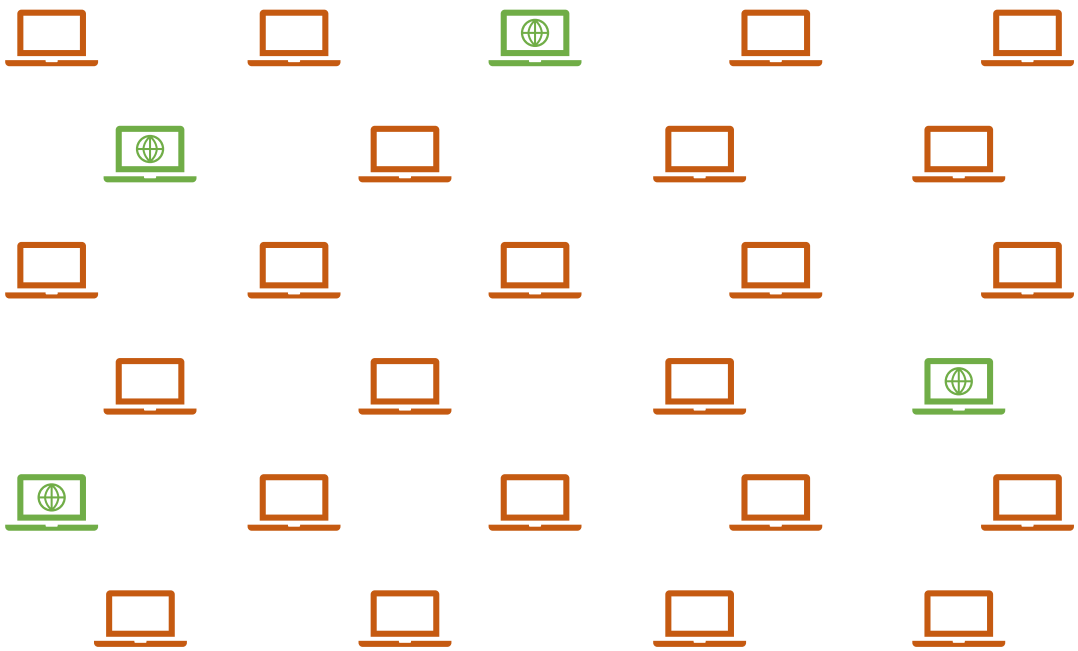
How many people work in this building?



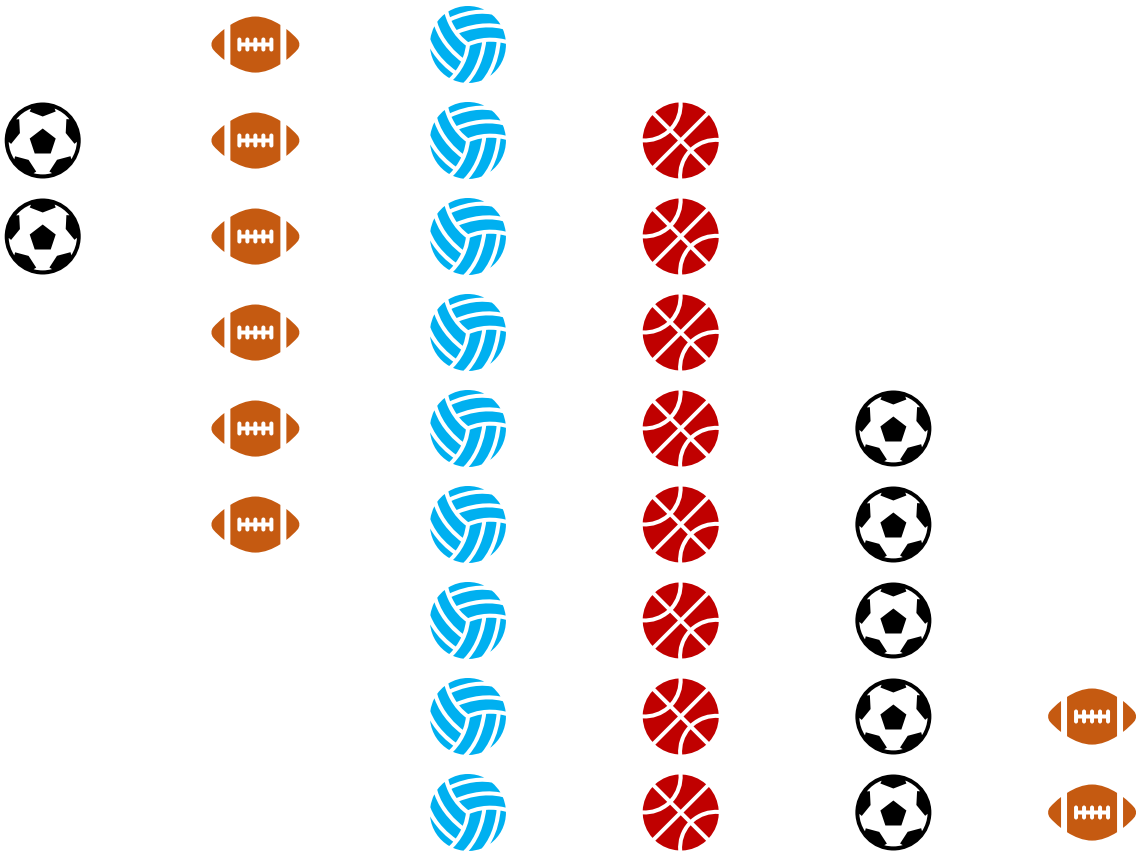
How many dots do you see?



