BRIDGES IN MATHEMATICS 3

GRADE 3 SUPPLEMENT

Set C4 Geometry: Quadrilaterals

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Skills & Concepts

- ★ identify and sketch parallel, intersecting, and perpendicular lines and line segments
- ★ identify and sketch right angles
- ★ identify and describe special types of quadrilaterals
- ★ measure and calculate perimeters of quadrilaterals in U.S. Customary and metric units
- ★ choose appropriate measuring tools and units
- ★ solve single- and multi-step word problems involving perimeters of quadrilaterals and verify the solutions

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Bridges in Mathematics Grade 3 Supplement
Set C4 Geometry: Quadrilaterals

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Bridges in Mathematics is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

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Set C4 ★ Activity 1

ACTIVITY

Sorting Quadrilaterals

Overview

After reviewing the term quadrilateral, students each build on a geoboard and record 4 different quadrilaterals. Students then work in small groups to sort their quadrilaterals in a variety of ways.

Skills & Concepts

★ identify and describe special types of quadrilaterals

★ identify and sketch parallel and perpendicular lines

★ identify and sketch right angles

You'll need

★ Recording Quadrilaterals (page C4.5, run a display copy and a class set)

★ class set of geoboards and rubber bands

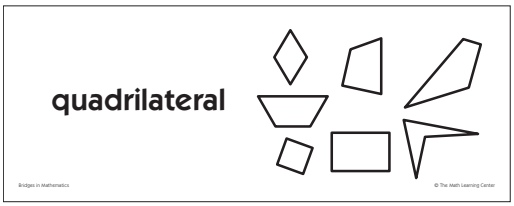
★ class set of rulers and scissors

★ 3″ × 3″ sticky notes

★ Word Resource Cards: acute angle, congruent, equilateral, line of symmetry, obtuse angle, parallelogram, parallel lines, perpendicular lines, quadrilateral, rectangle, rhombus, right angle, square, trapezoid

Instructions for Sorting Quadrilaterals

1. To start the activity, post the Word Resource Card for quadrilateral or place it under the document camera. Ask students to define the word. What is a quadrilateral? Do they remember from lessons earlier in the year? If not, can they use the pictures on the front of the card to help generate a definition?



2. After some discussion, turn the card over and have a student volunteer read the definition to the class: A *quadrilateral* is a 4-sided polygon. Review the definition of a polygon (any closed 2-dimensional figure made up of 3 or more line segments), and then flip the quadrilateral card over so students can see the front again. Do all of the polygons shown on the card have 4 sides? What are the names of these figures? Have students pair-share ideas, and then call on volunteers to identify each of the shapes by name (from left to right, top to bottom, the shapes on the card are a rhombus, a quadrilateral, a quadrilateral, a trapezoid, a square, a rectangle, and a quadrilateral).

3. Post the Word Resource Cards for *rectangle*, *rhombus*, *square*, and *trapezoid* as students name these shapes. Finally, post the *parallelogram* card. Can students find an example of a parallelogram on the *quadrilateral* card? If not, remind them that a parallelogram is any quadrilateral with two pairs of parallel and congruent sides, and repeat the question.

> ***Students*** *Oh! I thought parallelograms were kind of like squished rectangles.*
> *Yeah, like the one in the tangrams we made. Remember?*
> *If it can be any shape with 2 pairs of parallel lines, does that mean a rectangle is a parallelogram?*

Activity 1 Sorting Quadrilaterals (cont.)

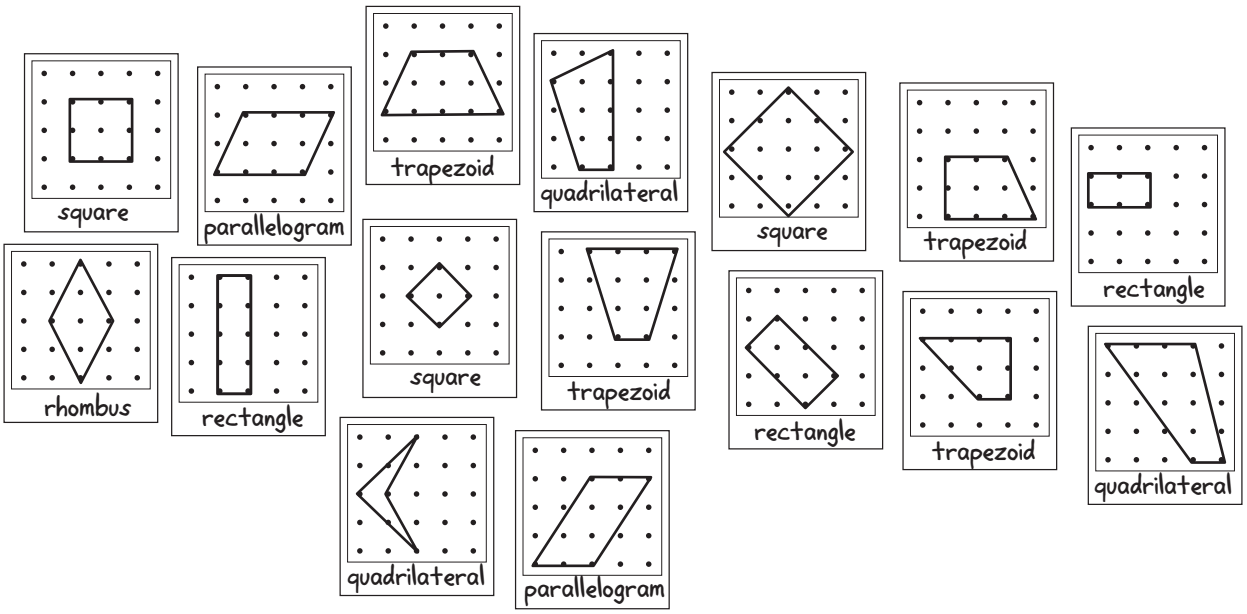
Students *I don't think so. That's weird.*
Maybe it's like how a square is a special kind of rectangle. Maybe a rectangle is a special kind of parallelogram.

Teacher *Yes, you're right about that. Because it has 2 pairs of parallel lines, a rectangle is also a parallelogram. Can you find other examples of parallelograms on our quadrilateral card?*

4. Explain that over the next few days, students will learn more about the different types of quadrilaterals. Today, you're going to start by having them construct some quadrilaterals on a geoboard and record them on geoboard paper. Give students each a geoboard, some rubber bands, and a copy of the Recording Quadrilaterals sheet. Read the instructions at the top of the sheet together. Then model the process by making a quadrilateral on a geoboard and copying it onto the recording sheet as students watch. Challenge the children to construct and record 4 different types of quadrilaterals (e.g., a rhombus, a rectangle, a trapezoid, and a quadrilateral that is neither a trapezoid nor a parallelogram), and to make them different from the ones they see other students building. When they understand what to do, have them go to work.

5. As students are building and recording their quadrilaterals, build and record 3 more on your own sheet. Then post near your discussion circle the Word Resource cards for *acute angle*, *obtuse angle*, *right angle*, *congruent*, *equilateral*, *parallel lines*, *perpendicular lines*, and *line of symmetry*. As students finish, use your own sheet to show them how to cut their recording sheets into fourths. Have them put their name on the back of each quadrilateral they've made, set them in a stack on their desk, and join you in the discussion circle.

6. When most students have arrived at the circle, lay your own drawings out on the floor. Explain that in a few minutes, students will work in small teams to sort their drawings. Call on 3 children to help demonstrate the process. Have the 3 of them bring their drawings to the circle and lay them out alongside yours so that the four of you, along with the rest of the class, are looking at a collection of 16 quadrilaterals.



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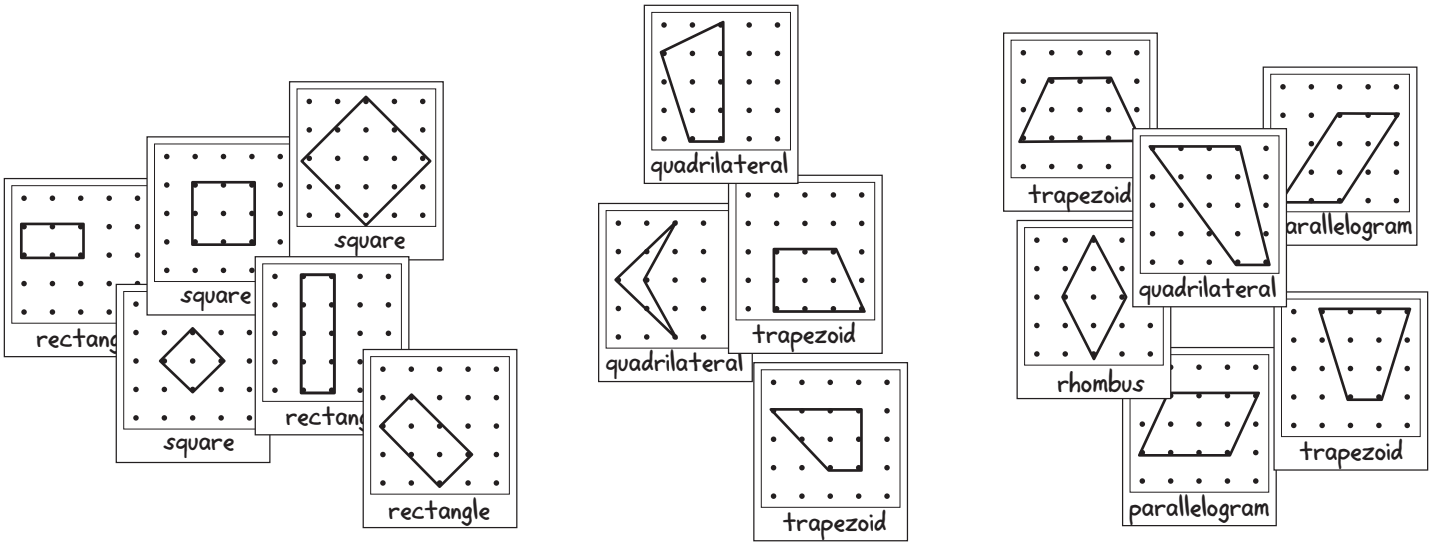
Activity 1 Sorting Quadrilaterals (cont.)

7. Now ask students around the circle to help brainstrorm ways these quadrilaterals might be sorted. Chances are, some students will suggest sorting the collection by type (e.g., squares, rhombuses, rectangles, trapezoids, parallelograms, and quadrilaterals); or rectangles and not rectangles; or trapezoids and not trapezoids; or even "weird" quadrilaterals and "regular" quadrilaterals. Others may focus on how the shapes are oriented, or their size, generating sorting categories such as tipped and straight, or tall and short, or large and amall. As the discussion unfolds, draw students' attention to the geometrical terms you have posted, and challenge them to use some of these words to think of additional ways to sort the shapes.

