

Area and Perimeter

Unit 13 Overview: 6 lessons

Students go past rectangles with whole number sides. They find the area and perimeter of rectangles with fraction and decimal sides, and of shapes made of two rectangles, finding a missing side from the sides across from it. They see a right triangle as half a rectangle, then find the area of a parallelogram (a triangle cut off and moved makes a rectangle), of any triangle (half a parallelogram) and of a trapezoid split into a rectangle and triangles. They answer stories in the right units and estimate perimeters, curved ones too. The unit uses the decimal and fraction multiplying of Units 6 and 8. Every lesson is one that some states teach in 5th grade: teach the ones your class learns.

THE UNIT, DAY BY DAY

Day 1	Pre-Check	What students already know, before the first lesson.
Day 2	13.1 Fraction and decimal side lengths	I can measure rectangles with fraction and decimal sides.
Day 3	13.2 Shapes made of rectangles	I can measure shapes made of rectangles.
Day 4	13.3 Area of right triangles	I can find the area of a right triangle.
Day 5	13.4 Parallelograms and triangles	I can find the area of parallelograms and triangles.
Day 6	13.5 Trapezoids and stories	I can find a trapezoid area and use the right units.
Day 7	13.6 Estimate perimeters	I can estimate perimeters, curved ones too.
Day 8	Unit Review	The review, to go over together.
Day 9	Unit Test	Form A; Form B (other numbers) is for a retest.

GET READY FOR THE UNIT

- Centimeter grid paper (the Graph Paper maker prints it) and colored pencils
- Rulers in inches and centimeters, and index cards for square corners
- Scissors, tape and paper shapes to cut apart
- String or yarn, and round lids and cans
- A wall chart of the area formulas: rectangle, right triangle, parallelogram, triangle

HOW EACH LESSON GOES

- 1. Warm up** (5 min)
- 2. Teach** (10 min)
- 3. Try it together** (10 min)
- 4. Practice** (15 min)
- 5. Exit ticket** (5 min): a quick check on the lesson.

Each lesson page ends with the Animal Math sheets, makers, tools and quizzes for it. “Sheet 3” is the third worksheet of a pack; a color pack prints each sheet again in black and white.

CHECKING AS YOU GO

PRINTABLE	Pre-Check: Day 1, with a key	EXIT TICKET	Exit Tickets: one a lesson, two to a page
PRINTABLE	Unit Review: the day before the test	PRINTABLE	Unit Test: Forms A and B, with keys



Area and Perimeter

Lesson 13.1: Fraction and decimal side lengths

GOAL Students find the area (length times width) and the perimeter (all four sides) of rectangles with fraction and decimal sides. They write mixed numbers in simplest form, place the decimal point by estimating, and give each answer its unit.

About 45 minutes

I can measure rectangles with fraction and decimal sides.

THE LESSON

- 1 Warm up** (5 min) Quick products on whiteboards: $2/5 \times 5/6$ and 1.5×4 . How do you know each answer makes sense?
- 2 Teach** (10 min) Draw a rectangle $2 \frac{1}{4}$ ft by $2/3$ ft. Area: $2 \times 2/3$ plus $1/4 \times 2/3$, so $4/3 + 1/6 = 1 \frac{1}{2}$ square feet. Perimeter: $2 \frac{1}{4} + 2/3 + 2 \frac{1}{4} + 2/3 = 5 \frac{5}{6}$ ft. Then a rectangle 3.5 cm by 2.2 cm: $3 \times 2.2 = 6.6$ and $0.5 \times 2.2 = 1.1$, so 7.7 square cm; the perimeter is $2 \times 5.7 = 11.4$ cm.
Say: "Area is length times width, in square units; perimeter is all four sides, in units. Fractions and decimals do not change that."
- 3 Try it together** (10 min) Pairs measure a sticky note to the nearest tenth of a centimeter and find its area and perimeter (a calculator checks the area at the end). Then the class does a rectangle $3 \frac{1}{3}$ yd by $3/4$ yd.
- 4 Practice** (15 min) No sheet does this whole lesson. Students find areas on sheet 2 of Multiplying Fractions and add the four sides of its two rectangles in feet. For decimal sides, they sketch a rectangle for each product on a Column Multiplication sheet with tenths and find its area and perimeter. Early finishers measure a desk to the tenth of a meter.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 13.1** and circle a face beside the "I can" line. On question 1, look for $A = 17/8$ sq m and $P = 6 \frac{1}{2}$ m; $1 \frac{1}{2}$ leaves out the $1/2$ of the length, and $3 \frac{1}{4}$ adds the sides once. On question 2, look for 10.8 sq cm and 13.8 cm; 108 drops the point, and 6.9 adds the sides once.