How many computers are turned off (the dark red ones)?



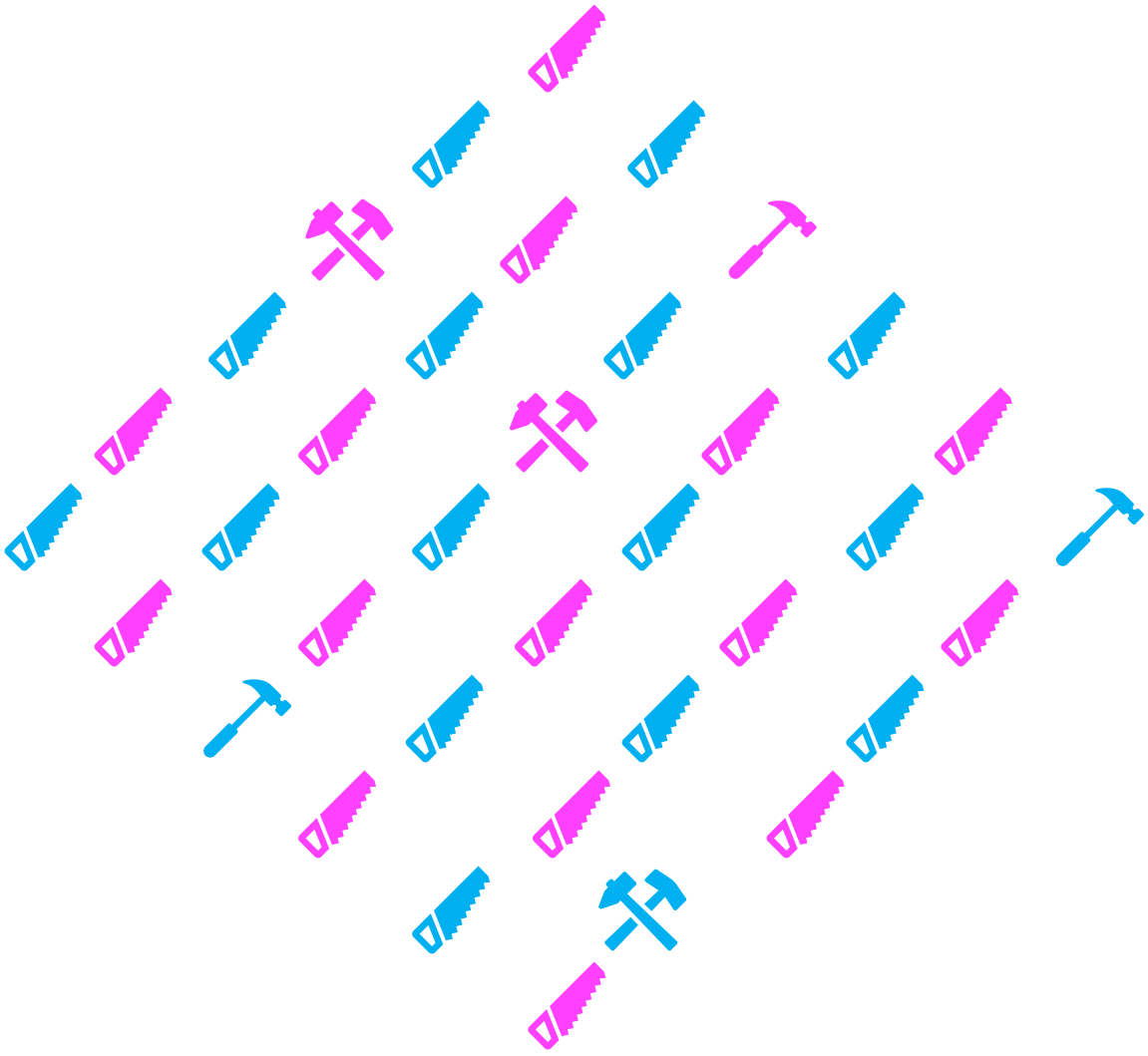
Count how many balls in all.



