

MATH UNIT

Around it, or across it: perimeter and area

Grade 4

7 lessons

7 × 30 minutes

3 source books

210 minutes in all

THE QUESTION THIS UNIT FOLLOWS

Which measure is the question asking for?

ABOUT THIS UNIT

A Grade 4 child who can compute both perimeter and area will still hand back the wrong one, because nothing in the two side lengths says which is being asked for. This unit starts there: one card, yarn round the edge and squares over the face, two numbers, and four questions to sort between them.

It then builds each measure properly — walked and summed, tiled and multiplied — before moving to the place where the language does the real damage. Four times as large and four more square yards act on the same field and differ by 1,796 square yards, and the only thing separating them is the phrase.

THE MATHEMATICAL ARC

Each lesson does one job the lesson before it made possible.

1 One card, two numbers, and which question each answers**2** Perimeter from the sides: walk it, then write the sum**3** Tile it, count by rows, and write the multiplication**4** Area from a formula, checked against a count**5** Four times as large: build it, find the extra, halve it

6 The phrase sets the operation

7 Say the difference both ways, and the relation that runs opposite

SOURCE BOOKS

Every lesson in this unit is already published under Math lessons. Nothing here asks you to teach anything you cannot open today.



**Zachary Zormer, Shape
Transformer: A Math Adventure**
3 lessons in this unit



Kitchen Math
2 lessons in this unit



Ball Game Math
2 lessons in this unit

HOW TO USE THIS GUIDE

Open the source lesson before you teach.

Each day names one lesson that already exists under Math lessons, with its book, its number and its title. This guide says what that lesson is doing in the sequence and what to collect from it; the lesson itself carries the steps, the printables and the answers.

Thirty minutes a day.

Five minutes to connect to yesterday, the twenty-minute source lesson, five minutes to close on something you can see. A day that runs long should lose the close, never the core.

Teach a lesson on its own if you need to.

Every day carries a one-sentence opening for a teacher who is using that lesson outside the sequence.

Stop after a checkpoint.

The unit holds together if you stop after either checkpoint and come back to it. Stopping between a checkpoint and the next one leaves a lesson without the evidence it was built on.

WHERE THIS FITS IN YOUR YEAR

When to teach it

Any term once multiplication facts are secure. Lessons 5 to 7 want the class comfortable multiplying a three-digit number by a one-digit one.

What students need first

Children can multiply within one hundred, can measure with a ruler in whole inches, and can subtract three-digit numbers.

What this unit develops

Distinguishing perimeter from area including their units; perimeter as a sum of sides; area by tiling and by multiplying; comparing two areas; scaling an area by a whole-number factor; identifying a multiplicative phrase against an additive one; stating a difference in both directions.

What it prepares them for

Area of composite figures, scale drawings, and any later work where a relation has to be read out of prose.

CURRICULUM CONNECTIONS

None claimed. The lessons in this unit carry their own standards classifications on their own pages, checked lesson by lesson. A unit-level expectation is a different claim, and none has been verified for this unit, so none is printed here. Use the placement guide above to site the unit in your year, and the individual lesson pages for the codes.

UNIT AT A GLANCE

#	MATHEMATICAL MOVE	SOURCE LESSON	COLLECT
1	One card, two numbers: twenty by going round and twenty-four by covering, and which question each answers	Zachary Zormer, Shape Transformer: A Math Adventure lesson 1, The Same Card, Two Different Numbers	Two numbers from one card, each written with the unit it belongs to.
2	Perimeter from the sides: walk it, then write the four sides as one sum	Zachary Zormer, Shape Transformer: A Math Adventure lesson 3, Twenty Inches Around a Hall Pass	A card with all four sides labelled and the running count written as a four-term sum.
3	Tile the rectangle, count by rows, and write the multiplication the rows produce <i>Checkpoint after this lesson</i>	Zachary Zormer, Shape Transformer: A Math Adventure lesson 2, Five Rows of Eight Square Inches	A tiled rectangle with its two edge numbers and the equation written beneath it.
4	Area from a formula, checked against a count of squares, and two pans compared	Kitchen Math lesson 4, Which pan spreads the batter thinner?	Two drawn and labelled rectangles, each carrying a counted area and a multiplied area.
5	Four times as large: build both fields, find the extra ground, and halve it	Ball Game Math lesson 4, Four Times as Large, and Only Half to Cover	Two drawings, the larger built from four copies of the smaller, with both areas written inside.
6	Four times as large or four more square yards: the phrase sets the operation <i>Checkpoint after this lesson</i>	Ball Game Math lesson 6, The Word That Sets the Operation	Two labelled rectangles on one sheet, each headed with the phrasing that produced it.