Need help? Draw the rectangle on grid paper, a square for each whole unit, and shade the fraction parts.

Ready for more? A square has sides of 2.5 m. Find its area and perimeter.

GET READY

- Rulers in inches and centimeters (with millimeters)
- Sticky notes and bookmarks to measure
- Grid paper

WORDS TO USE

mixed number: a whole number and a fraction: $2 \frac{1}{4}$

simplest form: top and bottom share no factor but 1

tenths: the first place after the decimal point

ASK

- Which two numbers give the area? Which four the perimeter?
- The width is less than 1. Is the area more or less than the length?
- What unit goes with each answer?

WATCH FOR

Multiplies only the whole numbers. Split it: the whole part times the width, plus the fraction part times the width.

Puts the decimal point in the wrong place.

Estimate first: 3.5×2.2 is about 4×2 , so 7.7, not 77.

Adds only two sides for the perimeter. Write all four sides, then add.

ON ANIMAL MATH

PRINTABLE

Multiplying Fractions: sheet 2

MAKER

Column Multiplication: Numbers Decimals, Decimal Places Tenths, Range Within 100

QUIZ

Area and Perimeter Quiz: the Fraction and Decimal Sides level

EXIT TICKET

5th Grade Area and Perimeter Exit Tickets: Exit Ticket 13.1

Area and Perimeter

Lesson 13.2: Shapes made of rectangles

GOAL Students find the area of a shape made of two rectangles: split it, find each part's area and add, and any split gives the same area. They find a missing side from the sides across from it, then the perimeter by adding every side around the outline.

About 45 minutes

I can measure shapes made of rectangles.

THE LESSON

- 1 Warm up** (5 min) Draw an L on grid paper. Students count the squares inside it, then the units around its edge.
- 2 Teach** (10 min) Draw an L-shaped room: the bottom 15 m, the left side 10 m, the top 6 m, the short right side 3 m. The missing sides: $15 - 6 = 9$ m across the step and $10 - 3 = 7$ m up it. Split it upright: $6 \times 10 = 60$ and $9 \times 3 = 27$, so 87 square meters; split it across: $15 \times 3 = 45$ and $6 \times 7 = 42$, 87 again. Perimeter: $15 + 3 + 9 + 7 + 6 + 10 = 50$ m.
Say: "I split the shape into rectangles and add their areas. For the perimeter, I find the missing sides, then go all the way around."
- 3 Try it together** (10 min) Pairs split the same paper L two ways and compare the areas. Then they find the area and perimeter of a T: a bar 11 cm by 2 cm across the top of a stem 3 cm wide and 7 cm tall, in the middle.
- 4 Practice** (15 min) Students split the shapes on sheets 3 to 5 of Area of Composite Shapes and add the sides of each sheet 4 shape for its perimeter; sheets 1 and 2 count squares, a step back. Area and Perimeter Formulas, a 4th grade pack, reviews perimeter and a missing side on sheets 1 and 4. Early finishers draw two L shapes with an area of 40 square units.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 13.2** and circle a face beside the "I can" line. On question 1, look for 46 sq ft ($36 + 10$, or another split); 60 counts the empty corner. On question 2, look for the missing side, 11 m, and $P = 32$ m; 21 leaves the missing side out of the sum.

Ready for more? Cut a 5 by 5 square from a corner of a 12 by 12 square. Find the area and the perimeter. Why is the perimeter unchanged?

GET READY

- Centimeter grid paper and colored pencils
- Paper L and T shapes to split
- Rulers

WORDS TO USE

composite shape: two or more rectangles put together

split: cut the shape into rectangles

outline: the edge all the way around

ASK

- Where can you split the shape into two rectangles?
- Which sides add up to the missing one?
- Did you count every side going around?

WATCH FOR

Multiplies the two longest sides. Shade the empty corner: it is not part of the shape.

Leaves the missing side out of the perimeter. Find it first, then touch each side as you add it.