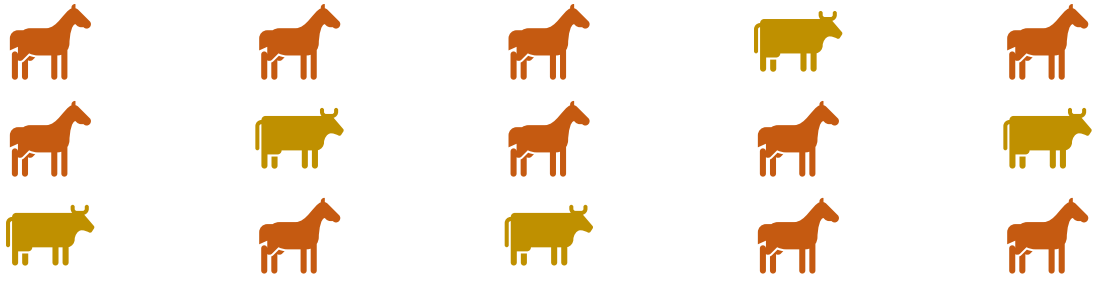
How many days has the sun shone in the past few weeks?

Sun	Mon	Tue	Wed	Thu	Fri	Sat

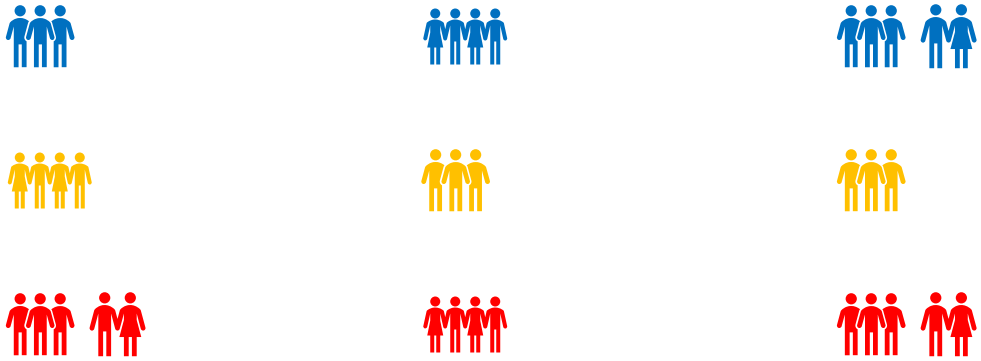
Count the saws we will find in this bunch.