> ***Teacher*** *We've heard some interesting ideas so far. Let's look at the vocabulary cards I've posted. Would there be a way to use one or more of these to help us sort our quadrilaterals? Talk with the person next to you for a minute, and then let's hear some ideas.*
>
> ***Students*** *We could sort them by their angles!*
> *Yeah, we could have ones with right angles and ones that don't have any right angles.*
> *Or we could do it by how many right angles they have. Like that weird trapezoid has 2 right angles.*
> *We could go by the ones that have parallel lines in them and the ones that don't.*
> *We could do perpendicular lines and not perpendicular lines, because some of them don't have any perpendicular lines at all.*

8. Once a variety of sorting ideas has been shared, ask your three teammates to choose one. Then work with them to sort the collection of quadrilaterals accordingly as the other students watch. When you finish, point to each subset as the class names it.



9. Explain to the class that they'll be working in teams of 3 or 4 at their tables to sort their quadrilaterals in just a few minutes. In order to get credit for each sorting idea, they will need to decide what to call each subset, raise their hands as a team, and name each subset as you come around and point to it.

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Activity 1 Sorting Quadrilaterals (cont.)

10. Model this procedure with your team for the class. Push the quadrilaterals back together, and go through the whole process once or twice more, using a different attibute—one suggested by the children—each time. When most students understand what to do, send them out in groups of 3 or 4 to retrieve their quadrilaterals, find a place to work, and start sorting. As each team gets settled, give them a 3" × 3" sticky note "score card", on which you'll mark a point each time they sort their shapes in a new way.

11. Once the students go to work, watch for the hands to go up. Remind students that everyone on a team has to be raising his or her hand before you'll come over to see how they have sorted the shapes and give them a point. When you see that a team has completed a sort and all hands are raised, go over to them, point to each subset as they name it, and mark a point on their sticky note. Then have them push their shapes back together and sort them a different way.

Note *If you insist that every member of the team name the subsets as you point to them, students will work together better and there will be less likelihood that one or two children will take over. If you find that you can't keep pace as teams raise their hands to have their sorts checked, ask one or two of your students to be checkers as well.*

12. Continue the sorting activity for as long as time allows. Ideally, each team will have time to sort their quadrilaterals in 4–5 different ways or more. At the end of the period, ask each team to report how many points they got for sorting. Record their scores on the board. Then ask students to add the numbers to find out how many different ways the whole class found to sort quadrilaterals today.

INDEPENDENT WORKSHEET

Use Set C4 Independent Worksheet 1 to provide students with more practice sorting quadrilaterals by their properties.

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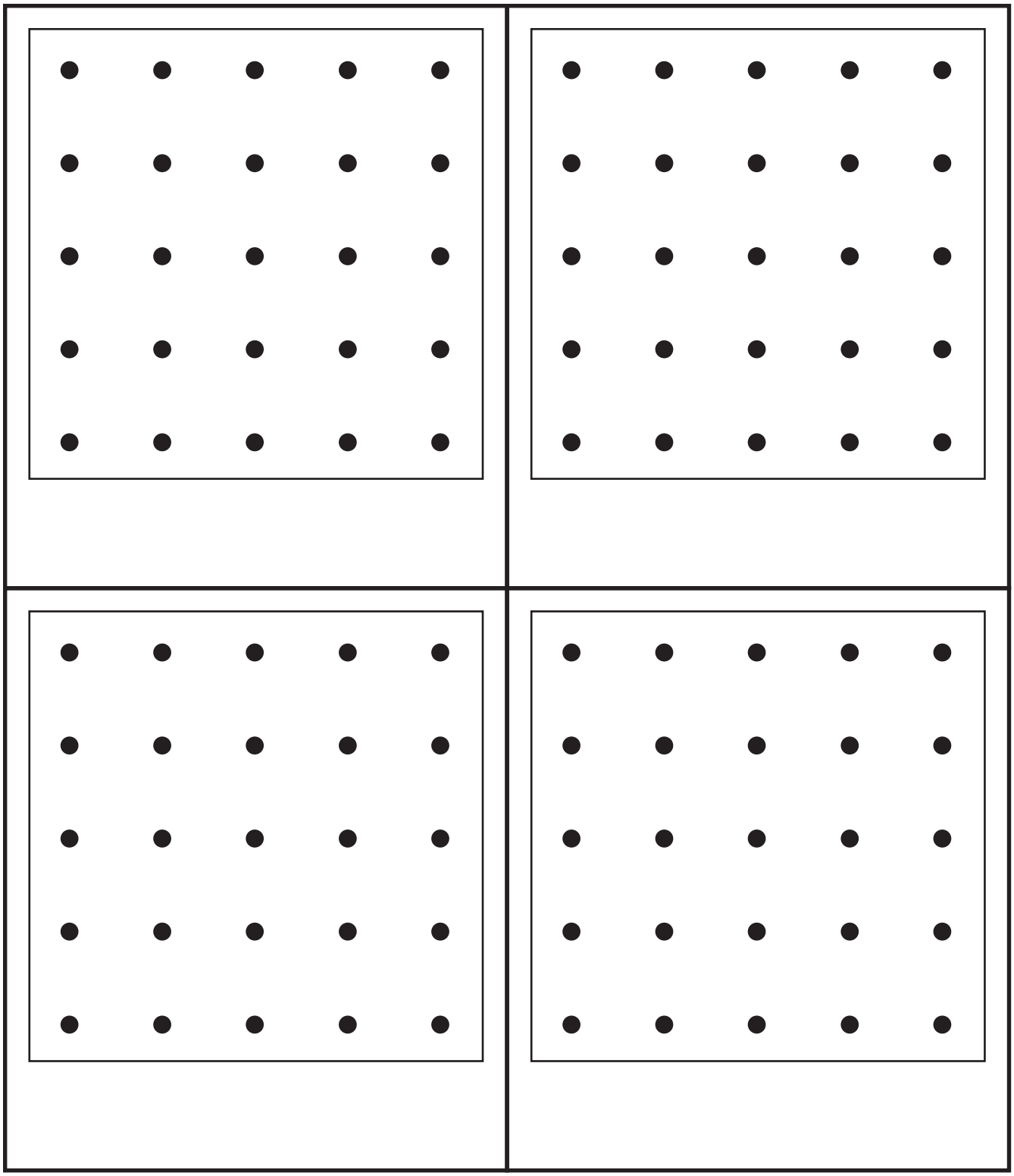
NAME _____ **DATE** _____

Recording Quadrilaterals

Make 4 different quadrilaterals on your geoboard. Draw each one below. Use a ruler to make the sides straight. Then label each quadrilateral with its name.



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Set C4 ★ Activity 2

ACTIVITY

Guess My Quadrilateral

Overview

Before the lesson begines, students cut apart sheets supplied by the teacher to make their own sets of paper quadrilaterals. When everyone is ready, the teacher holds up an envelope containing one quadrilateral from the set—the "mystery quadrilateral." She then gives one clue at a time while children sort through their sets to find the quadrilaterals that match each clue. The clues go from general to more specific until all but the quadrilateral that matches the one in the envelope have been eliminated. This activity helps students see and understand some of the properties that distinguish one quadrilateral from another.

Skills & Concepts

★ identify and describe special types of quadrilaterals

★ identify properties of different quadrilaterals

★ measure and calculate perimeters of quadrilaterals

You'll need

★ Quadrilateral Cards (page C4.12, class set plus an extra)

★ Check Your Quadrilaterals (page C4.13, 1 display copy)

★ Guess My Quadrilateral Riddles (C4.14, one copy for display or overhead transparency)

★ 4 small envelopes (see Advance Preparation)

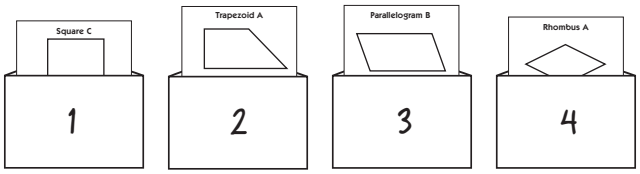
★ a small envelope or a paper clip for each student

★ scissors and rulers (class set)

★ Student Math Journals or lined paper

★ a piece of paper to mask portions of the display master

Advance Preparation Number the front of each of the 4 small envelopes with a numeral, 1–4. Cut apart one of the sheets of quadrilateral cards. Place Square C in the first envelope, Trapezoid A in the second, Parallelogram B in the third, and Rhombus A in the fourth. Seal the envelopes and recycle the rest of the cards.



Instructions for Guess My Quadrilateral

1. Open today's session by asking students to write in their journals or on a piece of lined paper at least three things they learned about quadrilaterals during the previous activity. After they have had a few minutes to write, give them a minute to pair-share, and then call on a few volunteers to share their ideas with the class.

> ***Students*** *A quadrilateral always has 4 sides.*
> *There are different kinds of quadrilaterals, like squares and rectangles and rhombuses.*
> *Some quadrilaterals are really weird, like the kind where none of the sides are parallel.*
> *Trapezoids only have 1 pair of parallel lines.*

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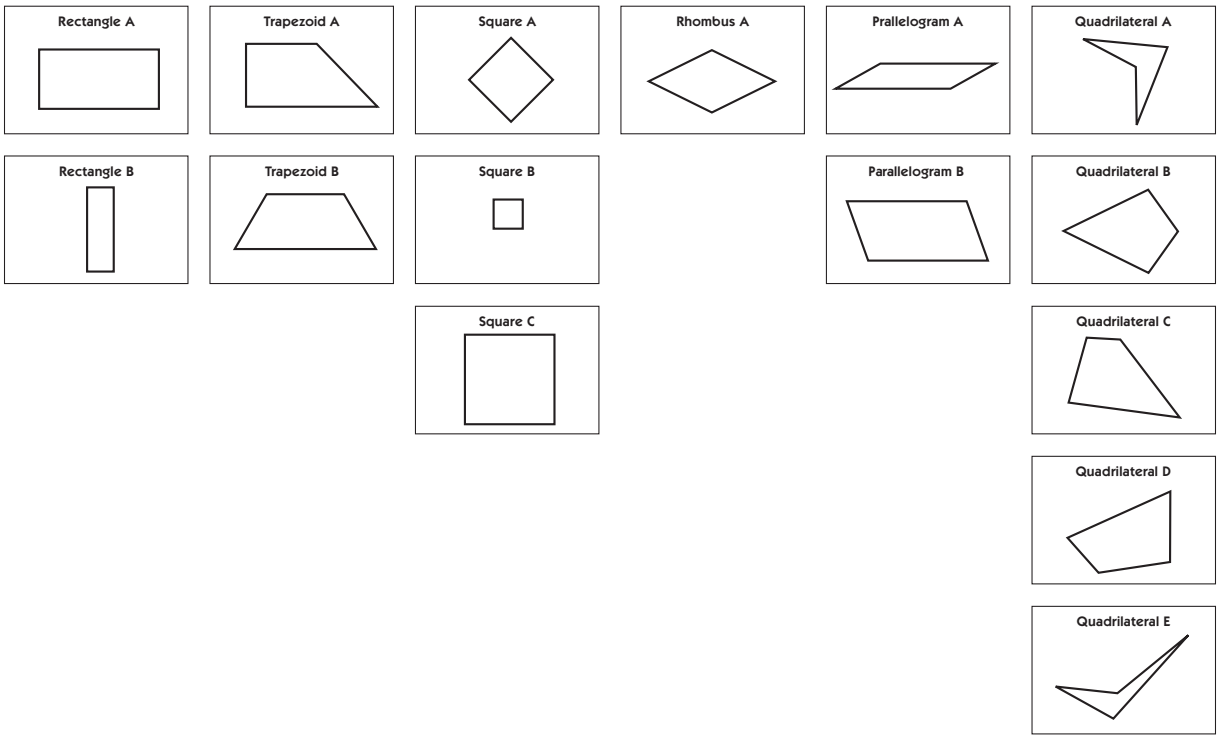
Activity 2 Guess My Quadrilateral (cont.)

