

CUT & GLUE SORT

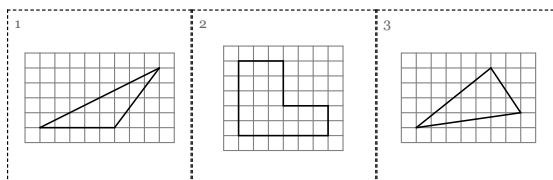


PERIMETER AND AREA ON THE COORDINATE PLANE

Area on the Grid: One Piece, Cut First, or Not Yet?

Twelve figures on squared paper · decide how to find the area · three rows

FREE



Row 1. One piece. The shape is a rectangle, or a triangle with one side along a grid line. Its base and height can be counted on the grid.

Row 2. Split it first. Draw one or more lines along the grid, from edge to edge of the figure. Each part is then a rectangle or a triangle like those in row 1.

Row 3. Not on this sheet. No side is along a grid line, and a line drawn along the grid from any corner ends between whole and half squares, so no length can be counted. A later unit shows how to find this area.

1. **Hand out pages 3 and 4**, one of each per student, with scissors and glue. No calculator is needed.
2. **Say this once:** *“Do not find the area. Look for sides along the grid lines. Can you find the area in one piece, after splitting it with lines along the grid, or not with what we know yet?”*
3. **Check a sheet in ten seconds:** every row gets four pieces.

Student sheets pages 3 and 4, one of each per student. Page 3 has the three rows. Page 4 has the pieces and a box that shows a base and its height.

Answers page 5.

Each piece is a figure on squared paper. The student decides only how its area can be found. An area formula needs a base and a height, and on squared paper the lengths that can be counted are the ones along the grid lines. A rectangle with its sides on grid lines, or a triangle with one side along a grid line, needs nothing more (row 1). Some of these triangles have their top corner past the end of the base, or a base that stands upright. The height is still counted straight up, or straight across, from the base line.

Row 2 is for figures that are split first by one or more lines along the grid. Each line goes from edge to edge, and the parts are row-1 pieces; some figures need two lines. A line that joins two corners on a slant does not help, because the parts then have no side to count. None of the four-sided figures in row 2 has two parallel sides, so none is a trapezoid. No formula on this sheet fits a row-2 figure in one piece.

Row 3 is where this method stops. Four figures have no side along a grid line and no right angle, and a line along the grid from any corner ends at a point that is not a whole or a half square along, so no base or height can be counted. Their areas can be found, but the way to do it comes in a later unit. Tell the class that these figures are not impossible. Guessing does not work: a simple rule, such as sorting by the number of sides, places at most six pieces correctly.



This is the free lesson this activity came from. The worksheet, the full answers and the lesson plan are on it, at three levels of difficulty.

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Cut & Glue Sort — how is the area found?

Area from the grid

Name _____

Period _____

Date _____

Each piece on the next page is a figure on squared paper. Do not find the area. **Decide how its area is found. Glue the piece in that row.** A line that splits a figure always runs along the grid, from edge to edge of the figure.

Row 1. One piece. The shape is a rectangle, or a triangle with one side along a grid line. Its base and height can be counted on the grid.

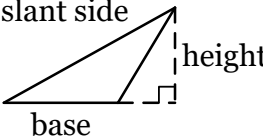
Row 2. Split it first. Draw one or more lines along the grid, from edge to edge of the figure. Each part is then a rectangle or a triangle like those in row 1.

Row 3. Not on this sheet. No side is along a grid line, and a line drawn along the grid from any corner ends between whole and half squares, so no length can be counted. A later unit shows how to find this area.

