

Unit 6

Introduction

The Excursions in this unit begin with a problem that combines time on a clock face with angle classification. Students will also discover opportunities to explore quadrilaterals in several problems involving fractions, symmetry, and perimeter. The Excursions conclude with a new type of number puzzle. This unit's Adventures extend students' thinking with quadrilaterals as they explore perimeter and area and identify fractions of squares. Additionally, students encounter a puzzle and riddle that require logic and multiplication to solve.

Excursions		
Tasks		Targeted Concepts
A	What Angle Is the Time?	Time on an analog clock; classification of angles
B	Shape Collection	Classification of polygons and quadrilaterals; fractions of a set
C	Quadrilaterals	Classification of quadrilaterals; systematic thinking; congruence and rotations
D	Quadrilateral Symmetry	Reflection symmetry; classification and properties of quadrilaterals
E	School Garden	Perimeter and area of rectangles
F	Introducing...Kakuro Puzzles! <i>Required before Adventure C</i>	Addition of whole numbers; logic; patterns
Adventures		
Tasks		Targeted Concepts
A	Geoboard Perimeter	Perimeter and area of rectilinear figures
B	Ten Fence Sections	Fractions on a geoboard
C	Kakuro Encore	Addition of whole numbers; logic; patterns
D	Product 196	Factors of whole numbers
E	Water Packaging	Multiplication of whole numbers
F	Three Squares	Multiplicative reasoning; area

Unit 6

Concept Quests Log

NAME _____

After you finish a task, mark the square below its banner with a check or an X. After your teacher checks your work, they can put their initials on the line next to the square.

EXCURSIONS

Excursion 6E
School Garden

Excursion 6C
Quadrilaterals

Excursion 6D
Quadrilateral Symmetry

Excursion 6B
Shape Collection

Excursion 6A
What Angle Is the Time?

Excursion 6F
Introducing ...
Kakuro Puzzles!
Required before Adventure C

ADVENTURES

Adventure 6B
Ten Fence Sections

Adventure 6A
Geoboard Perimeter

Adventure 6D
Product 196

Adventure 6E
Water Packaging

Adventure 6F
Three Squares

Adventure 6C
Kakuro Encore

YOU ARE HERE

 **E6A** **What Angle Is the Time?**

For each time below, consider how the hour and minute hands are positioned on an analog clock. Determine whether the angle formed by the hour and minute hands for each time forms an acute angle, a right angle, or an obtuse angle.

4:12**1:11****6:04****7:26****3:00****11:33****8:51****2:45****10:30****9:00**

 **E6B** Shape Collection

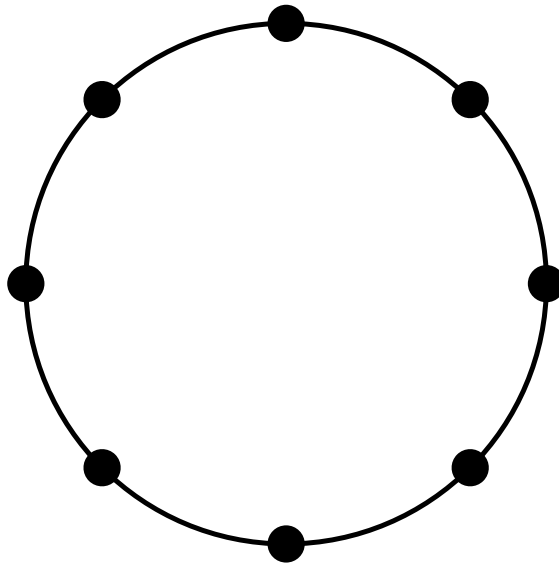
Travis and Nia have been collecting polygons to study. When looking at the polygons they collected, they noticed that:

- Triangles are $\frac{1}{3}$ of their polygons.
 - Non-square rectangles are $\frac{1}{4}$ of their polygons.
 - Trapezoids are $\frac{1}{12}$ of their polygons.
 - Squares are $\frac{1}{8}$ of their polygons.
 - Non-square rhombuses are $\frac{1}{6}$ of their polygons.
 - The rest of their polygons are parallelograms that are not rhombuses or rectangles.
- a** Draw a collection of shapes that meets this criteria.
- b** How many of the parallelograms are not also rectangles or rhombuses? What fraction of the collection is this group?