#	MATHEMATICAL MOVE	SOURCE LESSON	COLLECT
7	Thirteen squares said both ways, and the relation that runs opposite to it	Kitchen Math lesson 9, Thirteen squares, said both ways	Two overlaid rectangles with the difference visible, and four written sentences about them.

UNIT VOCABULARY

Words students say, not words they are taught to define.

perimeter	The distance round the outside, measured in inches.
area	The covering, measured in square inches.
square inch	The unit of the covering. Children write it in full.
four times as large	Lesson 6: the phrase that multiplies, set against four more, which adds.

MATERIALS

From the source lessons

Each day's materials are listed on that day's page below and on the source lesson itself. Nothing is duplicated here.

New for this unit

- Checkpoint 1 page, one per child
- Checkpoint 2 page, one per child
- Performance task set: squared paper, a ruler, coloured pencils and a card naming a rectangle's two sides and a scale factor, per pair
- Performance task page, one per child

ASSESSMENT PLAN

Daily evidence

Keep the two numbers with their units from lesson 1, the tiled rectangle with its multiplication from lesson 3, and the two labelled fields from lesson 6.

Checkpoint 1, after lesson 3: Two numbers, two units

A rectangle 7 inches by 3 inches. The child finds its perimeter and its area, writes each with its unit, and says which question each answers.

Book-free. A drawn rectangle, no book.

Look for. 20 inches and 21 square inches, each with the correct unit. A child who writes both as inches has not separated the two measures.

Checkpoint 2, after lesson 6: Four times, or four more?

A field 10 yards by 20 yards. The child finds its area, then finds the area of a field four times as large, then the area of a field four square yards larger, and says which phrase produced which.

Book-free. Squared paper, no book.

Look for. 200, 800 and 204. The two answers must be produced separately before either is judged.

Culminating task: Two fields, four sentences

Each pair draws a rectangle from the two sides on their card, counts it by rows and writes its area, and finds its perimeter by walking the sides and writing the sum. They then build a second field scaled by the factor on the card, count it, and shade everything in the large one that is not the small one. Finally they write four sentences about the pair: the scaling forwards and backwards, and the difference forwards and backwards, each with its number.

Collect. The two drawn fields with the difference shaded, the perimeter sum, and the four written comparison sentences.

What it assesses. Both measures with their units, scaling, and the two kinds of comparison said in both directions — every move the unit built.

DAILY LESSON PAGES

Lesson 1

One card, two numbers: twenty by going round and twenty-four by covering, and which question each answers

SKILL LESSON

Zachary Zormer, *Shape Transformer: A Math Adventure* (/math-library/120.html) ·

lesson 1, The Same Card, Two Different Numbers · Grade 4 · 20 minutes

Distinguishing perimeter from area on the same rectangle

I CAN

I can make two numbers from one card.

BIG IDEA

Two side lengths produce two different answers, and the words decide which one is wanted.

SUCCESS

The child sorts four questions to the right number and names the word in each that decided it.

CONNECT | 5 MIN

First lesson. Hold up a card and say it is four inches long and six inches wide, then ask how big it is. Take every answer and write them all up.

TAUGHT ON ITS OWN

Zack gives the hall pass two numbers on one page and then names only one thing about it; the area of that card is nowhere in the book.

SOURCE CORE | 20 MIN

Pairs run yarn round the edge of one card, cut it where it meets and read its length along a ruler; then cover a second identical card with one-inch squares and count them, writing the two numbers side by side.

COLLECT

Two numbers from one card, each written with the unit it belongs to.

CLOSE | 5 MIN

Each pair sorts four questions about the card to one of the two numbers, writing beside each the one word from the question that decided it, then writes why one number is inches and the other square inches.

From the source lesson: 4-by-6-inch index cards; Yarn; Rulers marked in inches; One-inch paper squares; Scissors; Pencils; Lined paper; Question cards for the sorting step; Word cards: area, perimeter, square inch

Watch for: A child writes both numbers with the same unit. Hand them the yarn and the tiles and ask which one each number came from.