Uses a whole outside side for one part. Color each rectangle and label only its own sides.

Need help? Cut the shape into two rectangles on grid paper and find each area before adding.

ON ANIMAL MATH

PRINTABLE

Area of Composite Shapes: sheets 3–5; sheets 1–2 for a step back

PRINTABLE

Area and Perimeter Formulas: sheets 1 and 4, 4th grade review

QUIZ

Area and Perimeter Quiz: the Shapes Made of Rectangles level

EXIT TICKET

5th Grade Area and Perimeter Exit Tickets: Exit Ticket 13.2

Area and Perimeter

Lesson 13.3: Area of right triangles

GOAL Students see that a right triangle is half of a rectangle: the two sides that meet at the square corner are the rectangle's length and width. They find the rectangle's area and take half, $A = 1/2 \times b \times h$, write square units, and leave out the slanted side.

About 45 minutes

I can find the area of a right triangle.

THE LESSON

- 1 Warm up** (5 min) Fold a paper rectangle from corner to corner and cut along the fold. Ask: what do you notice about the two triangles?
- 2 Teach** (10 min) Draw a rectangle 10 units by 6 units on grid paper: 60 square units. Cut it on a diagonal into two matching right triangles, so each is half, 30 square units. The two sides at the square corner are the rectangle's sides: $A = 1/2 \times b \times h$. Then a right triangle with sides of 21 cm and 28 cm at its square corner and a slanted side of 35 cm: $A = 1/2 \times 21 \times 28 = 1/2 \times 588 = 294$ square cm. The slanted side is not used.
Say: "A right triangle is half of a rectangle. I multiply the two sides that meet at the square corner and take half. The slanted side does not go in the area."
- 3 Try it together** (10 min) Pairs draw three right triangles on grid paper, draw the rectangle around each, and find both areas. Then they find the area of a right triangle with sides of 9 ft and 40 ft at its square corner and a slanted side of 41 ft.
- 4 Practice** (15 min) Students find the rectangle and the half on the grids of sheet 1 of Area of Triangles and Parallelograms and fill in its table, then estimate and find exact areas on sheet 2, writing the units. Early finishers draw three different right triangles with an area of 30 square units.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 13.3** and circle a face beside the "I can" line. On question 1, look for a rectangle of 28 and a triangle of 14 square units; 28 for the triangle is not halved. On question 2, look for 96 square meters; 192 is not halved, and 120 or 160 uses the slanted side.

Ready for more? A right triangle has an area of 35 square inches and a 7 inch side at its square corner. How long is the other one?

GET READY

- Paper rectangles and scissors
- Centimeter grid paper
- Index cards for square corners

WORDS TO USE

right triangle: a triangle with a square corner

base and height: the sides at the square corner

half: one of two equal parts

ASK

- Which two sides meet at the square corner?
- What rectangle is this triangle half of?
- Why does the slanted side not go in the area?

WATCH FOR

Forgets to take half. Draw the rectangle around it: the triangle is half.

Multiplies by the slanted side. Find the square corner first and use the two sides that meet there.

Writes units, not square units. An area covers: square centimeters.

Need help? Cut a paper rectangle on its diagonal and stack the two triangles.

ON ANIMAL MATH

PRINTABLE

Area of Triangles and Parallelograms: sheets 1-2

QUIZ

Area and Perimeter Quiz: the Right Triangles level

EXIT TICKET

5th Grade Area and Perimeter Exit Tickets: Exit Ticket 13.3

Area and Perimeter

Lesson 13.4: Parallelograms and triangles

GOAL Students find a parallelogram's area as base times height (a triangle cut off and moved makes a rectangle) and any triangle's as half of that, $A = 1/2 \times b \times h$, the height at a square corner to the base, never a slanted side.

About 45 minutes

I can find the area of parallelograms and triangles.

THE LESSON

- 1 Warm up (5 min)** Show a parallelogram and a rectangle on grid paper with the same base and height. Students guess which one covers more.
- 2 Teach (10 min)** Draw a parallelogram with a base of 14 cm, slanted sides of 15 cm and a dashed height of 9 cm. Cut off the triangle at one end and slide it to the other: a rectangle 14 cm by 9 cm, so $A = b \times h = 14 \times 9 = 126$ square cm. The 15 cm side is not the height. Then trace a triangle twice: the copies make a parallelogram, so the triangle is half. A triangle with a base of 24 cm, two sides of 15 cm and a height of 9 cm: $A = 1/2 \times 24 \times 9 = 108$ square cm.