 E6C **Quadrilaterals**

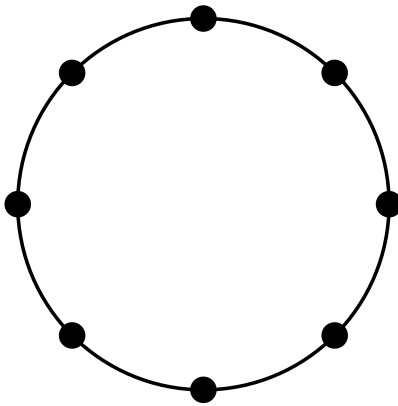
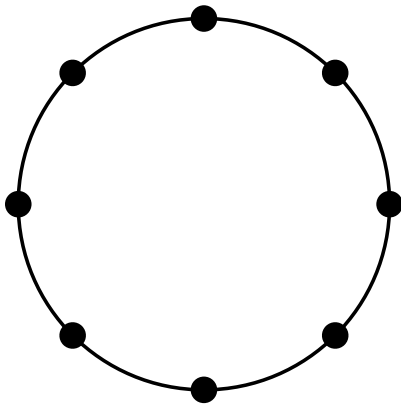
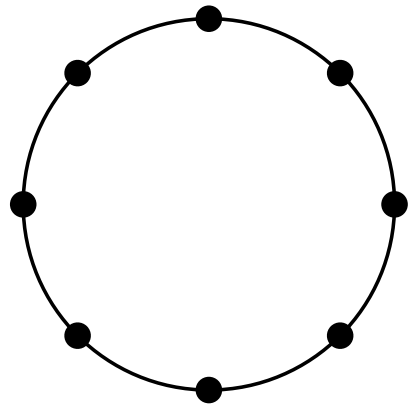
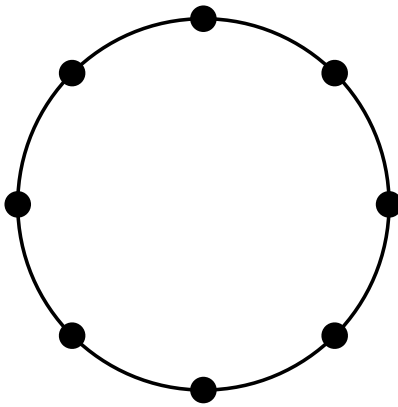
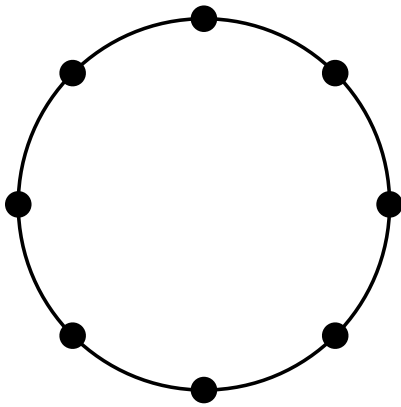
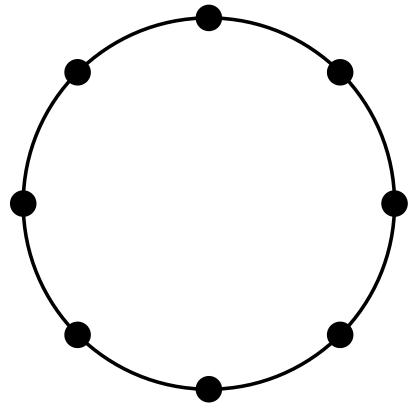
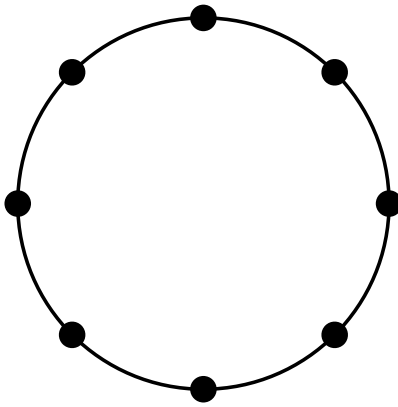
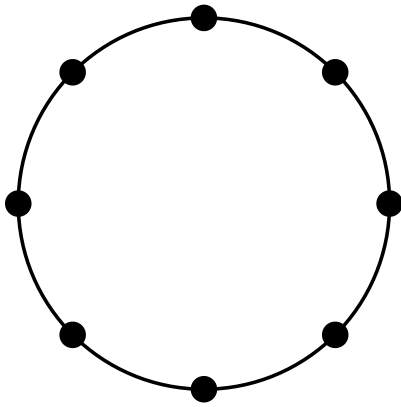
How many unique quadrilaterals can be made by joining the dots on the circle? (There are 8 evenly spaced dots.) A quadrilateral is not unique if rotating it produces a quadrilateral that has already been found. Show each quadrilateral on the supplement page.



For each of the quadrilaterals you find, identify which of the following term or terms apply: *trapezoid*, *kite*, *parallelogram*, *rectangle*, *rhombus*, *square*.

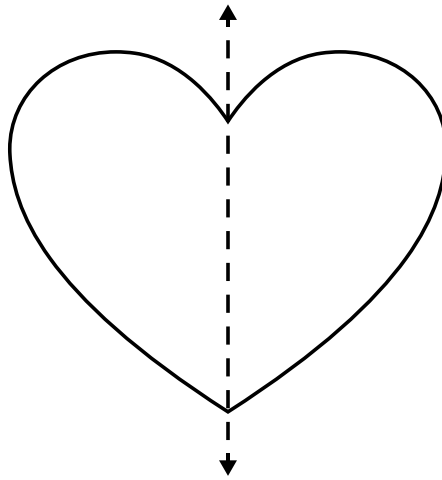


Quadrilaterals *Supplement*



E6D Quadrilateral Symmetry

A line of symmetry is a line that divides a shape into two mirror-imaged halves. For example, a heart has one line of symmetry.



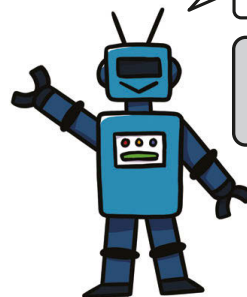
Use a geoboard to make each shape. On the supplement page, draw each shape you make and its line or lines of symmetry. Then write each shape's most specific name.