Lesson 2

Perimeter from the sides: walk it, then write the four sides as one sum

SKILL LESSON

 Zachary Zormer, Shape Transformer: A Math Adventure (/math-library/120.html) ·

lesson 3, Twenty Inches Around a Hall Pass · Grade 4 · 20 minutes

Finding the perimeter of a rectangle from its length and width

I CAN	I can find the perimeter by going round.
BIG IDEA	The trip round the outside meets each pair of sides twice, which is why two sides of four and two of six make twenty and not ten.
SUCCESS	Every side of the card carries a number, not just two.
CONNECT 5 MIN	Yesterday one of your two numbers came from the yarn. Today you find that number without the yarn.
TAUGHT ON ITS OWN	Zack says the card is four inches long and six wide and names its perimeter in the same breath, and the book never shows the working.
SOURCE CORE 20 MIN	Each student cuts a four-by-six card, writes a number on every side, then lays the ruler along one side at a time turning the corners and keeping a running count aloud until the finger returns to where it started.
COLLECT	A card with all four sides labelled and the running count written as a four-term sum.
CLOSE 5 MIN	Students write the four sides as one sum and again the short way, circle the line that shows more clearly why four and six each appear twice, and read the circled line to a partner.

From the source lesson: 4-by-6-inch index cards; Rulers marked in inches; Scissors; Pencils; Lined paper; Word cards: length, perimeter, width

Watch for: Only two sides labelled. The trip meets four sides; label all four before the walk begins.

Lesson 3

Tile the rectangle, count by rows, and write the multiplication the rows produce

SKILL LESSON

Zachary Zormer, *Shape Transformer: A Math Adventure* (</math-library/120.html>) ·

lesson 2, Five Rows of Eight Square Inches · Grade 4 · 20 minutes

Finding the area of a rectangle by multiplying its length by its width

I CAN	I can find the area by tiling and then by multiplying.
BIG IDEA	The two numbers in the area equation are a number of rows and a number in each row, so the multiplication is a shortcut for something already on the desk.
SUCCESS	The child counts by rows rather than by single squares and can say which number in the equation was which.
CONNECT 5 MIN	Yesterday you went round the edge. Today you cover the face, and the number that comes out is a different kind of number.
TAUGHT ON ITS OWN	The book's third demonstration hands over the area rule and a page to use it on: five inches by eight, forty square inches.
SOURCE CORE 20 MIN	Pairs lay one-inch squares onto a five-by-eight rectangle until nothing overhangs, write the two edge numbers, count by rows touching a whole row on each number word, and write the multiplication underneath.
COLLECT	A tiled rectangle with its two edge numbers and the equation written beneath it.
CLOSE 5 MIN	Students take a three-by-seven rectangle with no squares supplied, find its area by writing the multiplication alone, then lay one row of squares along it to check the row really holds seven.

From the source lesson: One-inch paper squares; Paper rectangles drawn 5 inches by 8 inches; Pencils; Lined paper; Word cards: area, square inch

Watch for: Counting the squares one at a time. Touch a whole row on each number word; that is what turns the count into the product.

Checkpoint after this lesson: Two numbers, two units. The page is at the end of this guide.

Lesson 4**Area from a formula, checked against a count of squares, and two pans compared****SKILL LESSON**

Kitchen Math (</math-library/523.html>) · lesson 4, Which pan spreads the batter thinner? · Grade 4 · 20 minutes

Computing the area of two rectangles from stated lengths and widths and comparing them

I CAN

I can compute two areas and compare them.

BIG IDEA

The same pan is two numbers in a sentence, a rectangle of squares and a product, and all three are one thing.

SUCCESS

The child produces each area twice, by counting and by multiplying, and the two agree.

CONNECT | 5 MIN

You can tile and you can multiply. Today two rectangles arrive as four numbers in a sentence and never get drawn for you.

TAUGHT ON ITS OWN

Two loaf pans are given with their lengths and widths, and the book supplies the rule that turns them into an area.

SOURCE CORE | 20 MIN

Pairs draw both pans on grid paper at one square per inch, count the squares in each row by row and write the number, then multiply the sides and write that underneath.

