

CUT & GLUE SORT

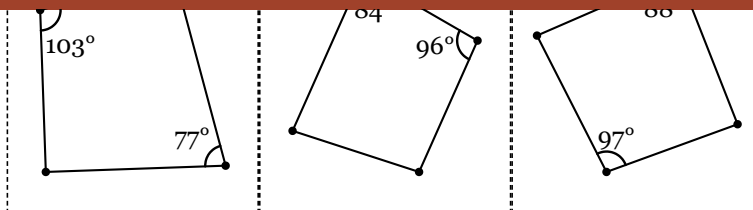


INSCRIBED (CYCLIC) QUADRILATERALS

Cyclic Quadrilaterals: On One Circle?

Twelve quadrilaterals, no circle drawn · yes, no, or cannot tell · three rows

FREE



Row 1. Yes. The four corners lie on one circle.

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Row 2. No. The four corners do not lie on one circle.

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Row 3. Cannot tell. The numbers on the piece do not decide it.

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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. No calculator is needed.
2. **Say this once:** *“No circle is drawn. Find two angles at opposite corners. An exterior angle gives the angle inside at its corner: 180° minus it. An angle cut by a diagonal is the sum of its two parts. If the two opposite angles add to 180° , the corners lie on one circle. If no two opposite angles are known, you cannot tell.”*
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 the rules as small drawings.
Answers	page 5.

This sort runs the rule backwards. This sheet calls a quadrilateral *cyclic* when all four of its corners lie on one circle, and its angles are the angles inside it. Some textbooks use other definitions, so tell the class which ones this sheet uses. If one pair of opposite angles of a quadrilateral adds to 180° , its four corners lie on one circle. If a pair of opposite angles does not add to 180° , they do not. Each piece is drawn to scale with no circle.

Rows 1 and 2 are each reached in two ways. Some pieces give two opposite angles. Others give an exterior angle, which tells the angle inside at that corner (180° minus it). Two pieces have a diagonal that cuts an angle into two parts, which must be added first.

Row 3 holds the pieces where no pair of opposite angles is known: two angles next to each other, or an exterior angle beside an angle at the next corner, or only one part of a cut angle. On two of its four pieces the two numbers add to 180° or are equal, so a student who only adds the numbers puts them in row 1. Guessing does not work: a simple rule, such as “two numbers that add to 180° mean yes,” 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 — on one circle?

Cyclic quadrilaterals

Name _____

Period _____

Date _____

Each piece on the next page is a quadrilateral with no circle drawn. Some of its angles have numbers. **Do the four corners lie on one circle? Use only the numbers. Glue the piece in its row.**

Row 1. Yes. The four corners lie on one circle.

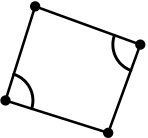
Row 2. No. The four corners do not lie on one circle.

Row 3. Cannot tell. The numbers on the piece do not decide it.

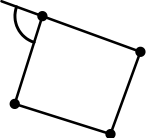
Cut & Glue Sort — the pieces

Cut along the dashed lines

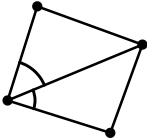
Cut out the twelve pieces. Glue each one in its row on the other sheet. An arc with a number shows the size of that angle.



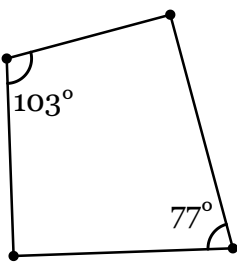
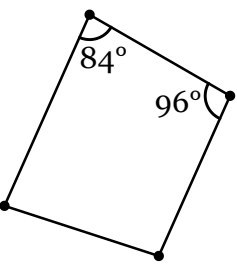
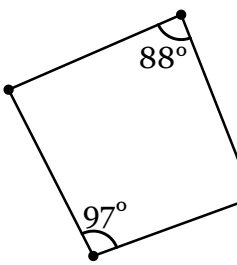
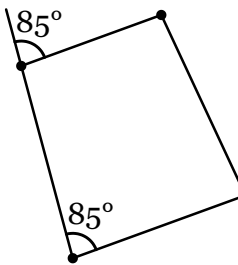
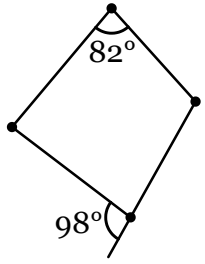
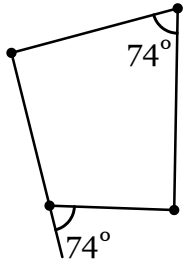
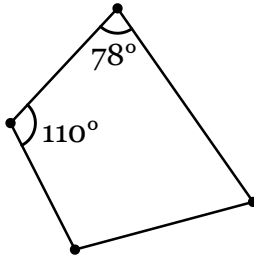
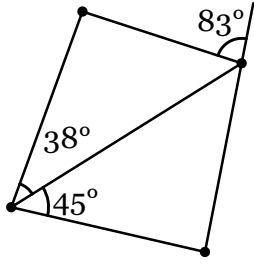
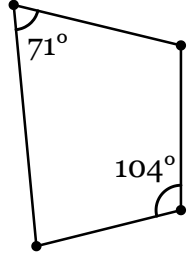
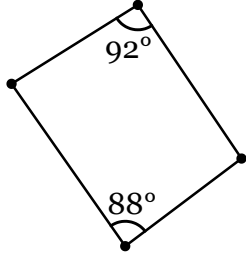
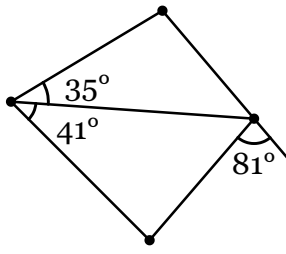
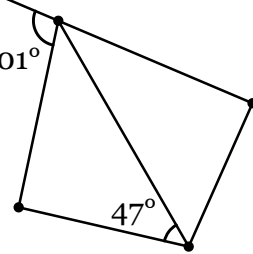
Opposite angles are across from each other. If two opposite angles add to 180° , the four corners lie on one circle. If they do not add to 180° , the corners do not lie on one circle.