- Make two quadrilaterals that have 0 lines of symmetry.
- Make a quadrilateral that has exactly 1 line of symmetry.
- Make a quadrilateral that has exactly 2 lines of symmetry.
- Make a quadrilateral that has exactly 4 lines of symmetry.



Ready
for more?

Make a polygon that has more than
4 lines of symmetry.

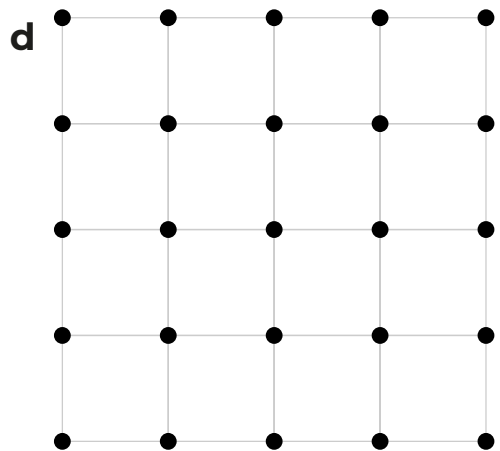
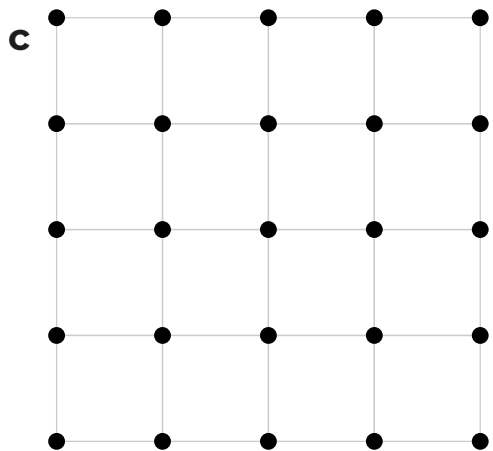
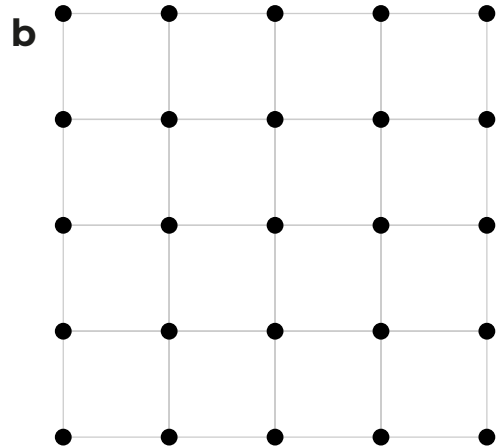
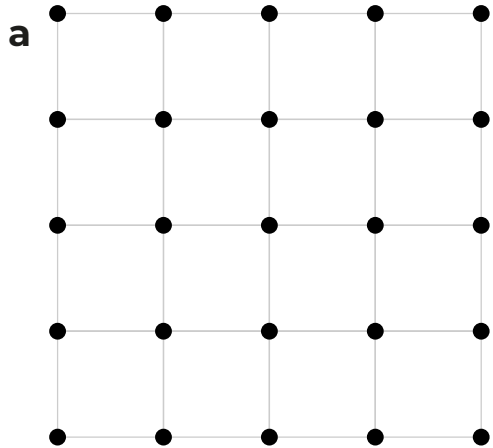


Want to try the
activity in the
Geoboard app?

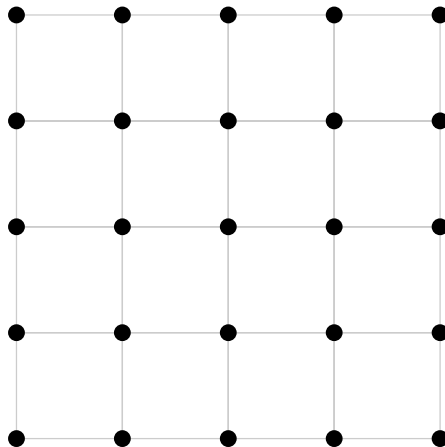


SHARE CODE
2NQ4-HH9K

Quadrilateral Symmetry *Supplement*



**Ready
for More**



E6E School Garden

Third graders need boards to build a raised garden bed made up of 2 rectangles. They will use 80 meters of boards for the beds. Find 2 arrangements they could use, and find the total area of each. Use pictures and equations to explain your thinking.



E6F Introducing ... Kakuro Puzzles!

To solve this Kakuro puzzle, use the numbers 1 through 9 to fill the white squares. You may use numbers more than once, but you cannot repeat numbers in any row or column, unless a gray square separates the repeated numbers. In the shaded squares, the numbers above each diagonal line indicate the sum of the numbers in that row (going across). The numbers below each diagonal line indicate the sum of the numbers in that column (going down). Use the supplement page to solve the puzzle!

