

CUT & GLUE SORT

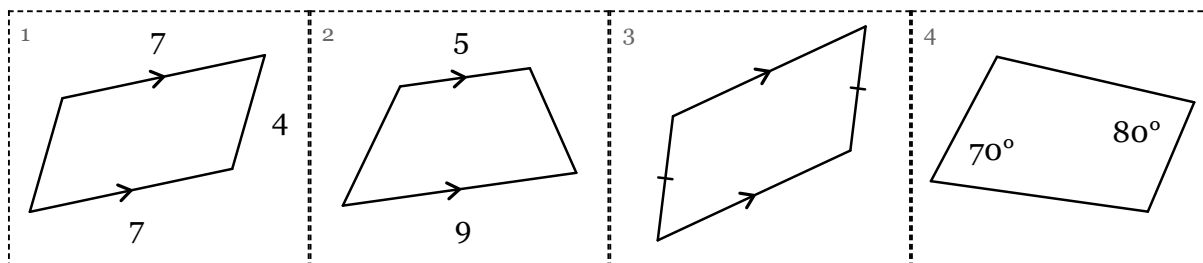


PROVING PARALLELOGRAMS

Must It Be a Parallelogram?

Yes, no, or cannot tell · marks, lengths and angles

FREE



Cut & Glue Sort — how to run it

25 minutes, including the cutting

1. **Hand out pages 3 and 4**, one of each per student, with scissors and glue. Nothing else is needed.
2. **Say this once:** *“Use only the marks and the numbers. A shape that looks like a parallelogram proves nothing. One pair of opposite sides that is both parallel and congruent is enough. Otherwise both pairs must match, such as both pairs parallel or both pairs congruent.”*
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 shows the five ways to prove a quadrilateral is a parallelogram as small marked drawings.
Answers	page 5.

What the three rows test. A piece goes in the first row when its marks or numbers meet one of the five ways shown on page 3. For example, both pairs of opposite sides are congruent, or one pair of opposite sides is both parallel and congruent. A piece goes in the second row when a printed number breaks something every parallelogram has, such as opposite angles printed 70° and 80° .

The last row is the hardest, and it is the point of the lesson. Its pieces carry marks that sound almost right. One pair of sides is parallel and the *other* pair is congruent. Only one pair of opposite angles is equal. Only one diagonal is cut in half. Each of these fits a shape that is not a parallelogram: an isosceles trapezoid or a kite. These pieces are drawn to look like parallelograms on purpose, because many students trust the drawing instead of the marks.

Two pieces in the second row also look almost like parallelograms, but their numbers do not match. A student who simply trusts the drawing places only six of the twelve 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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Must it be a parallelogram?

Yes, no, or cannot tell

Name _____

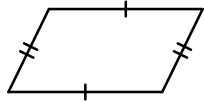
Period _____

Date _____

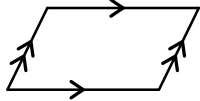
Cut out the twelve pieces on the next page. Each piece shows a quadrilateral with marks or numbers.

Decide which row the piece belongs in, and glue it there.

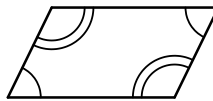
The marks **force** a parallelogram in these five ways, and in no other. Each way needs **both** pairs, or **one** pair doing **both** jobs.



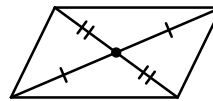
Both pairs of opposite sides are **congruent**.



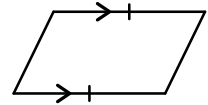
Both pairs of opposite sides are **parallel**.



Both pairs of opposite **angles** are congruent.



The diagonals **bisect** each other.



One pair of opposite sides is both parallel **and** congruent.

Use only the marks and the numbers. Do not measure. A shape that looks like a parallelogram proves nothing. In a parallelogram, opposite sides are equal, opposite angles are equal, and two angles next to each other add to 180° . A number that breaks one of these rules shows that the shape cannot be a parallelogram.