2. Explain that the class is going to do some more work with quadrilaterals today. Give students each a copy of the Quadrilateral Cards sheet. Ask them to cut the cards apart along the thin lines, and then sort the cards by type, rectangles in one group, trapezoids in another, and so on. Ask early finishers to help others nearby, or read silently until everyone in class has prepared his or her cards.



3. Let students know that the class is going to play a sorting game with the cards they have prepared, but first they need to check their cards to make sure they are labeled correctly. Place a copy of Check Your Quadrilaterals on display with all but the first box masked. Read the definition of *quadrilateral* together. Do the shapes labeled as quadrilaterals in their set of cards match this definition? Have students pair-share their thoughts, and then call on a couple of volunteers to share with the class.

> ***Students*** *We said all the quadrilateral cards are okay because they all have 4 sides.*
> *But all the shapes on these cards are quadrilaterals because they all have 4 sides. Why don't they all say* quadrilateral *on the card?*
> *We said it's probably because the others are special kinds of quadrilaterals, like squares and stuff.*

4. Next, reveal the picture and definition of *trapezoid*. Read it with the class, and ask students to check their cards. Do the shapes labeled as trapezoids fit the definition? Are there any other cards in the set that should be labeled as trapezoids? Why or why not?

> ***Students*** *I think Quadrilateral D looks like a trapezoid.*
> *Yeah, it does, kind of, but none of the sides are parallel, so it can't be.*

5. Repeat the step above with each of the other four quadrilaterals on the display master. When students are satisfied that all the cards in the set are labeled accurately, show them the envelopes you have prepared. Explain that you cut up a sheet of cards before the lesson, and placed a different quadrilateral in each of the four envelopes. Now you are going to give the students a set of clues that will help them

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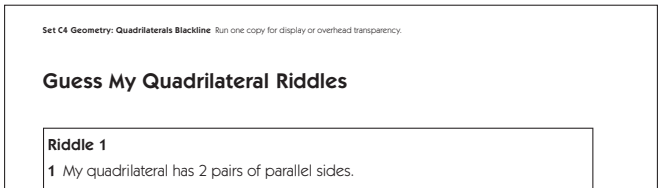
Activity 2 Guess My Quadrilateral (cont.)

identify which quadrilateral you have hidden in the first envelope. You will show the clues one at a time at the overhead or document camera. Each time students get a new clue, they will be able to eliminate some of the cards from their sets until they only have one left. The one remaining will match the shape in Envelope 1 if they have followed the clues carefully enough.

6. Place Guess My Quadrilaterals Riddles on display with all of the clues hidden but the first. Read it with the class and ask them to set aside any cards that do not fit the clue.



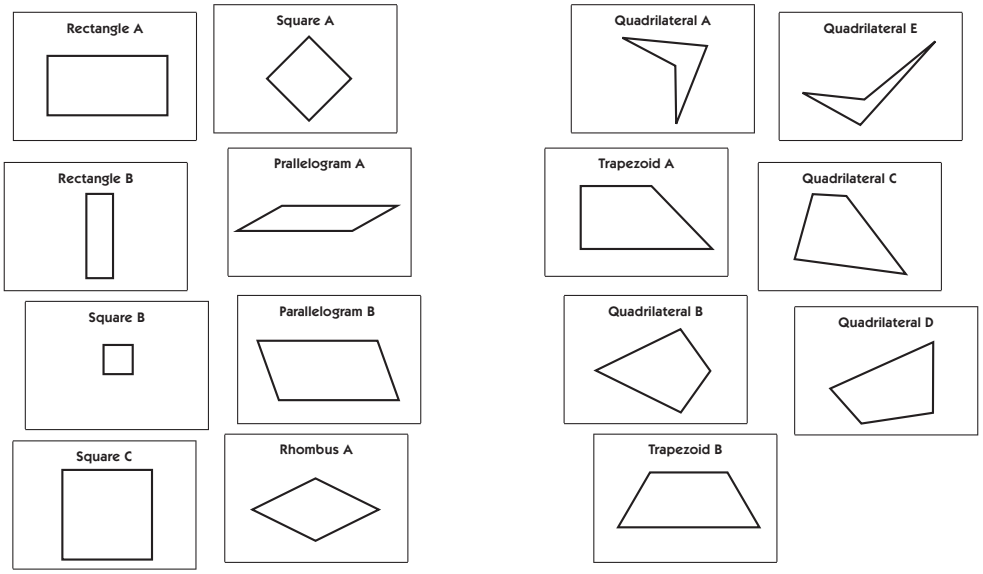
Set C4 Geometry: Quadrilaterals Blackline Run one copy for display or overhead transparency.

Guess My Quadrilateral Riddles

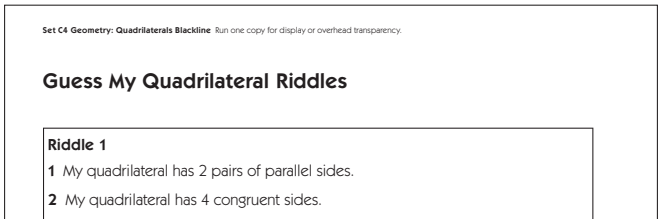
Riddle 1

1 My quadrilateral has 2 pairs of parallel sides.

Students *"My quadrilateral has 2 pairs of parallel sides."*
So we can keep the rectangles and squares, right?
That weird one that looks like an arrowhead doesn't have any pairs of parallel sides.
On those trapezoids, they just have one pair of parallel sides.



7. Once students have discarded the quadrilaterals that do not have 2 pairs of parallel sides, reveal the second clue.



Set C4 Geometry: Quadrilaterals Blackline Run one copy for display or overhead transparency.

Guess My Quadrilateral Riddles

Riddle 1

1 My quadrilateral has 2 pairs of parallel sides.

2 My quadrilateral has 4 congruent sides.

Students *Okay, we can get rid of the rectangles and the parallelograms.*
We can get rid of everything but the squares!
Wait, what about the rhombus? It has sides all the same length.

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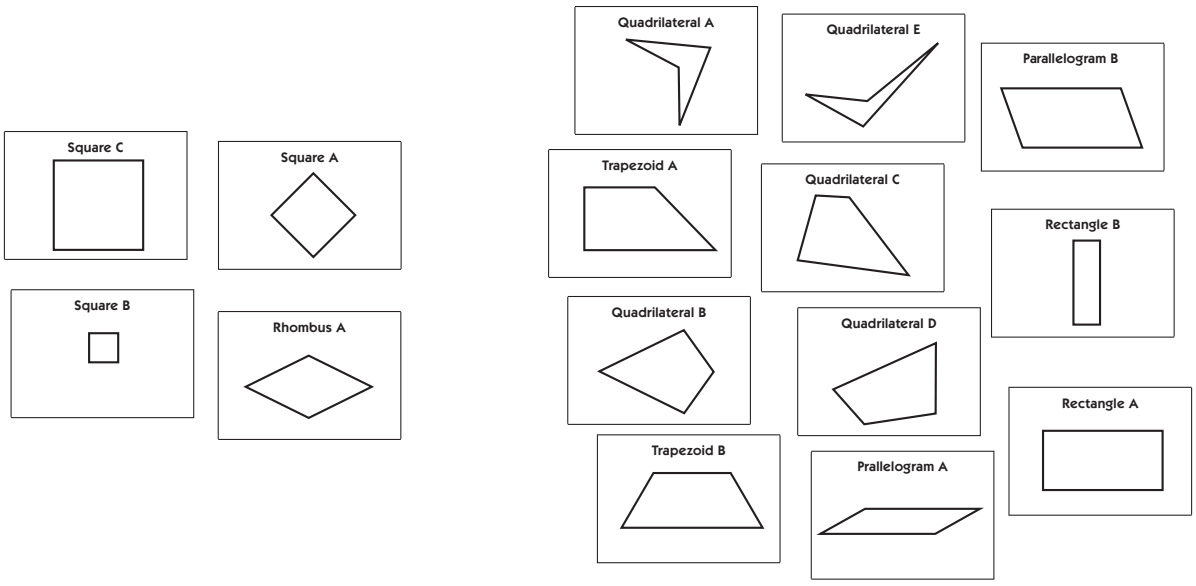
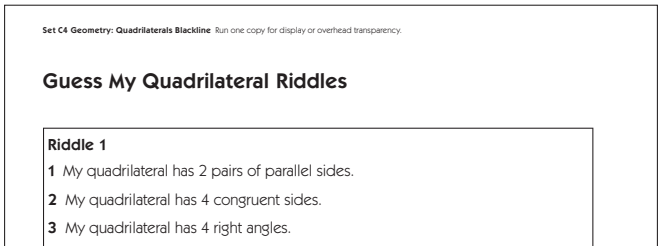
Activity 2 Guess My Quadrilateral (cont.)



8. When students have set aside all the quadrilaterals except the ones that have 2 pairs of parallel sides and all 4 sides congruent, reveal the third clue.



Set C4 Geometry: Quadrilaterals Blackline Run one copy for display or overhead transparency.