			12	29	
	16	14			
19					8
11			8		
	20				
	10				

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Introducing ...Kakuro Puzzles! *Supplement*

			12	29	
	16	14 10			
19					8
11			8 7		
	20				
	10				

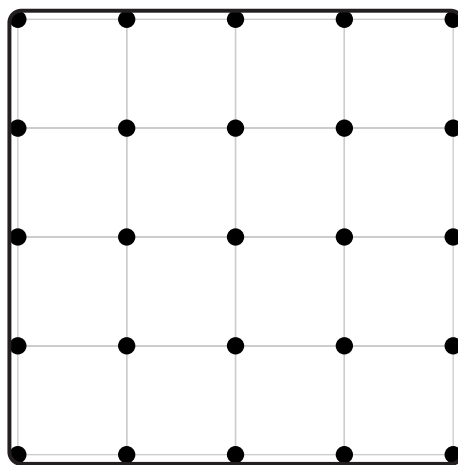
Puzzle copyright © 2015 by KrazyDad.com. This puzzle has been used with permission from Jim Bumgardner at KrazyDad.com. More Kakuro puzzles can be found at <https://krazydad.com/kakuro/>.



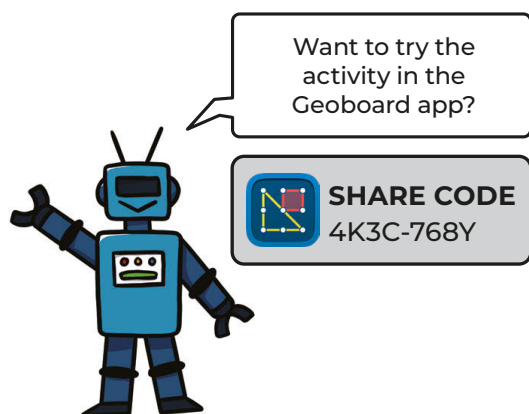


A6A Geoboard Perimeter

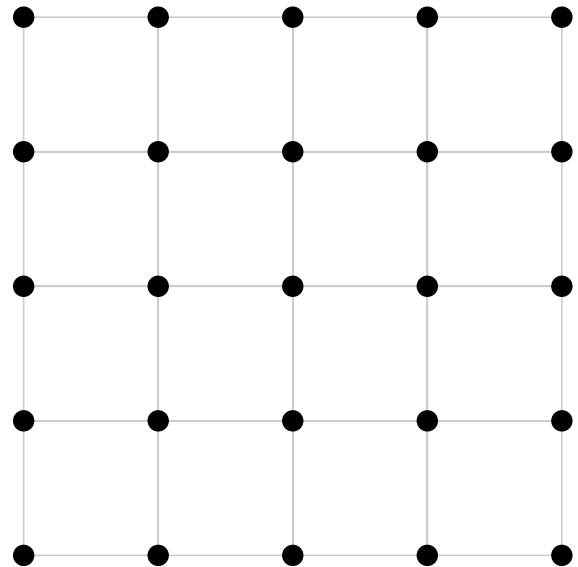
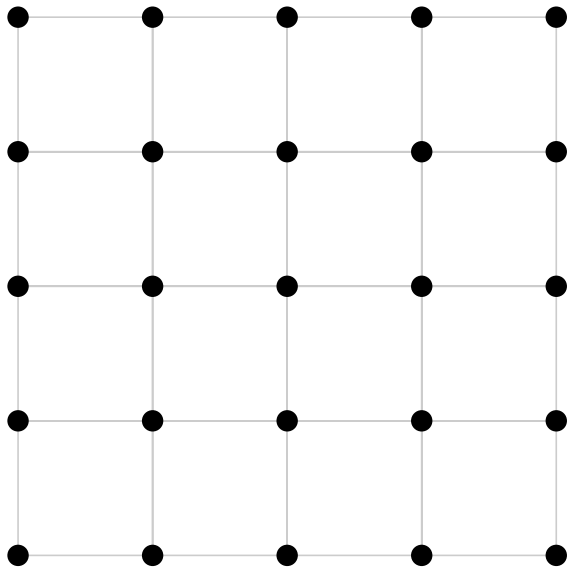
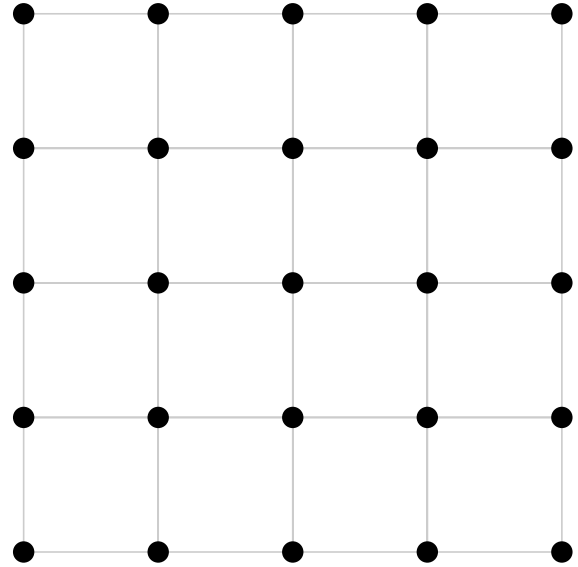
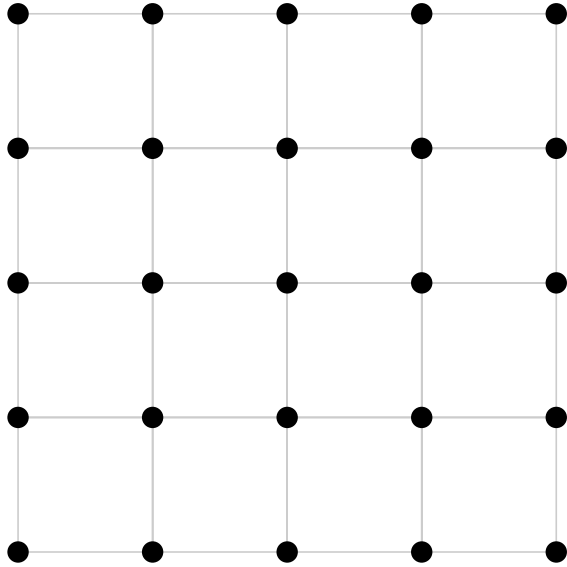
The square on this geoboard has a perimeter of 16 units and an area of 16 square units. Recreate this square on a geoboard. Then adjust the rubber band so that the perimeter stays the same (16 units) but the area decreases. How small can you make the area yet still have a perimeter of 16 units?