An exterior angle is outside the shape, where one side goes on past a corner. The angle inside at that corner is 180° minus it.



A diagonal cuts an angle into two parts. Add the two parts to get the whole angle.

1 	2 	3 	4 
5 	6 	7 	8 
9 	10 	11 	12 



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Every piece is listed by the number printed on its corner, with the reason. Each row holds four pieces. “Next to each other” means the two corners share a side.

1 Yes. The four corners lie on one circle.

1. An angle of 103° and an angle of 77° , at opposite corners. *Why:* The opposite angles 103° and 77° add to 180° , so the four corners lie on one circle.

6. An exterior angle of 74° and an angle of 74° , at opposite corners. *Why:* The angle inside next to the 74° exterior angle is $180^\circ - 74^\circ = 106^\circ$. The opposite angles 74° and 106° add to 180° , so the four corners lie on one circle.

8. A diagonal cuts one angle into parts of 38° and 45° ; an exterior angle of 83° is at the other end of the diagonal, the opposite corner. *Why:* The two parts make $38^\circ + 45^\circ = 83^\circ$, and the angle inside next to the 83° exterior angle is $180^\circ - 83^\circ = 97^\circ$. The opposite angles 83° and 97° add to 180° , so the four corners lie on one circle.

10. An angle of 88° and an angle of 92° , at opposite corners. *Why:* The opposite angles 88° and 92° add to 180° , so the four corners lie on one circle.

2 No. The four corners do not lie on one circle.

3. An angle of 97° and an angle of 88° , at opposite corners. *Why:* The opposite angles 97° and 88° add to 185° , not 180° , so the four corners do not lie on one circle.

5. An exterior angle of 98° and an angle of 82° , at opposite corners. *Why:* The angle inside next to the 98° exterior angle is $180^\circ - 98^\circ = 82^\circ$. The opposite angles 82° and 82° add to 164° , not 180° , so the four corners do not lie on one circle.

9. An angle of 104° and an angle of 71° , at opposite corners. *Why:* The opposite angles 104° and 71° add to 175° , not 180° , so the four corners do not lie on one circle.

11. A diagonal cuts one angle into parts of 41° and 35° ; an exterior angle of 81° is at the other end of the diagonal, the opposite corner. *Why:* The two parts make $41^\circ + 35^\circ = 76^\circ$, and the angle inside next to the 81° exterior angle is $180^\circ - 81^\circ = 99^\circ$. The opposite angles 76° and 99° add to 175° , not 180° , so the four corners do not lie on one circle.

3 Cannot tell. The numbers on the piece do not decide it.

2. An angle of 96° and an angle of 84° , at two corners next to each other. *Why:* The numbers give angles at two corners next to each other (they share a side). No pair of opposite angles is known, so the numbers cannot decide it.

4. An exterior angle of 85° and an angle of 85° , at two corners next to each other. *Why:* The numbers give angles at two corners next to each other (they share a side). No pair of opposite angles is known, so the numbers cannot decide it.

7. An angle of 78° and an angle of 110° , at two corners next to each other. *Why:* The numbers give angles at two corners next to each other (they share a side). No pair of opposite angles is known, so the numbers cannot decide it.

12. A diagonal cuts one angle, and only one part, 47° , is given; an exterior angle of 101° is at the other end of the diagonal, the opposite corner. *Why:* Only one part of the cut angle is given, so the whole angle is not known. No pair of opposite angles is known, so the numbers cannot decide it.

To check a piece with a student, ask: “Which two corners are across from each other? Do you know both of those angles? Do they add to 180° ?” Every piece in row 3 can be drawn on a circle and can also be drawn off one with the same numbers, so the numbers cannot decide it.