Guess My Quadrilateral Riddles

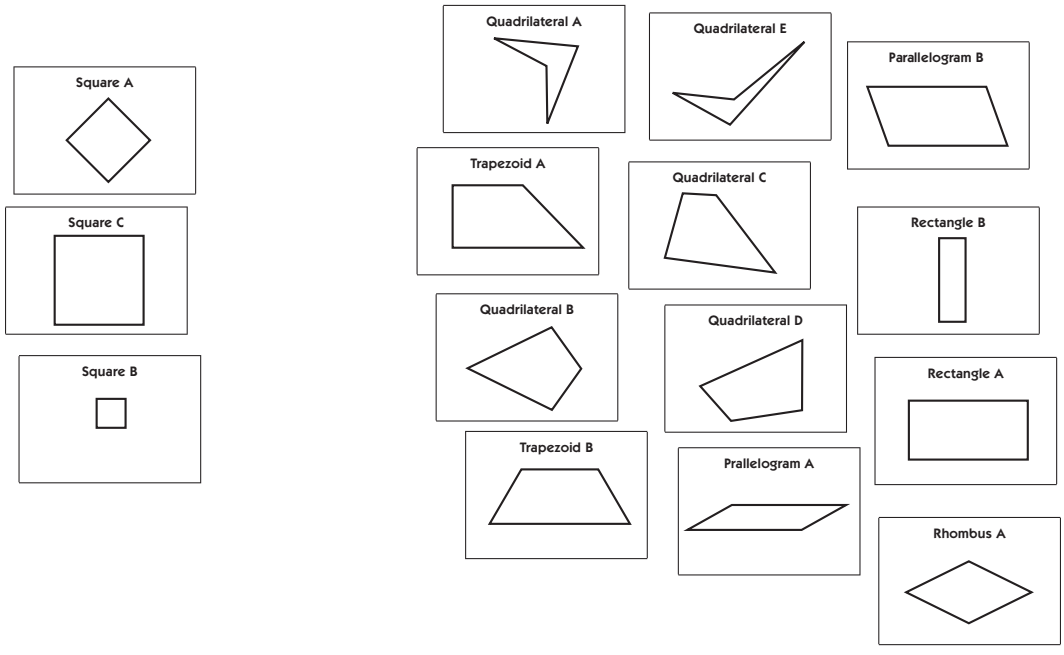
Riddle 1

1 My quadrilateral has 2 pairs of parallel sides.

2 My quadrilateral has 4 congruent sides.

3 My quadrilateral has 4 right angles.

Students *Oh my gosh, it has to be one of the squares. Only the squares have all right angles. The rhombus doesn't have any right angles!*



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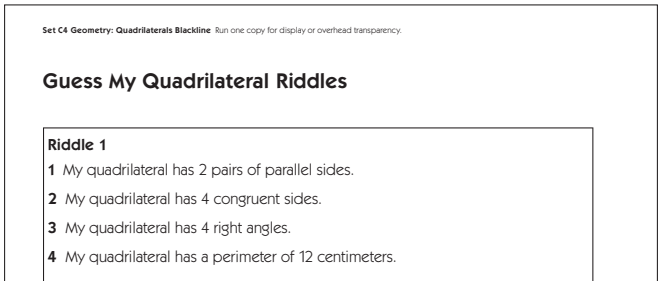
Activity 2 Guess My Quadrilateral (cont.)

9. When students have eliminated all but the squares, reveal the last clue.



Set C4 Geometry: Quadrilaterals Blackline Run one copy for display or overhead transparency.

Guess My Quadrilateral Riddles

Riddle 1

1 My quadrilateral has 2 pairs of parallel sides.

2 My quadrilateral has 4 congruent sides.

3 My quadrilateral has 4 right angles.

4 My quadrilateral has a perimeter of 12 centimeters.

Students *It's one of the squares, but it has to be 12 centimeters around. I've got it! It's the big square, the one with the C!*

10. Before you open Envelope 1 to show the hidden shape (Square C), have students review all the clues one more time. Does Square C fit each and every clue? Are there any other shapes that do so as well? If not, open the envelope to show students what good detectives they have been. Then have them push all their cards back together in preparation for the next riddle.

11. Repeat steps 4–10 with the second riddle on the sheet, and then riddles 3 and 4. Children should discover that the shape in Envelope 2 is Trapezoid A. The shape in Envelope 3 is Parallelogram B, and the shape in Envelope 4 is Rhombus A.

12. When the class has solved all 4 of the riddles, let them know that they will be writing their own riddles for classmates to solve during your next math class. In preparation for riddle-writing, have students each choose their favorite of the quadrilaterals in the set of cards. Ask them to draw that shape in their journals or on paper and write at least 3 mathematical observations about it. Challenge them to use *one* of the following terms correctly in each observation they write:

- right angles
- obtuse angles
- acute angles
- parallel sides
- congruent sides
- line(s) of symmetry

13. Finally, give students each a small envelope in which to store their quadrilateral cards for the next activity, or a paper clip to hold the set together.

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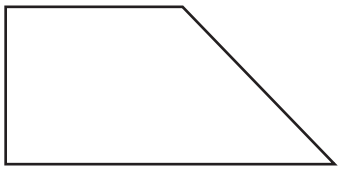
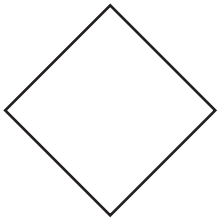
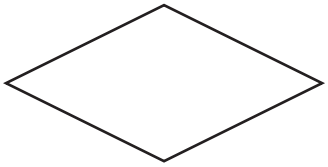
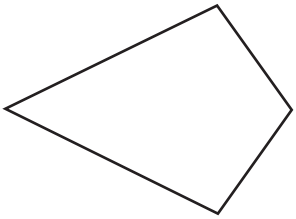
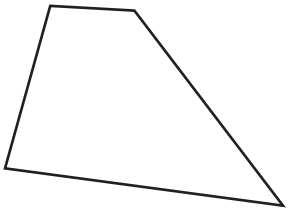
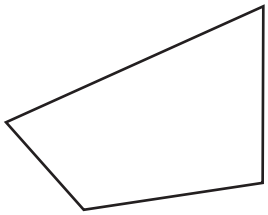
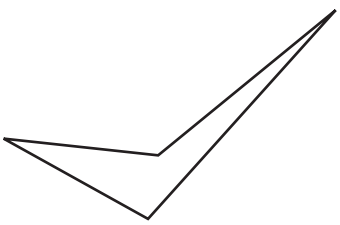
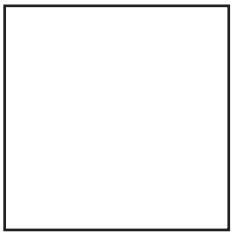
Quadrilateral Cards

Cut cards apart on thin lines.

Rectangle A	**Trapezoid A** 	**Quadrilateral A**
Square A 	**Rhombus A** 	**Parallelogram A**
Trapezoid B	**Quadrilateral B** 	**Square B**
Parallelogram B	**Quadrilateral C** 	**Quadrilateral D** 
Rectangle B	**Quadrilateral E** 	**Square C** 

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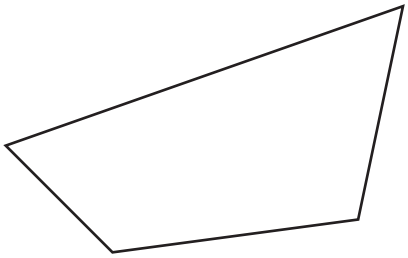
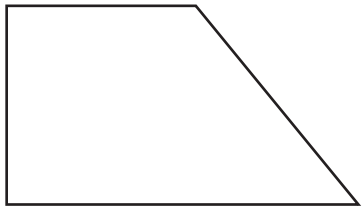
Check Your Quadrilaterals



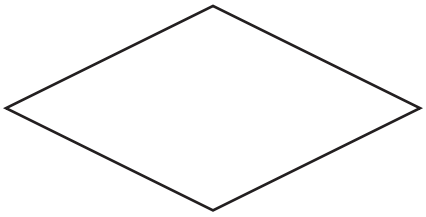
Quadrilateral
Any Polygon with 4 sides



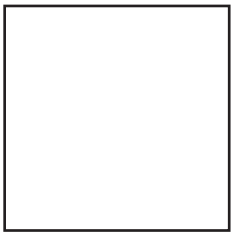
Trapezoid
A quadrilateral with exactly 1 pair of parallel sides

Parallelogram
A quadrilateral with 2 pairs of parallel sides opposite each other

Rectangle
A parallelogram with 4 right angles



Rhombus
A parallelogram with 4 congruent sides



Square
A parallelogram with 4 congruent sides **and** 4 right angles

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Guess My Quadrilateral Riddles

Riddle 1

1 My quadrilateral has 2 pairs of parallel sides.

2 My quadrilateral has 4 congruent sides.

3 My quadrilateral has 4 right angles.

4 My quadrilateral has a perimeter of 12 centimeters.

Riddle 2

1 My quadrilateral is not a parallelogram. (Remember that any quadrilateral with 2 pairs of parallel sides is a parallelogram.)

2 My quadrilateral has exactly 1 pair of parallel sides.

3 My quadrilateral has more than 1 type of angle.

4 My quadrilateral has exactly 2 right angles.

Riddle 3

1 My quadrilateral is a parallelogram. (Remember that any quadrilateral with 2 pairs of parallel sides is a parallelogram.)

2 My quadrilateral does not have any line segments that are perpendicular to each other.

3 My quadrilateral does not have 4 congruent sides.

4 My quadrilateral has a perimeter of 12 centimeters.

Riddle 4

1 My quadrilateral has at least 1 line of symmetry.

2 My quadrilateral has 2 obtuse angles.

3 My quadrilateral has at least 1 pair of parallel sides.

4 My quadrilateral has 4 congruent sides.

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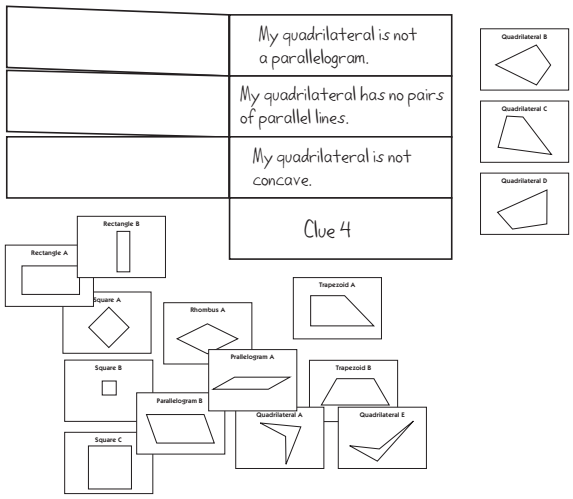
Set C4 ★ Activity 3

ACTIVITY

Writing Quadrilateral Riddles

Overview

Each student selects a quadrilateral from his or her collection of Quadrilateral cards and writes a series of clues that may be used to identify the shape. Students then solve one another's riddles. This activity provides a powerful opportunity to use the langage of geometry in the context of communicating accurately with others.



Skills & Concepts

- ★ identify and describe special types of quadrilaterals
- ★ identify properties of different quadrilaterals
- ★ identify right angles parallel, and perpendicular lines

You'll need

- ★ students' sets of Quadrilateral Cards from Set C4, Activity 2
- ★ writing paper
- ★ 9″ × 12″ white drawing paper (1 sheet per student)
- ★ several sheets of chart paper
- ★ marking pens and scotch tape
- ★ 3″ × 3″ sticky notes, 1 per student
- ★ Word Resource Cards: acute angle, congruent, equilateral, line of symmetry, obtuse angle, parallelogram, parallel lines, perpendicular lines, quadrilateral, rectangle, rhombus, right angle, square, trapezoid (see Advance Preparation)

Advance Preparation Post the Word Resource Cards in a pocket chart or on the wall before teaching this activity.