On the supplement page, draw the shapes you created that have the smallest area but still have a perimeter of 16 units. If you found more than one, draw them all!



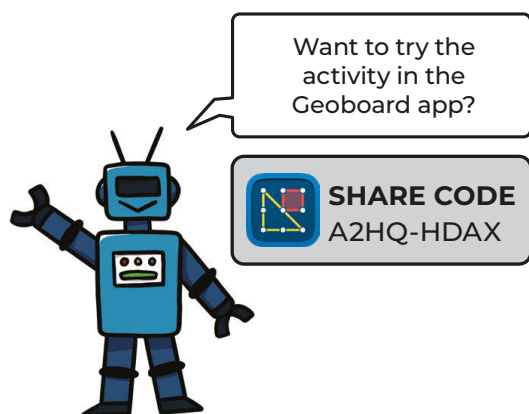
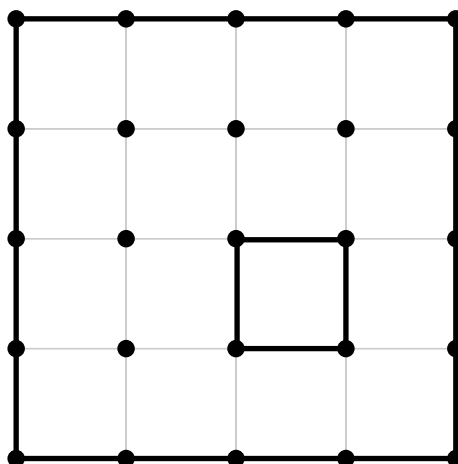
Geoboard Perimeter *Supplement*



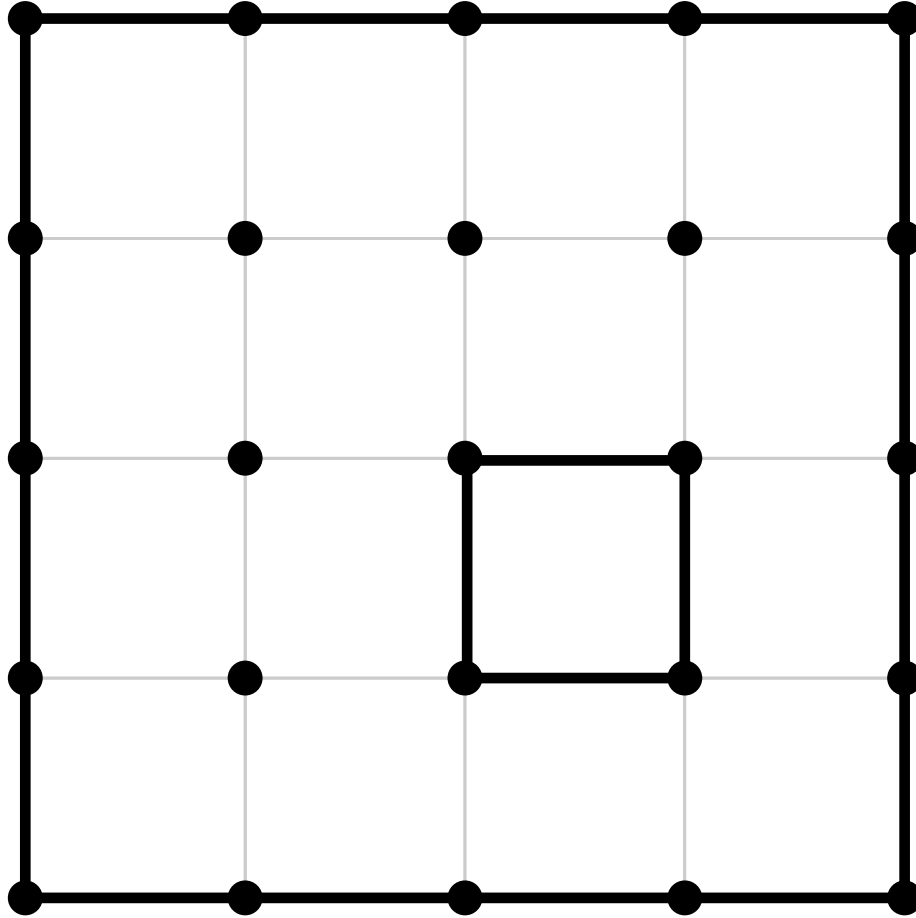


A6B Ten Fence Sections

A square chicken coop is set within a larger square enclosure, as shown on this geoboard. Ms. Beale has 10 fence sections to divide the enclosure into fifths. Each fence section can connect two pegs vertically or horizontally, but not diagonally. On the supplement page, show how Ms. Beale can use exactly 10 fence sections to divide the enclosure into fifths.