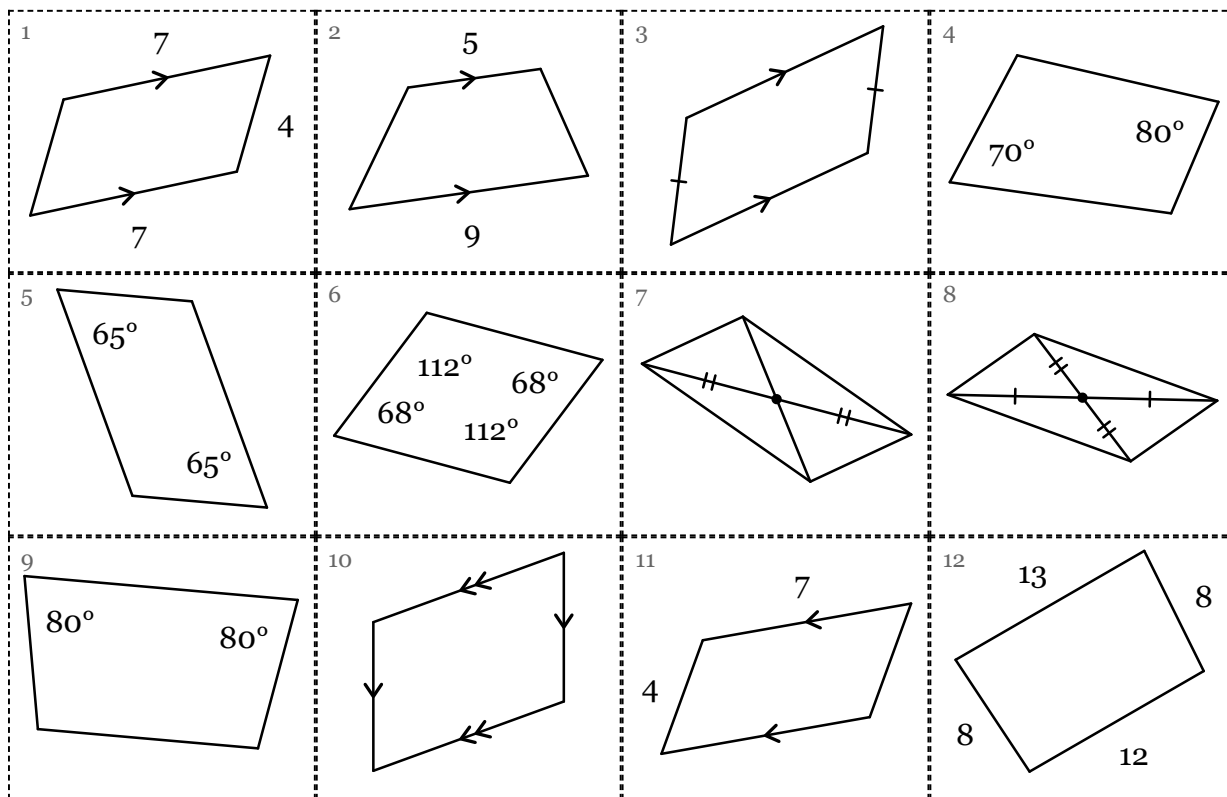
Yes. It must be a parallelogram.

No. It cannot be a parallelogram.

Cannot tell. The marks are not enough.

The twelve pieces

Cut along the dotted lines



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Cut & Glue Sort — answers

For the teacher

Yes	1 — The two sides with arrowheads are both 7, so one pair of opposite sides is both parallel and congruent. That forces a parallelogram. The 4 is not needed.	6 — Opposite angles are equal: 68° and 68° , 112° and 112° . If both pairs of opposite angles are congruent, the quadrilateral is a parallelogram.	8 — The ticks show that each diagonal is cut into two equal pieces, so the diagonals bisect each other. That forces a parallelogram.	10 — The arrowheads show both pairs of opposite sides are parallel. That is what a parallelogram is.
No	2 — The two parallel sides are 9 and 5. Opposite sides of a parallelogram are equal, so this is not one. It is a trapezoid.	4 — The two opposite angles are 70° and 80° . Opposite angles of a parallelogram are equal, so this is not one, even though it looks close.	9 — The 80° and 80° are next to each other. Two angles of a parallelogram that are next to each other add to 180° , and $80 + 80 = 160$, so this is not one.	12 — The sides 12 and 13 are opposite each other and are not equal. Opposite sides of a parallelogram are equal, so this is not one, even though it looks close.
Cannot tell	3 — One pair of sides is parallel and the OTHER pair is congruent. An isosceles trapezoid has these marks too, so the marks are not enough.	5 — Only one pair of opposite angles is given. A kite can have two opposite angles of 65° and not be a parallelogram.	7 — Only one diagonal is shown cut in half. In a kite, one diagonal cuts the other in half and the figure is not a parallelogram.	11 — The 7 and the 4 are sides next to each other, so they do not need to be equal. One pair of parallel sides is not enough: a trapezoid has one.

Every row holds four pieces. To check a piece with a student, ask first: “Do the marks show both pairs matching, or one pair that is both parallel and congruent?” If so, it is Yes. Then ask: “Does a printed number break something every parallelogram has?” If so, it is No. Otherwise it is Cannot tell, and the student should name a shape that has the same marks and is not a parallelogram.