Say: "A parallelogram is base times height, like the rectangle it turns into. A triangle is half of that. The height always meets the base at a square corner."

- 3 Try it together (10 min)** Pairs cut a paper parallelogram, slide its triangle across to make a rectangle, and check that the area stays the same. Then they fit two copies of a paper triangle into a parallelogram, and find the area of a parallelogram with a base of 13 ft and a height of 7 ft.
- 4 Practice (15 min)** Students count the base and the height on the grids, then find each parallelogram's area and perimeter on sheet 3 of Area of Triangles and Parallelograms, and find triangle areas on grids and with dashed heights on sheet 4. Early finishers draw a parallelogram and a triangle with the same area on grid paper.
- 5 Exit ticket (5 min)** Students do **Exit Ticket 13.4** and circle a face beside the "I can" line. On question 1, look for 66 sq cm; 110 means the slanted 10 cm side was used, and 33 means it was halved like a triangle. On question 2, look for 210 sq in.; 420 means the product was not halved, and 350 or 238 means a slanted side was used.

Ready for more? A triangle and a parallelogram have the same base and the same area. How do their heights compare? Draw an example.

ON ANIMAL MATH

PRINTABLE **Area of Triangles and Parallelograms:** sheets 3–4

EXIT TICKET **5th Grade Area and Perimeter Exit Tickets:** Exit Ticket 13.4

GET READY

- Paper parallelograms and triangles on grid paper, two copies of each triangle
- Scissors and tape
- Index cards for square corners

WORDS TO USE

parallelogram: a four-sided shape with two pairs of parallel sides

base: the side the height is measured from

height: the distance straight up from the base, at a square corner

ASK

- Where is the height? Does it meet the base at a square corner?
- What rectangle does the parallelogram turn into?
- Why is a triangle half of base times height?

WATCH FOR

Uses the slanted side as the height. Put an index card corner on the base: the height runs along its edge.

Halves a parallelogram. Only a triangle is half. A parallelogram cut and moved makes a whole rectangle.

Forgets to halve a triangle. Trace a second copy: two triangles make the parallelogram.

Need help? Cut out each shape and move the pieces before using the formula.

Area and Perimeter

Lesson 13.5: Trapezoids and stories

GOAL Students find a trapezoid's area by splitting it into a rectangle and triangles and adding the parts. In area and perimeter stories they decide how far around or how much covered, and write each answer with the right units.

About 45 minutes

I can find a trapezoid area and use the right units.

THE LESSON

- 1 Warm up** (5 min) Read two jobs aloud: edging around a tabletop and varnish on a tabletop. Students say feet or square feet for each.
- 2 Teach** (10 min) Draw a trapezoid with a bottom of 13 m, a top of 7 m and a height of 6 m, its left side straight up. A dashed line down from the top's right end makes a rectangle and a triangle: $7 \times 6 = 42$ and $\frac{1}{2} \times 6 \times 6 = 18$, so 60 square meters. Then read: A quilt patch is a parallelogram with a base of 13 in., slanted sides of 5 in. and a height of 4 in. How much ribbon goes around it? Around is a perimeter: $13 + 5 + 13 + 5 = 36$ inches. How much cloth covers it? Covering is an area: $13 \times 4 = 52$ square inches.
Say: "I split a trapezoid into shapes I know and add. In a story I ask: around, in units, or covered, in square units?"
- 3 Try it together** (10 min) Pairs split a trapezoid with a top of 13 ft, a bottom of 23 ft and a height of 6 ft, its two slanted sides the same, into a rectangle and two triangles and add the parts. Then they solve two story cards, writing the units for each answer.
- 4 Practice** (15 min) Students split the trapezoids, then solve the stories on sheet 5 of Area of Triangles and Parallelograms, writing the number and the units for each. Early finishers write a story that asks for the perimeter and the area of the same shape.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 13.5** and circle a face beside the "I can" line. On question 1, look for 104 sq ft ($80 + 24$); 128 counts the whole 16 by 8 rectangle, and 208 is $(16 + 10) \times 8$ not halved. On question 2, look for 82 feet; 41 adds each side once, and 400 or square feet is an area.