Ten Fence Sections *Supplement*




A6C Kakuro Encore

To solve the Kakuro puzzle on the supplement page, fill in the white squares with the numbers 1 through 9. Do not repeat any numbers in the connected white squares of the same row or the same column. Remember that the numbers above a diagonal indicate the sum of the numbers in that row and the numbers below a diagonal indicate the sum of the numbers in that column. Have fun!

		34	17			30	10	17
	17			17	20			
30					23			
16			23				19	
17			11	3	24			6
	7				3	4		
	4	6				3		
16				10				
7					3			

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Kakuro Encore *Supplement*

		34	17			30	10	17
	17			17	20			
30					23			
			23				19	
16				24				6
	7				3	4		
	4	6				3		
		12				3		
16				10				
7					3			

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 A6D **Product 196**

The product of four different numbers is 196.

What is the sum of these four numbers?



A6E

Water Packaging

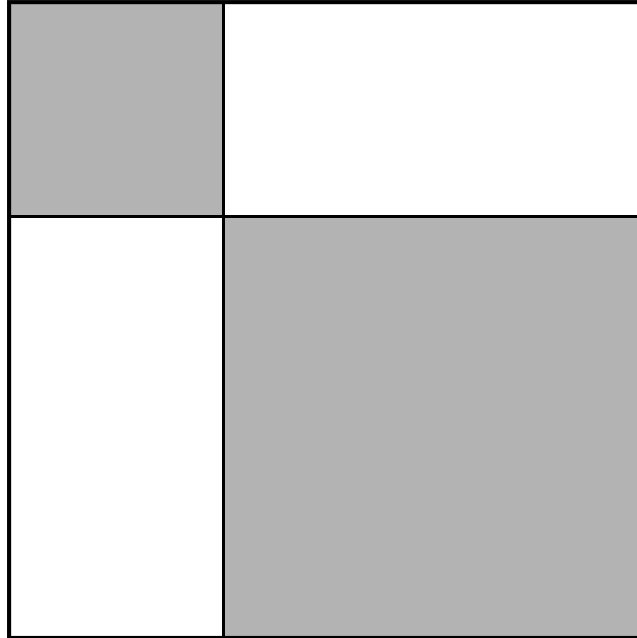
Water comes in packages of 8 or 9 bottles at the local grocery store.

What is the fewest number of packages that are needed to get exactly 301 bottles of water?