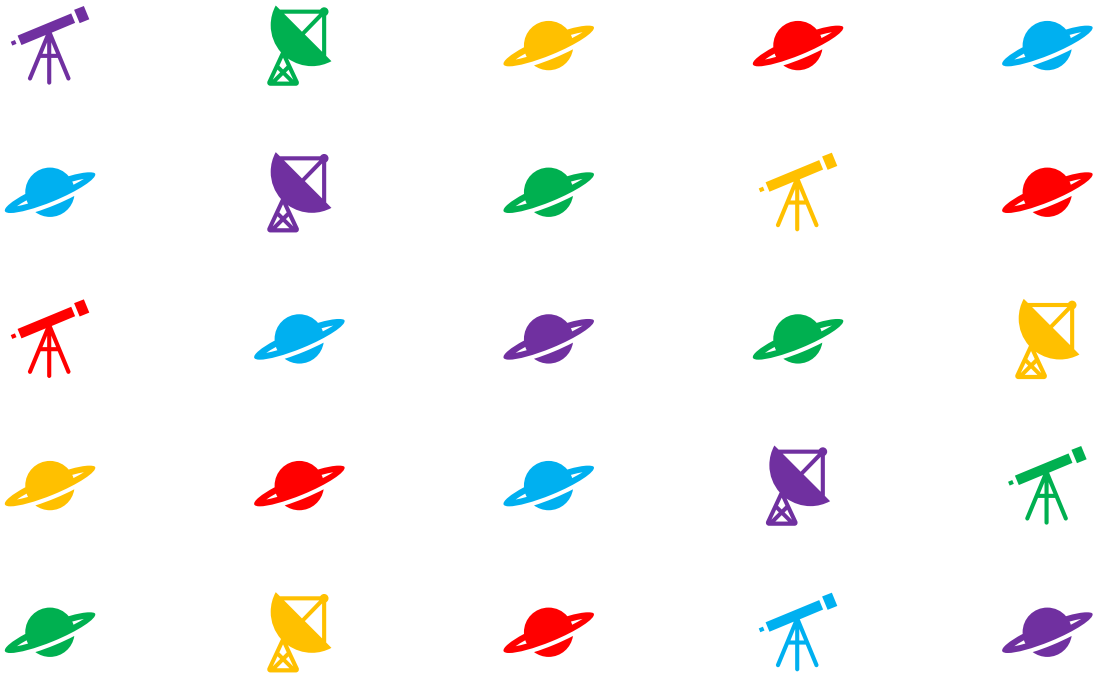
How many cows? How many horses? How many in all?



Count the people in this crowd.



What are there more of: Planets, telescopes, or satellite dishes?



Materials for 2c (to be prepared before activity)

0	0	0	0
1	1	1	1
2	2	2	2

3	3	3	3
4	4	4	4
5	5	5	5

6	6	6	6
7	7	7	7
8	8	8	8

9	9	9	9
10	10	10	10
11	11	11	11

12	12	12	12
13	14	15	16
17	18	19	20

20	20	20	21
22	23	24	24
+ (plus)	+ (plus)	+ (plus)	+ (plus)

− (minus)	− (minus)	− (minus)	− (minus)
X (times)	X (times)	X (times)	X (times)
÷ (divided by)	÷ (divided by)	÷ (divided by)	÷ (divided by)

Multiplication Table

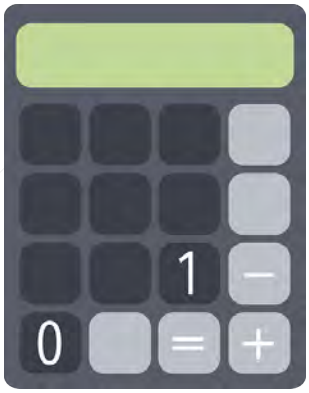
	0	1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10	11	12
2	0	2	4	6	8	10	12	14	16	18	20	22	24
3	0	3	6	9	12	15	18	21	24	27	30	33	36
4	0	4	8	12	16	20	24	28	32	36	40	44	48
5	0	5	10	15	20	25	30	35	40	45	50	55	60
6	0	6	12	18	24	30	36	42	48	54	60	66	72
7	0	7	14	21	28	35	42	49	56	63	70	77	84
8	0	8	16	24	32	40	48	56	64	72	80	88	96
9	0	9	18	27	36	45	54	63	72	81	90	99	108
10	0	10	20	30	40	50	60	70	80	90	100	110	120
11	0	11	22	33	44	55	66	77	88	99	110	121	132
12	0	12	24	36	48	60	72	84	96	108	120	132	144

Materials for 3b

Year of birth

Restriction: The only keys that work are 1, 0, +,– , =.
Goal: Can you get the display to show the four digit year of your birth? (e.g., 1990, 2011)

1. Explain your strategy.
2. How many moves did it take you?
3. Can you do it in fewer moves? More?
4. Can you get the display to show your parents' year of birth?
5. Explain your strategy.
   Did you use the same strategy or a different one?
6. How many moves did it take you?
7. Can you do it in fewer moves? More?



Where's the 1?

Restriction: The #1 key is broken!
Goal: We need to make the number 1,111 show up on the calculator screen.

1. Explain your strategy.
2. How many moves did it take you?
3. Can you do it in fewer moves? More?
4. Is there a different operation you can use?

Raffle Tickets

Student Name:			
Station 1:	Station 2	Station 3	Station 4

Student Name:			
Station 1:	Station 2	Station 3	Station 4

Student Name:			
Station 1:	Station 2	Station 3	Station 4

Student Name:			
Station 1:	Station 2	Station 3	Station 4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