Instructions for Writing Quadrilateral Riddles

1. Tell students that they are going to write their own quadrilateral riddles today, similar to the ones you shared with them during the last activity. Have the class brainstorm a list of words they might need to know how to spell in addition to the ones on the Word Resource cards. List these on the board or a piece of chart paper.

> ***Students*** *We need words like sides and corners, and angles.*
> *You can tell how to spell angle from looking at the cards.*
> *Can we have symmetrical on the list?*
> *It seems like we have most of the other words we need, except maybe straight.*
>
> ***Teacher*** *We can add more words to the list later if you need them.*

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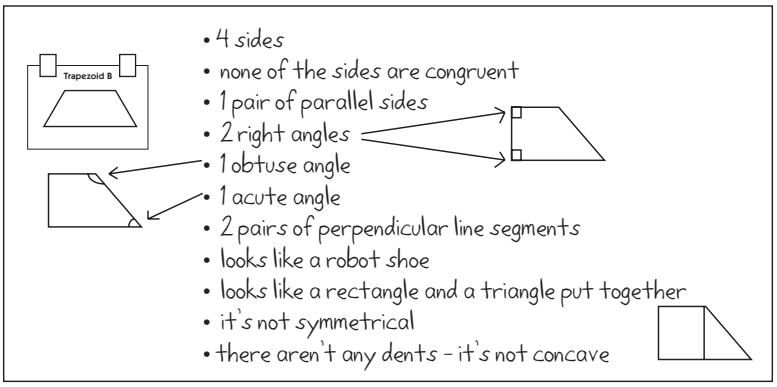
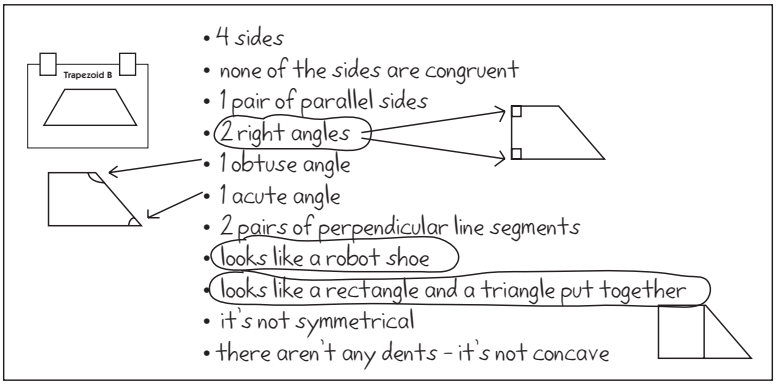
Activity 3 Writing Quadrilateral Riddles (cont.)

2. Next, choose a shape from your collection of Quadrilateral Cards. Post it on the board and ask students to make as many observations about the shape as they can, using the Word Resource cards as a source of ideas. List their observations beside the shape itself. Work with input from the class to illustrate at least some of the observations so all the students can see and understand them.



3. After you have listed students' observations, ask them to spread out all their Quadrilateral cards from the previous activity and take a good look at them. Are there any observations that are true only of the shape you have posted? If so, they would be "dead giveaways," or clues you would want to save for last in writing a riddle about the shape.

> ***Students*** *Trapezoid A is the only shape in our cards that has exactly 2 right angles.*
> *Oh yeah! If you used that one for your first clue, people would know right away.*
> *It's the only one that really looks like a robot shoe.*
> *I don't really see any other shapes that look like a rectangle and a triangle put together.*
> *Oh, I get it. Like if you start with "none of the sides are congruent" there are still lots of shapes left, but if you start with "2 right angles" everyone will know after the first clue.*
>
> ***Teacher*** *Let's circle the observations that are very specific to Trapezoid A. That way, we can remember not to use them first when we write our riddle.*



4. After you have circled the "dead giveaways," ask students which piece of information they might use for their first clue.

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Activity 3 Writing Quadrilateral Riddles (cont.)

Teacher *If you were going to write a riddle about this trapezoid, which clue might you start with?*

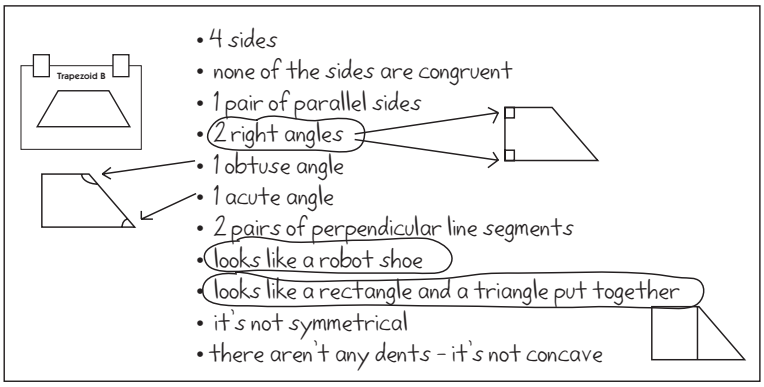
Students *I'd say it has 4 sides.*
But they all have 4 sides. That wouldn't help you get rid of any of the shapes.
We could start with not symmetrical. That would get rid of the rectangles and squares, but most of those weird quadrilaterals aren't symmetrical, so you'd still have some.

Ben *It's kind of like you have to tell something, but you don't want to give away too much right away.*

Teacher *That's right. You don't want to start with the information that will give your secret away too soon, but you do have to write something that your classmates will be able to figure out. If someone can go through your clues and narrow it down to just one shape at the end, you'll know you've written a successful riddle. Let's start with something that will help people eliminate some of the Quadrilateral Cards without knowing exactly which shape it is right away.*

Dara *Let's start with the one about not symmetrical. That's a good one because you can get rid of some of the shapes right away, but you still have to keep a bunch of them.*

5. After some discussion, work with input from the class to write a 4-clue riddle about the shape you have posted. Be sure students understand that the last clue *has* to be a dead giveaway; it has to enable other people to identify the mystery shape with complete assurance.



My Quadrilateral Riddle
by Mrs. Hansen

1. My quadrilateral is not symmetrical.
2. My quadrilateral has no congruent sides.
3. My quadrilateral is not concave.
4. My quadrilateral has 2 right angles.

6. Have students test the riddle by sorting their Quadrilateral Cards according to the clues you have written. Is the last shape left in the collection actually the shape you started with? Is that shape the only one that fits all 4 clues? If not, how can you fix the clues so the riddle works?

7. Once you have modeled the riddle-writing procedure, review the steps:

- choose a quadrilateral from your set of cards
- write as many observations as you can about the quadrilateral
- circle any observations that are dead giveaways and save them for last
- use your observations to draft a riddle with 4 clues
- find a partner to test your riddle and see if it works

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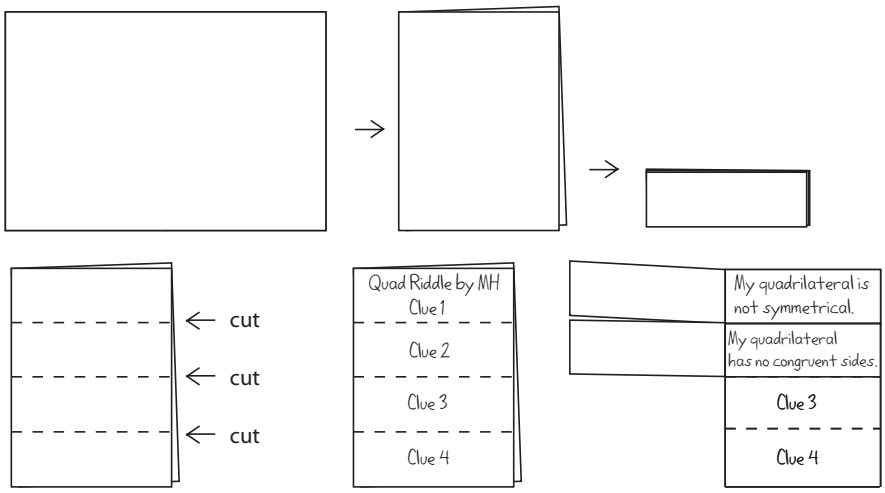
Activity 3 Writing Quadrilateral Riddles (cont.)

8. Once students understand what to do, have them go to work. As a few finish and test their riddles, pull the class back together and show them how to make a riddle booklet by folding a piece of drawing paper into eighths, unfolding the paper, and cutting along the folds on the left side to create 4 "doors" that can be opened one by one to reveal the clues in order. Then show them how to label the doors, write their clues behind the doors, write the answer on the back cover of the booklet, and cover it with a sticky note.



9. After you have had a chance to look over the students' finished work, you can

- set up a special time for children to solve one another's riddles over the next day or two, or
- set up the riddles with several sets of Quadrilateral Cards at a back table for students to solve when they have a few minutes to spare, or
- set up the riddles and a few sets of Quadrilateral Cards as a Work Place.

INDEPENDENT WORKSHEET

Use Set C4 Independent Worksheet 2 to provide students with more practice classifying quadrilaterals by their properties.

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Set C4 ★ Activity 4

ACTIVITY

Perimeters of Paper Quadrilaterals

Overview

After reviewing the meaning of *perimeter*, students estimate, measure, and compare the perimeters of 5 different paper quadrilaterals.

Skills & Concepts

★ identify and describe special types of quadrilaterals

★ estimate and measure perimeters of quadrilaterals in metric units

You'll need

★ Perimeter Record Sheet, (page C4.23, class set plus a display master)

★ Paper Quadrilaterals, (page C4.24, half class set plus a few extra, see note at right)

★ a piece of 20 cm × 25 cm red construction paper

★ blue masking tape

★ rulers (class set)

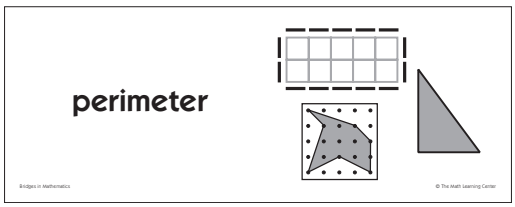
★ scissors (class set)

★ Word Resource Cards (perimeter)

Note *The side lengths of all the figures on the Paper Quadrilaterals sheet should be whole numbers. Run 1 copy and check to see that the side lengths on the square are 9 cm. If they are not, make adjustments to your printer or copy machine as needed. Run copies of the Paper Quadrilaterals sheet on several different colors of copy paper (e.g., 4 copies on pink, 4 on green, 4 on blue, and 4 on yellow) This will make it easier for students to keep their work separate from others nearby.*

Instructions for Perimeters of Paper Quadrilaterals

1. Post the perimeter card on the board and give students a minute to share anything they already know about this term.



Students *It's how far it is around a shape, like a square or a rectangle.*
You measure all the sides and add them together.
You have to find out how many inches or centimeters around.