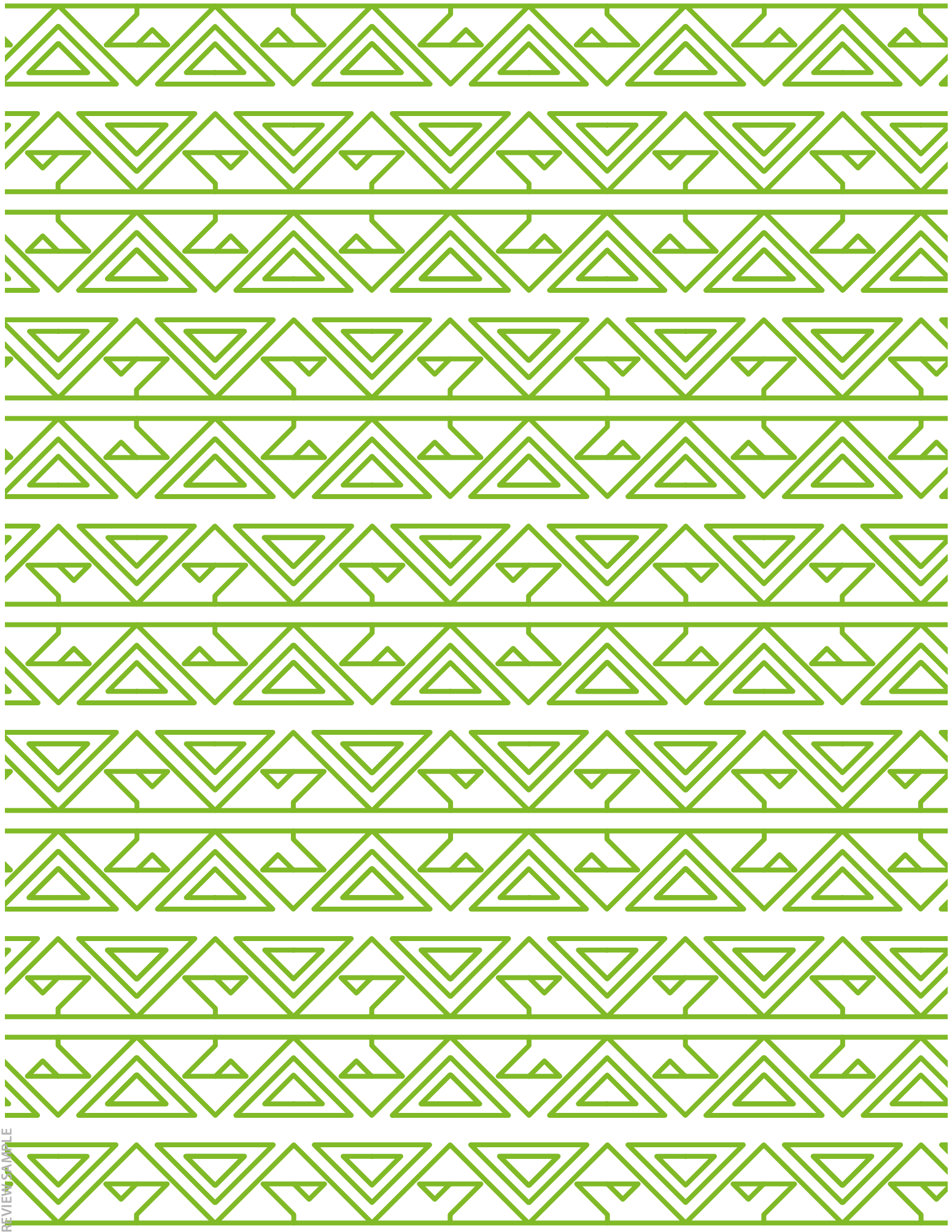


A6F Three Squares

The largest square in this image has a total area of 144 square units. It contains two shaded squares. The larger shaded square has an area that is 4 times that of the smaller shaded square.



Without measuring, determine the total area of the shaded regions.



Concept Quests

Grade 3, Unit 6 – Answer Key

Excursion 6A: What Angle Is the Time?

4:12 – acute	1:11 – acute
6:04 – obtuse	7:26 – acute
3:00 – right	11:33 – obtuse
8:51 – acute	2:45 – obtuse
10:30 – obtuse	9:00 – right

Excursion 6B: Shape Collection

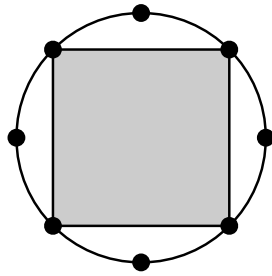
- a** The smallest collection of polygons that Travis and Nia may have consists of 24 polygons, although any multiple of 24 will work (48, 72, 96, etc.).

If the student draws a collection of 24 polygons, there should be:

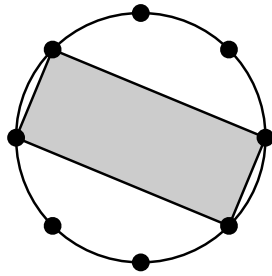
- 8 triangles
 - 6 non-square rectangles
 - 2 trapezoids
 - 3 squares
 - 4 non-square rhombuses
 - 1 non-rectangle/non-rhombus parallelogram
- b** This question is not meant to confuse students by having overlapping groups of shapes. Instead, the categories are mutually exclusive. For this size collection (24), there is 1 parallelogram that is not a rectangle or a rhombus, which is $\frac{1}{24}$ of the set.

If students draw different-sized sets, adjust the numbers accordingly.

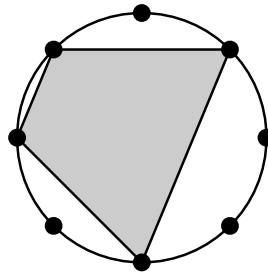
Excursion 6C: Quadrilaterals



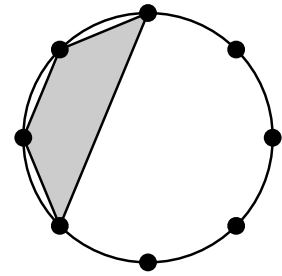
square, rhombus,
rectangle,
parallelogram