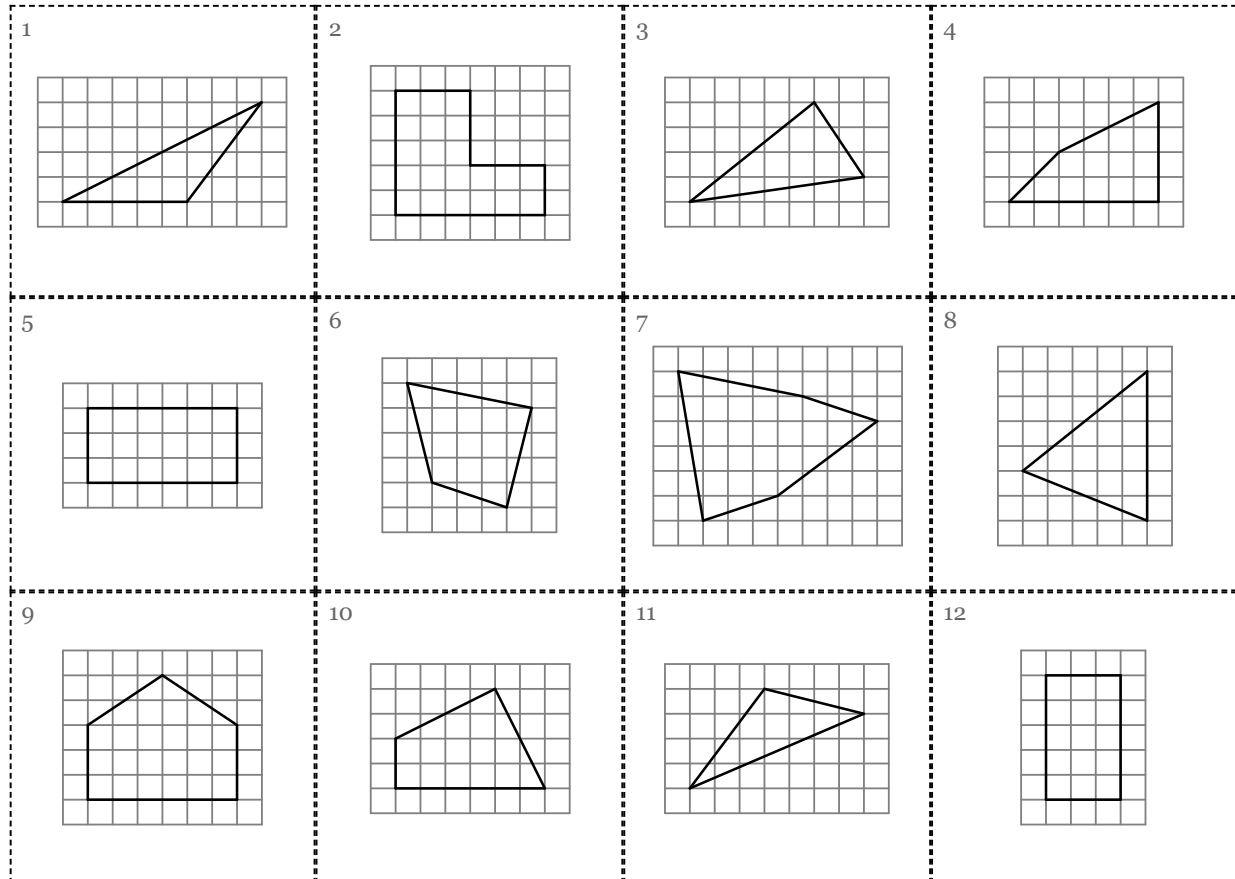
Cut & Glue Sort — the pieces

Cut along the dashed lines

Cut out the twelve pieces. Glue each one in its row on the other sheet.



Area is the space inside, in square units. Rectangle: $\text{base} \times \text{height}$. Triangle: $\frac{1}{2} \times \text{base} \times \text{height}$. The height goes straight up, down or across from the base line to the opposite corner. A slant side is never the height. An area never needs a square root here. A line that splits a figure runs along the grid, from edge to edge.



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Each row holds four pieces. For each piece, the key gives its corners as if the lower-left grid crossing of its drawing were (0, 0), and the area, though the students do not find it.