COLLECT

Two drawn and labelled rectangles, each carrying a counted area and a multiplied area.

CLOSE | 5 MIN

Pairs read the book's sentence about surface area and time, point at the larger rectangle and say which pan finishes first, then lay one rectangle over the other, mark and count the squares that stick out, and say that number both ways round.

From the source lesson: Inch grid paper, one sheet per pair; Pencils; The pan card, one per pair; Scissors, one pair per table; Word cards: length, width, surface area, square inches

Watch for: A pair multiplies and skips the count. The agreement between the two routes is what makes the product mean something.

Lesson 5**Four times as large: build both fields, find the extra ground, and halve it****SKILL LESSON** **Ball Game Math** (</math-library/520.html>) · lesson 4, Four Times as Large, and Only

Half to Cover · Grade 4 · 20 minutes

Area of a rectangle, and a rectangle scaled by a whole-number factor

I CAN

I can build a field four times as large.

BIG IDEA

Four times as large is four copies, and what is extra is what the new field has that the old one did not.

SUCCESS

The extra ground is shaded on the drawing and the number written matches the shading.

CONNECT | 5 MIN

You can compute an area from its sides. Today one area is built from another, and the phrase says how.

TAUGHT ON ITS OWN

The book gives last year's field as twenty yards by thirty, says the new field is four times as large, and asks how much extra ground a defender covers.

SOURCE CORE | 20 MIN

Pairs draw last year's field at one square per yard and count it by rows, then lay four copies of that rectangle side by side and count the squares, writing both areas inside the shapes.

COLLECT

Two drawings, the larger built from four copies of the smaller, with both areas written inside.

CLOSE | 5 MIN

Pairs take last year's area off the new one, shade the extra on the drawing, then split the shaded extra down the middle and count one half, saying which number answers the book's question and which was a step on the way.

From the source lesson: Squared paper, two sheets per pair; Ruler; Pencil; Word cards: area, four times, defense**Watch for:** A child multiplies each side by four and reaches sixteen times the area. Build the four copies; the drawing settles it.

Lesson 6

Four times as large or four more square yards: the phrase sets the operation

MATH THROUGH THE READING **Ball Game Math** (/math-library/520.html) · lesson 6, The Word That Sets the Operation · Grade 4 · 20 minutes

Students work the book's soccer field twice, once as its own sentence says it and once with four times as large replaced by four more square yards, and show that one phrase turns a 600-square-yard field into 2400 and the other turns it into 604.

I CAN	I can tell a scaling phrase from an adding one.
BIG IDEA	The numbers on the page are plain; what has to be extracted is which operation the sentence names.
SUCCESS	Two labelled rectangles stand on one sheet, one at 2400 square yards and one at 604.
CONNECT 5 MIN	Yesterday four copies made the new field. Today the same sentence arrives with two words changed and the field comes out almost the same size as before.
TAUGHT ON ITS OWN	This book never writes an equation; every operation it wants is carried in a phrase.
SOURCE CORE 20 MIN	Pairs build the six-hundred-square-yard field, lay four copies together and count, underlining the phrase that told them to; then take the second strip, in which four times as large has become four more square yards, and draw what it asks for beside the first.
COLLECT	Two labelled rectangles on one sheet, each headed with the phrasing that produced it.
CLOSE 5 MIN	Each student writes one sentence about their own two drawings using the book's phrase correctly, and a partner checks it against the drawings rather than against the number.

From the source lesson: Squared paper, three sheets per pair; Two sentence strips per pair, one printed with the book's phrase and one with the swapped phrase; Ruler and pencil; Coloured pencil for the added squares; Last year's twenty by thirty rectangle, drawn where the whole class can see it

Watch for: A child treats four more as four more copies. Draw the four added squares; the size of the change is the argument.

Checkpoint after this lesson: Four times, or four more?. The page is at the end of this guide.

Lesson 7

Thirteen squares said both ways, and the relation that runs opposite to it

MATH THROUGH THE READING

Kitchen Math (</math-library/523.html>) · lesson 9, Thirteen squares,

said both ways · Grade 4 · 20 minutes

Students build both loaf pans on grid paper, find the thirteen squares between them, and say the relation forwards and backwards over one unchanged arrangement.

I CAN

I can say a difference both ways, and notice when a relation runs the other way.