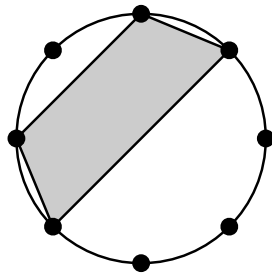
rectangle,
parallelogram



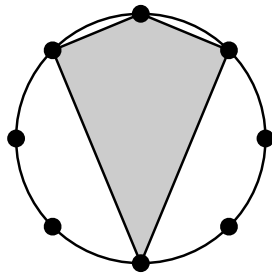
trapezoid



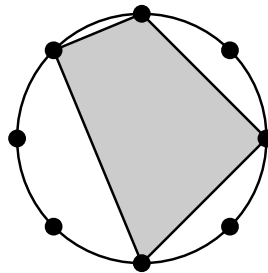
trapezoid



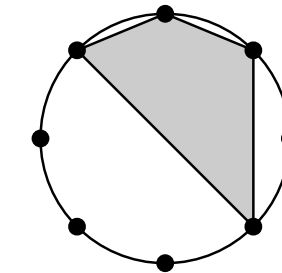
trapezoid



kite



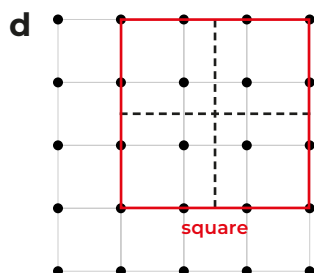
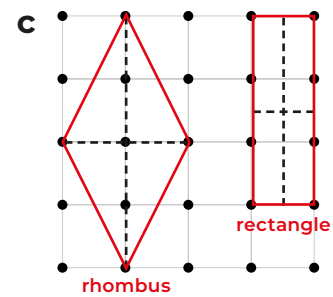
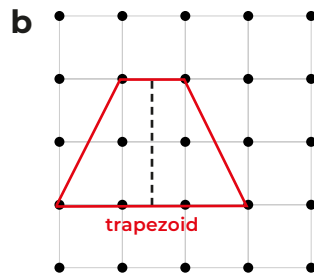
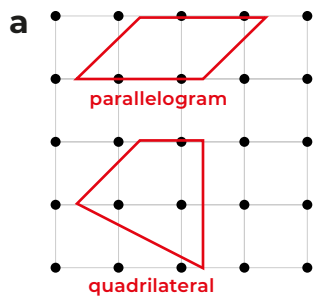
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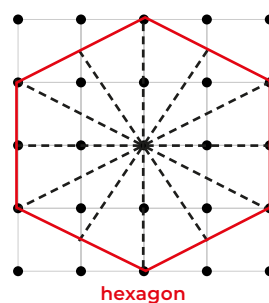
none apply

Excursion 6D: Quadrilateral Symmetry

Answers will vary. Sample answers:



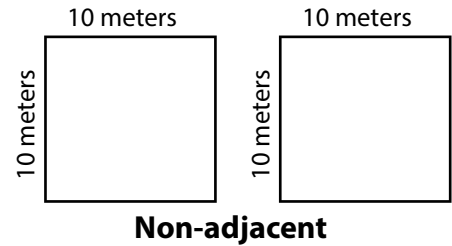
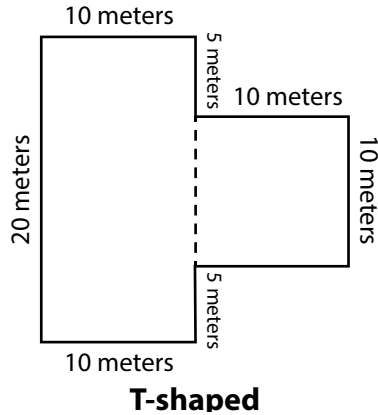
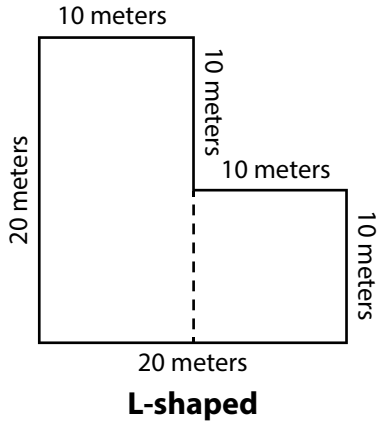
Ready for More



Answer Key

Excursion 6E: School Garden

Answers will vary. Students might choose to make two separate rectangles each with a perimeter of 40 meters. Students might also choose to connect the rectangles, thereby saving on fencing for one of the rectangle's sides and a portion of one of the other rectangle's sides. Three possible solutions are shown.



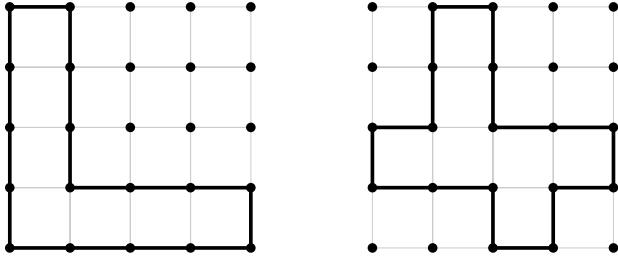
Excursion 6F: Introducing... Kakuro Puzzles!

			12	29	
	16	14	9	5	
19	7	1	3	8	8
11	9	2	8	7	1
	20	3	1	9	7
	10	4	6		

Answer Key

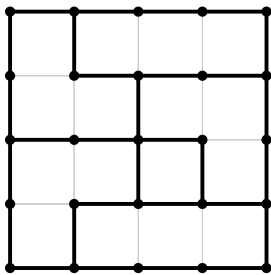
Adventure 6A: Geoboard Perimeter

The smallest area is 7 square units. There are multiple possibilities for how this might look, including the following two options.



Adventure 6B: Ten Fence Sections

Each resulting space should be 3 square units. Here is one way this can be accomplished.



Adventure 6C: Kakuro Encore

		34	17			30	10	17
	17	8	9	17	20	7	4	9
30	7	6	8	9	23	9	6	8
16	9	7	23	8	9	6	19	
17	8	9	11	3	24	7	8	9
	7	4	1	2	3	4	3	1
	4	6	3	1	2	3	3	1
16	3	8	5	10	1	2	4	3
7	1	4	2		3	1	2	

Answer Key

Adventure 6D: Product 196

The numbers are 1, 2, 7, and 14. The sum is 24.

Adventure 6E: Water Packaging

The fewest number of packages would be 29 packages of 9 bottles of water (total 261 bottles) and 5 packages of 8 bottles of water (total 40 bottles).

Adventure 6F: Three Squares

The area of the small, shaded square is 16, and the area of the large, shaded square is 64. The total area of the shaded squares is 80 square units.

The dimensions of the square are 12-by-12 because the total area is 144 square units. The length of the two, shaded squares added together is equal to 12 units. The length of the large shaded square appears to be twice that of the small shaded square. Therefore, students could start by finding a set of dimensions that add to 12 in which one dimension is twice the other.