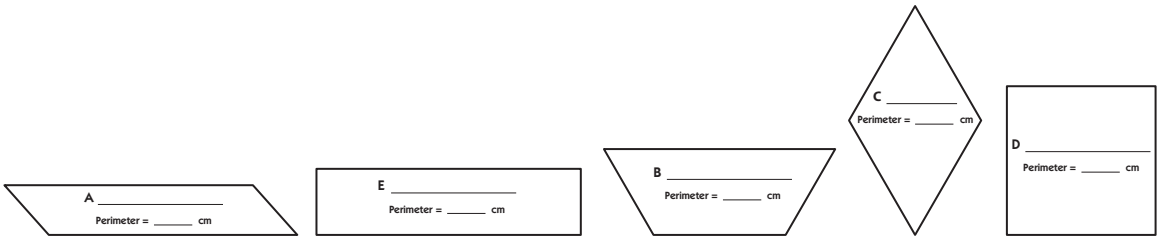
Activity 4 Perimeters of Paper Quadrilaterals (cont.)

2. Explain that perimeter is the distance around any figure. People find the perimeter of a figure by measuring its side lengths and adding them together. As students watch, tape the piece of red construction paper to the board. Have one of the students come up and indicate, using a ruler or other pointer, where the perimeter of this rectangular piece of paper is. Then work with input from the class to measure and find the perimeter of the red rectangle in centimeters. Next, ask the students what they would do to find the perimeter of a rhombus or a trapezoid or a square.

> ***Students*** *Just measure the sides and add them together.*
> *A square would be easy. You don't even have to measure all t1 the sides are congruent*

3. Give each pair of students a copy of the Paper Quadrilaterals sheet. (If you give each pair at a table a different color sheet, they'll be able to keep track of their own quadrilaterals more easily.) Have students work with their partners to label each of the 5 quadrilaterals with its most specific name (A: Parallelogram, B: Trapezoid; C: Rhombus; D: Square; E: Rectangle). Then ask them to carefully cut out the 5 quadrilaterals along the heavy lines.

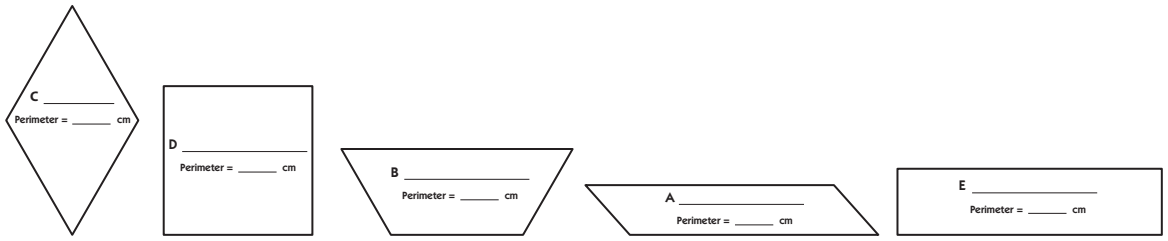
4. Let students know that in a minute, they'll be estimating and finding the perimeter of each quadrilateral in centimeters. Before they do, ask them to use their estimation skills to place the 5 figures in order, from smallest to largest perimeter. Have them discuss their thinking with their partners as they sequence the quadrilaterals, and then choose a few volunteers to share their ideas with the class.



> ***Andrew*** *We thought the square looked biggest around so we put it last. The parallelogram and the rectangle looked pretty skinny, so we put them together at the beginning.*

> ***Dara*** *We thought the trapezoid and rhombus looked like they would be pretty big around, but not as big as the square, so we put them in the middle.*

> ***Jason*** *We had a different idea from Andrew and Dara. We thought that the parallelogram and the rectangle would have the biggest perimeters. Even though they're not as tall as the others, they're the longest. Here's how we put our shapes in order.*



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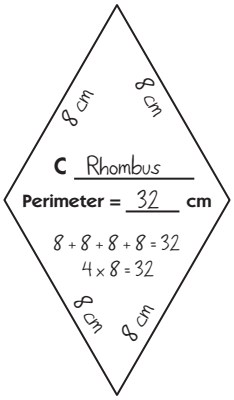
Activity 4 Perimeters of Paper Quadrilaterals (cont.)

5. Ask students to get out their rulers, and give each student a copy of the Perimeter Record Sheet. Review the instructions on the sheet with the class. Have them continue to work in pairs even though each student needs to complete his or her own sheet. As you review the instructions, remind students to write the measurements, computations, and perimeter on the quadrilaterals themselves. You may want to demonstrate this process or work with the class to find the perimeter of one of the shapes.

> ***Teacher*** *Let's do the rhombus together. How many centimeters around do you think the rhombus is? Please talk to the person next to you, and then I'll ask some people to share their ideas with the class. (Waits a few moments.) Sydney?*
>
> ***Sydney*** *We think it might be about 40 centimeters, because each side looks like it's about 10 centimeters, and 4 times 10 is 40.*
>
> ***Jake*** *Ours is pretty close. We think maybe each side is about 9 centimeters, so the perimeter would be 36 because 9 + 9 + 9 + 9 is 36.*
>
> ***Teacher*** *I'll record those estimates on the board. Now let's measure the rhombus to find its actual perimeter. Do we need to measure all the sides?*
>
> ***Students*** *Yes, you measure all the sides and then add up the numbers.*
> *I respectfully disagree with Hannah. I think you can just measure one side and multiply it by 4.*
>
> ***Teacher*** *How are you thinking about that, Katie?*
>
> ***Katie*** *Well, we found out last week that the sides of a rhombus are like a square because they're all equal. If you just measure 1 side, you can multiply that number by 4 or add it up 4 times, and you'll have the answer.*
>
> ***Teacher*** *Let's try it out. I'd like each of you to work with your partner. Measure the rhombus, and I'll record the information up here, right on my rhombus.*



6. When students understand what to do, have them go to work. Encourage them to use the measurements from the first quadrilateral to estimate the side lengths and perimeters of the other 4 shapes. Remind them to enter their estimates and the actual perimeters on the Perimeter Record Sheet as they go.

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Activity 4 Perimeters of Paper Quadrilaterals (cont.)

7. Have students share and compare their results with other pairs as they finish. Pull the class back together toward the end of the math period, or at the beginning of the math period the following day, to share and discuss their results. Start the discussion by asking students to put their quadrilaterals in order from smallest to largest perimeter. How does that order compare with their original predictions? Here are some questions you may want to pose during the discussion:

- Are you surprised that the rhombus and the square have the smallest perimeters? Why or why not?
- The square looks pretty big. How is it possible that the rectangle had a larger perimeter than the square?
- Do you need to measure the length of every side to find the perimeter of a quadrilateral? Why or why not?
- Can you find an example of a quadrilateral in our collection where you only have to measure 2 of the sides to find the perimeter? Can you find an example where you only have to measure 1 of the sides to find the perimeter?

Key: *Here are the perimeters of each of the quadrilaterals in order from smallest to largest for your reference. Quadrilateral C (rhombus): 32 cm; Quadrilateral B (trapezoid): 34 cm; Quadrilateral D (square): 36 cm; Quadrilateral A (parallelogram): 38 cm; Quadrilateral E (rectangle): 40 cm.*

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NAME _____ DATE _____

Perimeter Record Sheet

1 Label each figure on the Paper Quadrilaterals sheet with its name.

2 Work with your partner to carefully cut out the 5 quadrilaterals and put them in order, from smallest to largest perimeter.

3 After you've agreed on the order, write the letters of the quadrilaterals where you think they belong in the boxes below.

Smallest Perimeter → Largest Perimeter				

4 Estimate the perimeter of each quadrilateral. Write your estimates on the chart below. Then measure the perimeter of each quadrilateral and label the quadrilateral to show your work. Record the actual perimeters on the chart below.

Quadrilateral Letter	Your Estimate in centimeters (cm.)	Actual Perimeter in centimeters (cm)

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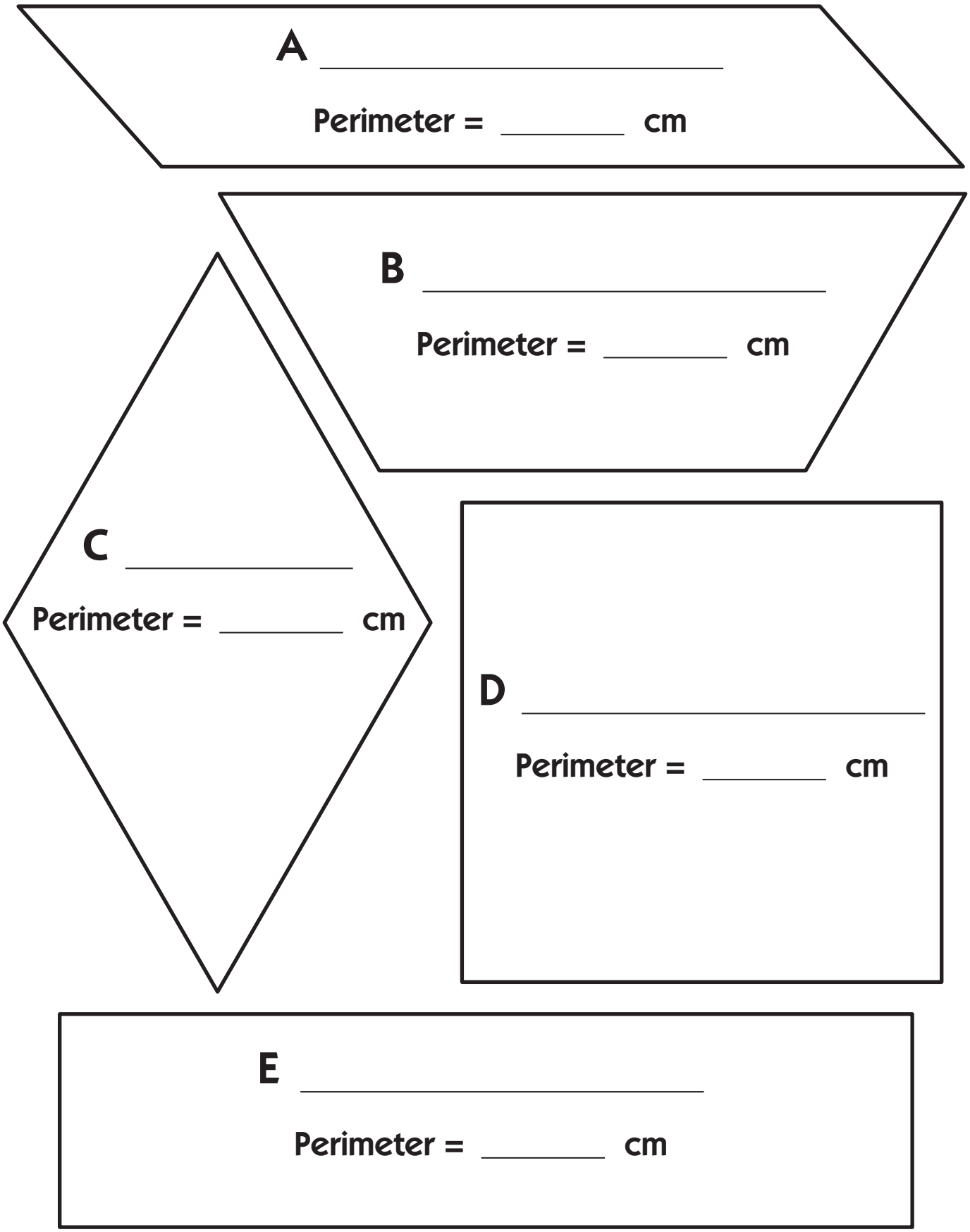
Paper Quadrilaterals



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Set C4 ★ Activity 5

ACTIVITY

Measuring Classroom Quadrilaterals

Overview

Students estimate and measure the perimeters of quadrilaterals in the classroom, such as the whiteboard, a desk, a table, a piece of chart paper, the calendar grid pocket chart, and so on. In doing so, they must choose appropriate tools and units, based on the sizes of the objects they are measuring.