- 1 **One piece. The shape is a rectangle, or a triangle with one side along a grid line. Its base and height can be counted on the grid.**
 1. Triangle with corners at (1, 1), (6, 1), (9, 5). *Why:* Its base is along a grid line. The top corner is past the end of the base, but the height is still counted straight up from the base line: $\frac{1}{2} \times 5 \times 4 = 10$ square units.
 5. Four-sided figure with corners at (1, 1), (7, 1), (7, 4), (1, 4). *Why:* A rectangle with its sides on grid lines: base 6, height 3, area $6 \times 3 = 18$ square units.
 8. Triangle with corners at (6, 1), (6, 7), (1, 3). *Why:* Its base stands upright along a grid line, so the height is counted straight across: $\frac{1}{2} \times 6 \times 5 = 15$ square units.
 12. Four-sided figure with corners at (1, 1), (4, 1), (4, 6), (1, 6). *Why:* A rectangle with its sides on grid lines: base 3, height 5, area $3 \times 5 = 15$ square units.
- 2 **Split it first. Draw one or more lines along the grid, from edge to edge of the figure. Each part is then a rectangle or a triangle like those in row 1.**
 2. Six-sided figure with corners at (1, 1), (7, 1), (7, 3), (4, 3), (4, 6), (1, 6). *Why:* Split along grid lines into a 3 by 5 rectangle (15) and a 3 by 2 rectangle (6). Total 21 square units. No single formula on this sheet fits the whole shape.
 4. Four-sided figure with corners at (1, 1), (7, 1), (7, 5), (3, 3). *Why:* Split along grid lines into a triangle with base 2 and height 2 (2), a 4 by 2 rectangle (8) and a triangle with base 4 and height 2 (4). Total 14 square units. No single formula on this sheet fits the whole shape.
 9. Five-sided figure with corners at (1, 1), (7, 1), (7, 4), (4, 6), (1, 4). *Why:* Split along grid lines into a 6 by 3 rectangle (18) and a triangle with base 6 and height 2 (6). Total 24 square units. No single formula on this sheet fits the whole shape.
 10. Four-sided figure with corners at (1, 1), (7, 1), (5, 5), (1, 3). *Why:* Split along grid lines into a 4 by 2 rectangle (8), a triangle with base 4 and height 2 (4) and a triangle with base 2 and height 4 (4). Total 16 square units. No single formula on this sheet fits the whole shape.
- 3 **Not on this sheet. No side is along a grid line, and a line drawn along the grid from any corner ends between whole and half squares, so no length can be counted. A later unit shows how to find this area.**
 3. Triangle with corners at (1, 1), (8, 2), (6, 5). *Why:* No side is along a grid line and no two corners are on one grid line. A line along the grid from any corner meets the far side at a point that is not a whole or a half square along, so no base or height can be counted. Its area is found in a later unit.
 6. Four-sided figure with corners at (5, 1), (6, 5), (1, 6), (2, 2). *Why:* No side is along a grid line and no two corners are on one grid line. A line along the grid from any corner meets the far side at a point that is not a whole or a half square along, so no base or height can be counted. Its area is found in a later unit.
 7. Five-sided figure with corners at (2, 1), (5, 2), (9, 5), (6, 6), (1, 7). *Why:* No side is along a grid line and no two corners are on one grid line. A line along the grid from any corner meets the far side at a point that is not a whole or a half square along, so no base or height can be counted. Its area is found in a later unit.
 11. Triangle with corners at (1, 1), (8, 4), (4, 5). *Why:* No side is along a grid line and no two corners are on one grid line. A line along the grid from any corner meets the far side at a point that is not a whole or a half square along, so no base or height can be counted. Its area is found in a later unit.

To check a piece with a student, ask: “Which sides are along grid lines? Where would you draw a line to split it, and does that line run along the grid?”