

Shape Area Lab

Cut, rearrange and develop the area rules

GRADE 6 • 6.MG.2.a

6.MG.2.a "Develop the formula for determining the area of parallelograms and triangles using pictorial representations and concrete manipulatives (e.g., two-dimensional diagrams, grid paper)."

NAME _____

DATE _____

BUILD UNDERSTANDING

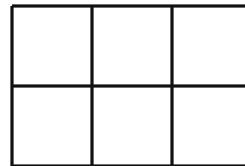
Use tracing paper, scissors and tape. Trace the supplied outline before cutting so this page stays intact. Rearranging pieces without gaps or overlaps preserves area. A base and its height meet at a right angle; a slanted side is not automatically a height. Diagram lengths are in abstract units, not centimeters measured from the print. Keep the constructed paper models for your teacher; use response lines to explain and record dimensions.

WORKED EXAMPLE

Count the unit squares in this rectangle. How do equal rows help?

1. There are 2 rows of 3 squares.
2. $3 + 3 = 6$; equivalently $3 \times 2 = 6$.

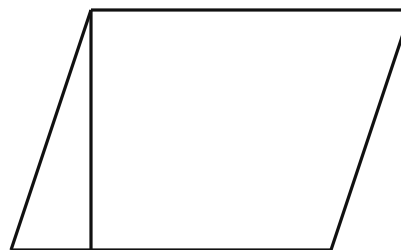
Answer: Rectangle area is 6 square units; row length times number of rows counts every square.



Rectangle: 3 by 2 unit squares

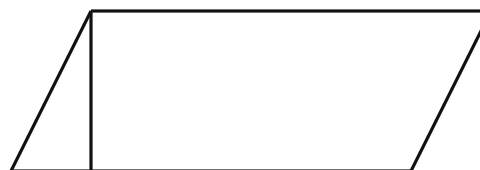
PRACTICE 4 problems

- 1** Trace this parallelogram. Cut along the shown perpendicular segment. Slide the left triangular piece to the right end, without rotating it, to make a rectangle. Label the rectangle dimensions on your paper model and determine the area.



Base 4; perpendicular height 3

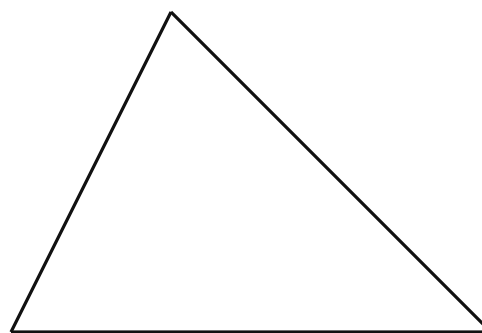
- 2** Repeat the cut-and-slide construction with this second parallelogram. Label the dimensions on your rectangle. Explain why the slant changes neither its base-height calculation nor the preserved area.



Base 5; perpendicular height 2

- 3** Use both constructed rectangles to develop a formula for any parallelogram. Let b name the base and h its perpendicular height. Explain what each factor counts and why rearranging is allowed.

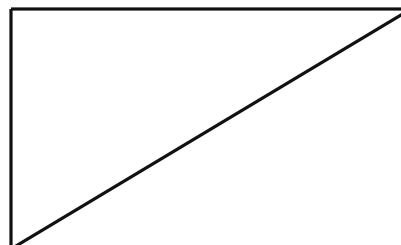
- 4** Trace and cut out two copies of this triangle. Rotate one copy half a turn and join the copies along a matching slanted side to make a parallelogram. Label base and height on the joined model, and compare one triangle with the whole.



Base 6; perpendicular height 4

APPLY IT Show your work

- Trace this rectangle and cut along its diagonal. Separate the two triangles, then fit them back together. Label base and height on one cut triangle, and explain its area using the rectangle.

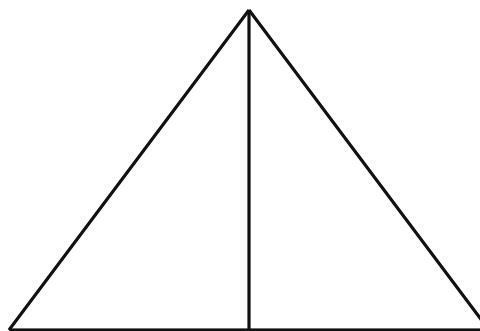


Rectangle: base 5, height 3

- 2** Use your paired-triangle and cut-rectangle models to develop a formula for triangle area with base b and perpendicular height h . Explain why dividing by 2 is necessary in both models.

CHALLENGE One step up

A student uses base 6 and slanted side 5 for this triangle and gets area 15. Trace two copies and use a joined model to explain the mistake. Name the correct perpendicular height and area.



Base 6; height 4; sides 5

Require the actual traced and cut models with labeled dimensions. The diagrams use a consistent scale internally, but answers come from labeled unit lengths; printing at a different scale does not change the stated units. Check no gaps or overlaps after joining. Different valid rearrangements are acceptable if base, perpendicular height and area conservation are explained.

PRACTICE 1

The new rectangle has base 4 and height 3, so its area is 12 square units. The same pieces fill it without gaps or overlaps; the parallelogram also has area 12.

PRACTICE 2

The rectangle has base 5 and height 2, area 10 square units. Sliding the triangular piece preserves area and perpendicular height.

PRACTICE 3

$A = b \times h$. Cutting and translating a triangular end forms a rectangle with the same base and perpendicular height; no material is added or removed. Area is in square units.

PRACTICE 4

Two congruent triangles form a parallelogram of base 6 and height 4, area 24 square units. Each triangle is half: 12 square units. The copies have equal area.

APPLY IT 1

Rectangle area is $5 \times 3 = 15$ square units. The diagonal makes two congruent triangles, each with base 5 and height 3, so each area is 7.5 square units.

Accept an equivalent justified solution with the required model or recorded evidence.

APPLY IT 2

$A = (b \times h) / 2$. Two congruent copies fill a parallelogram (or the rectangle in the right-triangle case) with area $b \times h$. One copy is exactly half of that area.

Accept an equivalent justified solution with the required model or recorded evidence.

CHALLENGE

The perpendicular height is 4, not slanted side 5. Two copies make a parallelogram with area $6 \times 4 = 24$; one triangle is 12 square units. Using 5 as height overcounts.