BIG IDEA

Two sentences describe one arrangement, and a second relation on the same pair can point in the opposite direction.

SUCCESS

Four sentences are written about one pair of rectangles, two about area and two about time, with the comparison word flipping between them.

CONNECT | 5 MIN

You have built and compared areas. Today the same two pans give you a pair of sentences about area and a pair about time that do not point the same way.

TAUGHT ON ITS OWN

The book gives two pans as four numbers, states that greater surface area usually means less baking time, and never prints the relation between them.

SOURCE CORE | 20 MIN

Pairs draw both pans, count the squares in each and check against the product, lay one rectangle over the other and count the squares that stick out, then write one sentence starting from each pan about that same difference.

COLLECT

Two overlaid rectangles with the difference visible, and four written sentences about them.

CLOSE | 5 MIN

Students write the pair of time sentences for the same two pans and mark which comparison word had to flip against the area word, then swap papers and check a partner's four sentences against the rectangles.

From the source lesson: Inch grid paper, one sheet per pair; Scissors, one pair per table; A sentence frame strip carrying more than and fewer than; Pencils; The two pan sentences and the surface-area-and-time sentence, displayed together

Watch for: A child copies the direction of the area sentence into the time sentence. Ask which pan bakes faster before the time sentences are written.

CULMINATING PERFORMANCE TASK

Two fields, four sentences

Each pair draws a rectangle from the two sides on their card, counts it by rows and writes its area, and finds its perimeter by walking the sides and writing the sum. They then build a second field scaled by the factor on the card, count it, and shade everything in the large one that is not the small one. Finally they write four sentences about the pair: the scaling forwards and backwards, and the difference forwards and backwards, each with its number.

Collect. The two drawn fields with the difference shaded, the perimeter sum, and the four written comparison sentences.

What it assesses. Both measures with their units, scaling, and the two kinds of comparison said in both directions — every move the unit built.

TEACHER KEY AND RUBRIC

Key

- Checkpoint 1: 20 inches and 21 square inches.
- Checkpoint 2: 200, 800 and 204 square yards.
- Task: work the four sentences yourself before the lesson. For a rectangle of a by b scaled by k , the scaling is k times as large and one k th as large; the difference is $(k-1)ab$ more and $(k-1)ab$ less.

Rubric

STRAND	SECURE LOOKS LIKE	DEVELOPING	NOT YET
Representation	The scaled field is built from copies of the first, and the difference is shaded rather than only computed.	Does it with the arrangement in front of them.	Produces an answer without the arrangement or the reason.
Calculation	The area is checked against a count of squares and the perimeter against a walk of the sides.	Does it with the arrangement in front of them.	Produces an answer without the arrangement or the reason.
Meaning	Every number carries its unit, and inches and square inches are never mixed.	Does it with the arrangement in front of them.	Produces an answer without the arrangement or the reason.
Explanation	All four sentences are true of one arrangement, and the child can point at what makes each one true.	Does it with the arrangement in front of them.	Produces an answer without the arrangement or the reason.

PRINT-READY STUDENT PAGES

CHECKPOINT 1 • GRADE 4

Two numbers, two units

Name

Date

A rectangle 7 inches by 3 inches. Find the distance round the outside and the number of squares that cover it. Write each with its unit, and say which question each one answers.

CHECKPOINT 2 • GRADE 4

Four times, or four more?

Name

Date

A field 10 yards by 20 yards. Find its area. Now find the area of a field four times as large. Then the area of a field four square yards larger. Which phrase produced which?

CULMINATING TASK • GRADE 4

Two fields, four sentences

Name

Date

Draw the rectangle from your card on squared paper. Count it by rows and write its area. Walk its sides and write the perimeter as a sum. Now build a second field scaled by the factor on your card, count it, and shade everything in the large one that is not the small one. Write four sentences about the pair: the scaling forwards and backwards, and the difference forwards and backwards. Put the number in every one.

TEACHER PLANNING AND HANDOFF

- Children who wrote both measures in inches at checkpoint 1 need lesson 1 again; the unit distinction is the whole unit.
- Lesson 6's phrase test is the one that carries into the money unit, where a phrase again chooses the operation.
- Ball Game Math's perimeter-to-side lesson is not used here; it is a good extension for a class that wants a division step on top.

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