Need help? Cut out the trapezoid, cut off its triangle, and find each part on its own.

Ready for more? Two copies of a trapezoid, one turned over, fit together into a parallelogram. Use that to find the area of the 13 m, 7 m and 6 m trapezoid another way.

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PRINTABLE

Area of Triangles and Parallelograms: sheet 5

EXIT TICKET

5th Grade Area and Perimeter Exit Tickets: Exit Ticket 13.5

GET READY

- Paper trapezoids on grid paper, and scissors
- Story cards: tabletops, quilt patches, kites
- A chart: around is units, covered is square units

WORDS TO USE

trapezoid: a four-sided shape with at least one pair of parallel sides

parallel: the same distance apart all the way

units, square units: feet around; square feet covered

ASK

- Where can you split the trapezoid into a rectangle and triangles?
- Does the story ask how far around or how much is covered?
- What units go with your answer?

WATCH FOR

Counts the whole rectangle around the trapezoid. Shade the part outside the trapezoid: it is not part of the shape.

Forgets to halve the triangle. Draw the rectangle around the triangle: the triangle is half of it.

Writes square units for a distance around.

Around is a length, in feet. Only covering is in square feet.

Area and Perimeter

Lesson 13.6: Estimate perimeters

GOAL Students estimate a polygon's perimeter by rounding each side and adding, and say why the estimate makes sense. For a curve they measure string laid along the edge, or compare: a circle is a little more than 3 times as far around as across.

About 45 minutes

I can estimate perimeters, curved ones too.

THE LESSON

- 1 Warm up** (5 min) Students round each length to the nearest centimeter on whiteboards: 6.3 cm, 2.8 cm, 4.6 cm and 7.1 cm.
- 2 Teach** (10 min) Draw a four-sided shape with sides of 6.3 cm, 2.8 cm, 5.9 cm and 4.2 cm. Round and add: $6 + 3 + 6 + 4 = 19$, about 19 cm, close to the exact 19.2 cm. Then a round lid 13 cm across: string laid around it measures about 41 cm, a little more than $3 \times 13 = 39$ cm and less than the square around it, $4 \times 13 = 52$ cm.
Say: "To estimate a perimeter, I round each side and add. For a curve, I follow the edge with string, or think: a circle is a little more than 3 times across."
- 3 Try it together** (10 min) Pairs measure the sides of a shape drawn on paper to the nearest tenth of a centimeter, estimate its perimeter by rounding, then add the exact sides and compare. Then they wrap string around three round things and compare each string with 3 times the distance across.
- 4 Practice** (15 min) Students round the sides and estimate on sheet 5 of Estimating and Measuring: Length, Mass and Liquid Volume, and use the grid or string for the curved shapes. Early finishers draw a shape with a perimeter of about 20 cm, then measure it.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 13.6** and circle a face beside the "I can" line. On question 1, look for about 17 cm; 17.3 is the exact sum, not an estimate, and 16 rounds 3.6 down. On question 2, look for 9 cm circled; 12 cm is the square around the circle, and 6 cm only twice across.

Ready for more? A bike wheel is about 60 cm across. About how far does it roll in one turn? In 10 turns?

GET READY

- String or yarn, scissors and centimeter rulers
- Round lids, cans and paper plates
- Shapes drawn on centimeter grid paper

WORDS TO USE

estimate: a close answer that is easy to find

round: go to the nearest whole number

curved: bending, with no straight sides

ASK

- What does this side round to?
- Is your estimate more or less than the exact sum? Why?
- How does the string compare with the distance across?

WATCH FOR

Rounds 4.6 down to 4. Look at the tenths: 5 tenths or more rounds up.

Takes the square around a circle for its perimeter. The circle fits inside the square, so it is shorter: about 3 times across, not 4.

Lets the string slip off the edge. Hold one end down and follow the curve slowly.

Need help? Measure with a ruler that shows millimeters, and say each side before rounding it.

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PRINTABLE

Estimating and Measuring: Length, Mass and Liquid Volume: sheet 5

TOOL

Measuring Tool: Measure With Centimeter Ruler, Object Lengths In Between (Nearest Unit)

EXIT TICKET

5th Grade Area and Perimeter Exit Tickets: Exit Ticket 13.6