Skills & Concepts

- ★ identify and describe special types of quadrilaterals
- ★ estimate and measure perimeters of quadrilaterals
- ★ measure perimeter in U.S. customary units
- ★ choose appropriate tools and units of measure

You'll need

- ★ Measuring Classroom Quadrilaterals, (page C4.28, class set plus a display master)
- ★ rulers (class set)
- ★ other tools to measure length in U.S. Customary units, including yardsticks and measuring tapes marked in inches and feet

Instructions for Measuring Classroom Quadrilaterals

1. Open this activity by asking students to share what they know about perimeter now.

> ***Students*** *Perimeter is how far it is around something.*
> *You have to measure the side lengths and add them together.*
> *You can do multiplication too, like if the shape is a square. Then you can just measure 1 of the sides and multiply by 4.*
> *You can do perimeter with lots of different shapes, not just squares and rectangles.*
> *I think the sides have to be straight, though, because you can't really measure how far it is around a circle with a ruler.*

2. Explain that today, students are going to work in pairs to measure the perimeters of quadrilaterals around the classroom. Ask them to look around quietly from where they are sitting to find examples of small and large quadrilaterals, including non-rectangular quadrilaterals if possible. After they've had a few moments to search the room with their eyes, have students pair-share their ideas, and then call on volunteers to share with the class. As each idea is shared, ask the class to identify what kind of quadrilateral it is. Record the name and shape of each item suggested by the students on the board. 3. Then show students the measuring tools available to them, including a ruler, a yardstick, and a measuring tape. Ask them whether they would use the same tools and units to measure all of the items listed on the board. Would they, for instance, use the same tools and units to measure the trapezoid pattern block and the whiteboard? Why or why not? Record some of the ideas that emerge as students share their thinking with the group.

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Activity 5 Measuring Classroom Quadrilaterals (cont.)

Students *No way! I would use inches for the pattern block, and feet for the whiteboard. I think maybe feet or yards would be good for the whiteboard because it's really big. You could use the yardstick to get the feet or yards. If it doesn't come out exact, you could use a regular ruler to do the inches that are left over.*
I think inches are good for things like a notebook or the tile on the floor, but you should use feet or yards for big things like the rug.
It seems like it would be easier to use a regular ruler for little things, and a measuring tape for big things.
Can we use more than one unit? Like can we use feet and inches? Because sometimes things don't come out perfect when you measure them.

4. Give students each a copy of the Measuring Classroom Quadrilaterals sheet and place a copy on display at the overhead or document camera. Review the instructions at the top of the sheet with the class. Then examine the example given in the first row of the chart with students.

Set C4 Geometry: Quadrilaterals Blackline

NAME _____ DATE _____

Measuring Classroom Quadrilaterals

1 Choose 6 different quadrilateral-shaped items in your classroom to measure. Fill in the chart below to show the following for each item:

- the name of the item
- the shape of the item (tell which kind of quadrilateral it is)
- the unit of measure you're planning to use for that item (inches, feet, or yards)
- your estimate of the perimeter
- the actual perimeter (show your work)

Item Name	Shape Name	Unit of Measure	Esitmated Perimeter	Actual Perimeter (Show you work.)
Example red pattern block	trapezoid	inches	6 inches	1+1+1+2=5 inches
a				
b				
c				
d				

Teacher *What classroom quadrilateral did they use for an example in the first row of the chart?*

Juan-David *One of those red pattern blocks. It's a trapezoid.*

Teacher *Why do you think they picked inches for the unit of measure?*

Teal *Because it's really little. You couldn't measure it in feet or yards - that doesn't make sense.*

Teacher *Was the estimate they made correct? No? Is that okay?*

Marcus *Yes, because it's just an estimate. It doesn't have to be exact.*

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Activity 5 Measuring Classroom Quadrilaterals (cont.)

5. After you have examined the example at the top of the chart together, model the steps described at the top of the worksheet. Choose one of the larger classroom quadrilaterals from the list on the board. Work with input from the class to fill in Row A on your display sheet with the name and shape of the item. Discuss with students whether it would be most appropriate to measure the item in inches, feet, or yards. Make an estimate of the item's perimeter. Then have students help you measure the side lengths. As you do so, establish with the class the desired degree of accuracy (i.e., to the nearest foot, the nearest inch, the nearest half an inch). Get students' input to record the equation needed to determine the perimeter of the item. Have students solve the equation to find the actual perimeter.

6. Once students understand what to do, have them go to work in pairs, each partner responsible for filling in his or her own sheet. Ask them to choose items of different sizes to measure - not all small and not all large. Let them know that they can choose items from the list on the board, or other items of their own choosing, as long as they are quadrilaterals. Challenge them to include at least one non-rectangular quadrilateral among the items they measure; more than one if possible. Ask students who finish quickly to turn the worksheet over, draw a chart on the back similar to the one on the front, and continue measuring and recording.

7. Toward the end of the math period, pull the group back together to discuss their discoveries and results. Here are some questions you might want to pose:

- Which items did you decide to measure in feet?
- Were there any you measured in yards, instead of feet or inches?
- What unit of measure would you use to find the perimeter of the playground?
- What items were you able to find that were non-rectangular quadrilaterals? Why do you suppose it's so challenging to find objects that are shaped like rhombuses, parallelograms, and trapezoids? Why are rectangles and squares so common in our surroundings?
- When might you need to find the perimeter of something in your everyday life? What about your parents? What kinds of workers would need to find the perimeters of things on the job?
- Did you get any surprises as you were finding the perimeters of different items in our classroom?

INDEPENDENT WORKSHEET

Use Set C4 Independent Worksheet 3 to provide students with more practice measuring quadrilaterals to determine their perimeter.

NAME _____ **DATE** _____

Measuring Classroom Quadrilaterals

1 Choose 6 different quadrilateral-shaped items in your classroom to measure. Fill in the chart below to show the following for each item:

- the name of the item
- the shape of the item (tell which kind of quadrilateral it is)
- the unit of measure you're planning to use for that item (inches, feet, or yards)
- your estimate of the perimeter
- the actual perimeter (show your work)

Item Name	Shape Name	Unit of Measure	Esitmated Perimeter	Actual Perimeter (Show you work.)
Example red pattern block	trapezoid	inches	6 inches	1 + 1 + 1 + 2 = 5 inches
a				
b				
c				
d				
e				
f				

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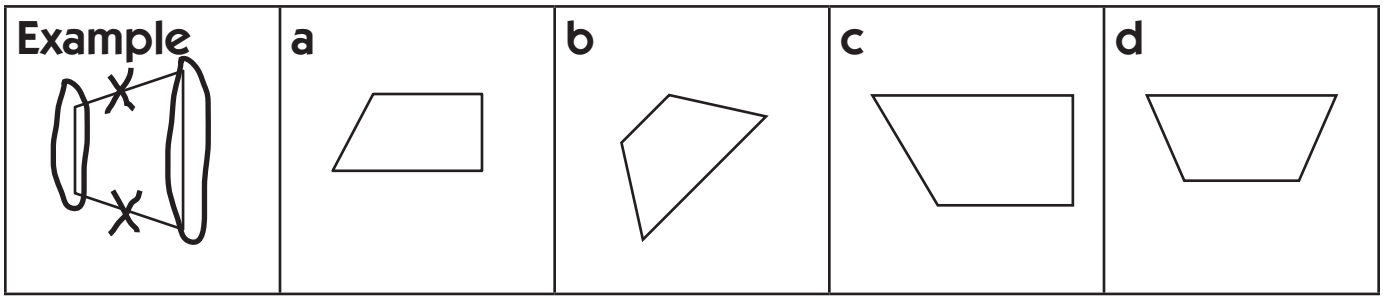
NAME _____ **DATE** _____

Set C4 ★ Independent Worksheet 1

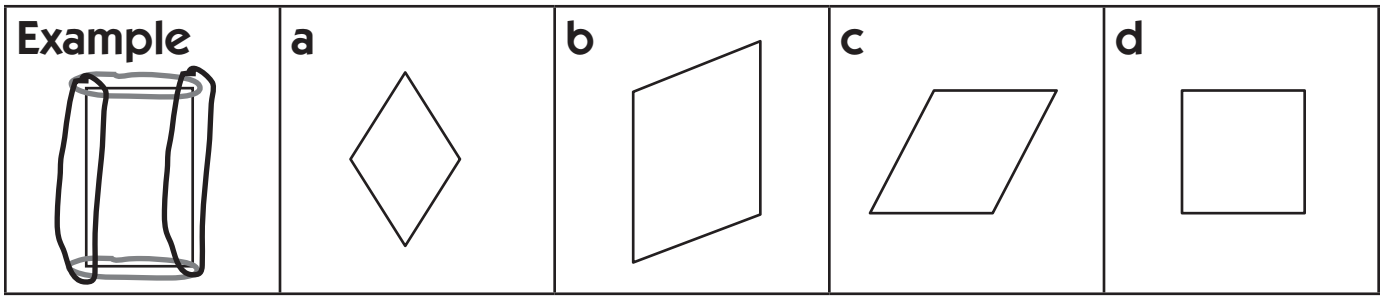
INDEPENDENT WORKSHEET

Sorting and Identifying Quadrilaterals

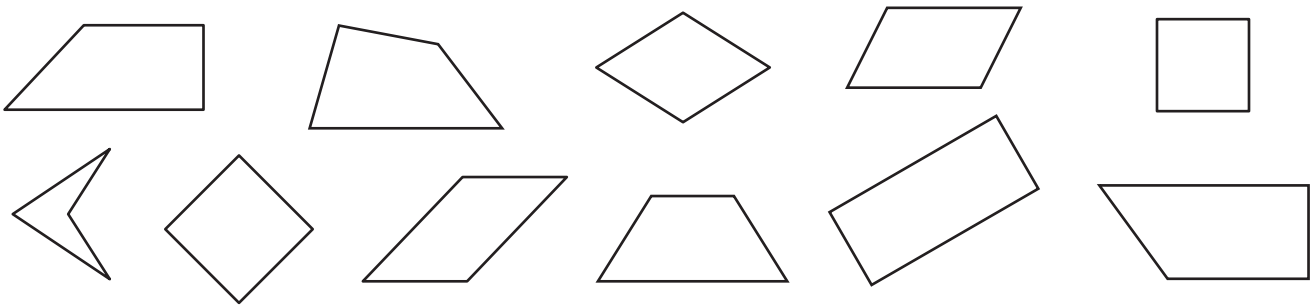
1 A trapezoid is a quadrilateral with exactly 1 pair of parallel lines. Circle the 2 lines that are parallel to each other on each of the trapezoids below. Mark the 2 lines that are *not* parallel to each other with an x on each of the trapezoids below.



2 A parallelogram is any quadrilateral with 2 pairs of parallel lines. On each of the parallelograms below, circle 1 pair of parallel lines in blue. Circle the other pair of parallel lines in red.



3 Find all the trapezoids below. Color them orange. Find all the parallelograms below. Color them purple. When you finish, you should have 2 quadrilaterals that are not colored.



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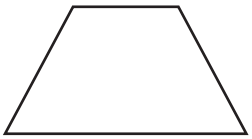
Independent Worksheet 1 Sorting and Identifying Quadrilaterals (cont.)

4 Fill in the bubble to show the answer. Then write an explanation.

a This shape is a



◯ trapezoid ◯ square ◯ parallelogram ◯ rectangle

Explain why:.

b How do you know that the shape in **a** is *not* a parallelogram? Use labeled sketches, numbers, and/or words to explain. Give at least 2 reasons.

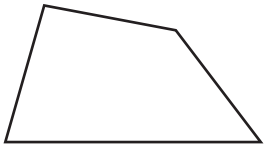
c This shape is a

◯ trapezoid ◯ square ◯ parallelogram ◯ rectangle

Explain why:.

d How do you know that the shape in **c** is *not* a rectangle? Use labeled sketches, numbers, and/or words to explain. Give at least 2 reasons

e This shape is a



◯ trapezoid ◯ square ◯ quadrilateral ◯ rectangle

Explain why:.

f How do you know that the shape in **e** is *not* a trapezoid? Use labeled sketches, numbers, and/or words to explain. Give at least 2 reasons.

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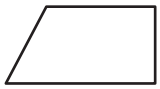
Set C4 ★ Independent Worksheet 2

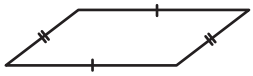
INDEPENDENT WORKSHEET

Classifying Quadrilaterals

A quadrilateral is any polygon that has 4 sides. There are many kinds of quadrilaterals, including:

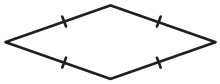


trapezoid
a quadrilateral with exactly 1 pair of parallel sides

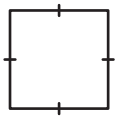


parallelogram
a quadrilateral with 2 pairs of parallel sides opposite each other

rectangle
a parallelogram with 4 right angles



rhombus
a parallelogram with 4 congruent sides



square
a parallelogram with 4 congruent sides and 4 right angles

1 Look carefully at the figures below. Find out how many right angles, pairs of parallel sides, and pairs of congruent sides each has. Then circle all the words that describe the figure.

Figure	How many right angles?	How many pairs of congruent sides?	How many pairs of parallel sides?	Circle the word(s) that describe(s) the figure.
a				trapezoid parallelogram rectangle rhombus square

(continued)

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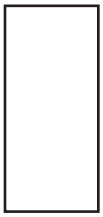
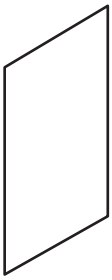
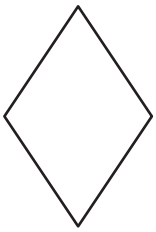
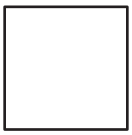
Independent Worksheet 2 Classifying Quadrilaterals (cont.)

Figure	How many right angles?	How many pairs of congruent sides?	How many pairs of parallel sides?	Circle the word(s) that describe(s) the figure.
b 				trapezoid parallelogram rectangle rhombus square
c 				trapezoid parallelogram rectangle rhombus square
d 				trapezoid parallelogram rectangle rhombus square
e 				trapezoid parallelogram rectangle rhombus square

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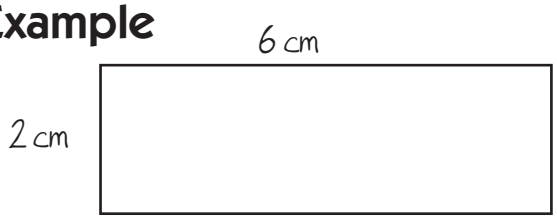
Set C4 ★ Independent Worksheet 3

INDEPENDENT WORKSHEET

Perimeter Review

1 For the quadrilaterals below, measure in centimeters and label as many sides as you need to find the perimeter. Then write an equation to show the perimeter of the quadrilateral and fill in the answer at the bottom of the box.

Example

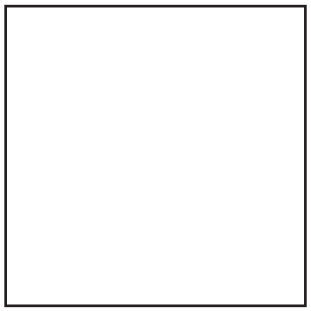


$(2 \times 6) + (2 \times 2) = 12 + 4$

$12 + 4 = 16$ cm

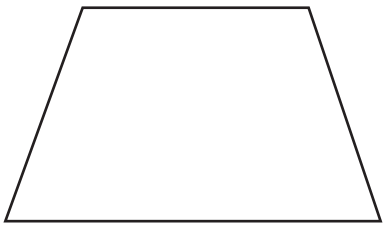
Perimeter = 16 cm

a



Perimeter = _____

b



Perimeter = _____

c

Perimeter = _____

2 Sarah says you only need to measure one side of a square to figure out its perimeter. Do you agree with Sarah? Why or why not? Use labeled sketches, numbers, and/or words to explain your answer.

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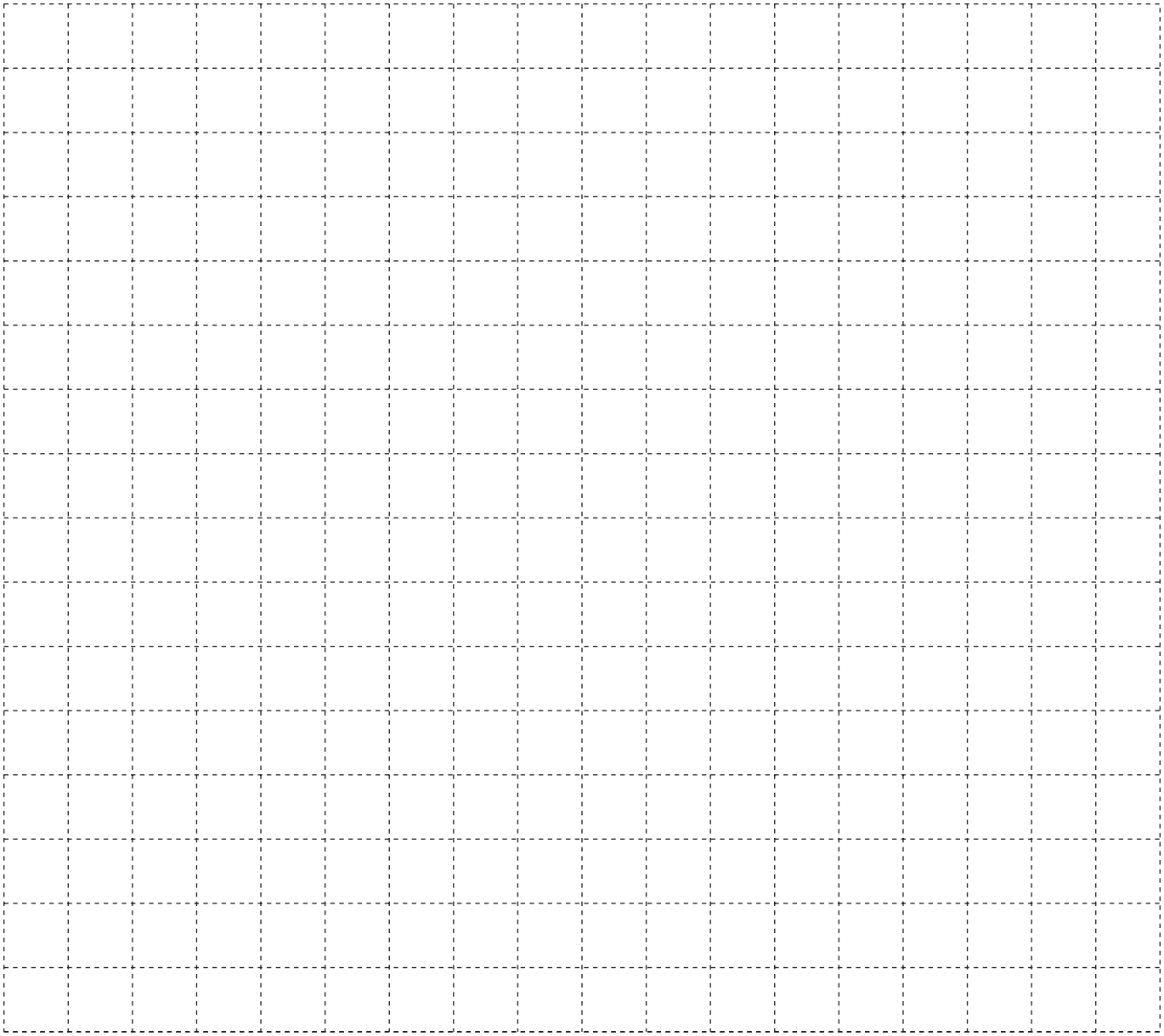
Independent Worksheet 3 Perimeter Review (cont.)

3 Jacob and his dad are going to make a rabbit pen in the backyard. They have 16 feet of fencing. Help Jacob draw some plans. Sketch and label at least 4 different rectangles with a perimeter of 16 centimeters on the centimeter grid paper below. Write an equation under each sketch to show that the perimeter is actually 16 centimeters. Circle the sketch you think would be best for a rabbit pen.



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