

MYSTERY PICTURE

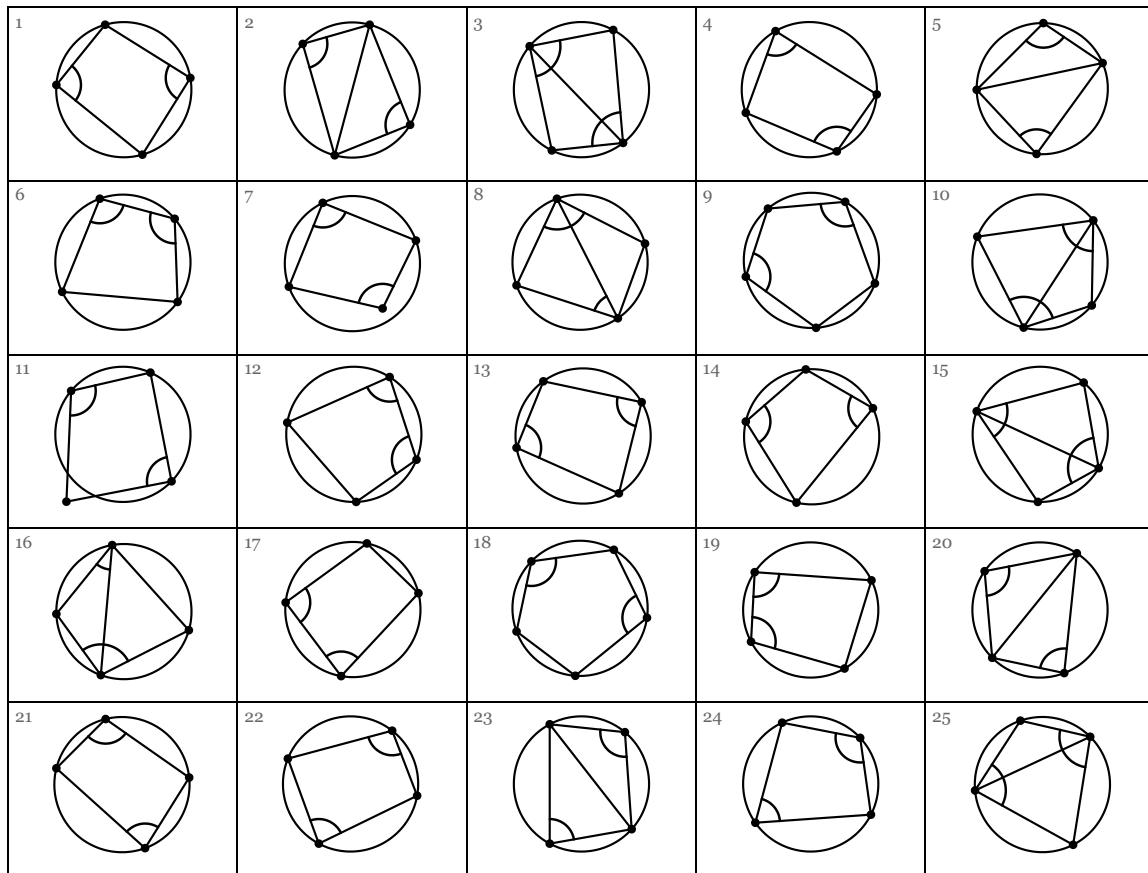


INSCRIBED (CYCLIC) QUADRILATERALS

Cyclic Quadrilaterals: Must They Add to
 180° ?

25 squares · four corners on a circle? · no numbers · a picture appears

FREE



1. **Give each student page 3** and a pencil. No calculator is needed.
2. **Say this once:** *“Opposite angles add to 180° only when the shape has four corners and all four are on the circle. Check the corners, then check the two arcs. If the two angles must add to 180° , fill the square.”*
3. **Let them work.** The picture shows when they are right. Nothing else is needed.

Student sheet page 3, one per student. A box at the top shows the rules as small drawings.
Answers pages 4–5, for you.

Each square shows a circle and a shape whose corners are dots. Two angles are marked with arcs and no numbers. The student computes nothing. 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. Opposite angles of a cyclic quadrilateral add to 180° . Fifteen squares are filled.

The white squares are the four ways students misuse the rule. In two, one corner is plainly off the circle. In four, the two angles are next to each other. In two, one arc marks only part of an angle, cut off by a diagonal. In two, the shape is a pentagon. On every white square the two angles are at least 10° away from 180° , so none of them adds to 180° by chance.

If part of a student’s picture looks wrong, the mistake is in that square. Ask: *“How many corners? Are they all on the circle? Do the two arcs mark whole angles at corners across from each other?”* Guessing does not work. Every simple guessing rule, such as filling every square where all the dots are on the circle, gets at least six squares wrong.



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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Mystery Picture — must they add to 180° ?

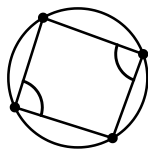
Cyclic quadrilaterals

Name _____

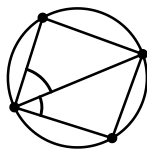
Period _____

Date _____

Each square has a circle and a shape. Two angles are marked with arcs. **If the two marked angles must add to 180° , fill the square with slanted lines. If not, leave it white.** A picture appears. If part of it is missing, or one square does not fit, check that square again.



All four corners on one circle: opposite angles (across from each other) add to 180° .



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

Fill a square only when all three are true: the shape has four corners; all four corners are on the circle; the arcs mark the whole angles at two opposite corners.

An arc that crosses a diagonal covers the whole angle, both parts. An arc that stops at the diagonal covers one part.

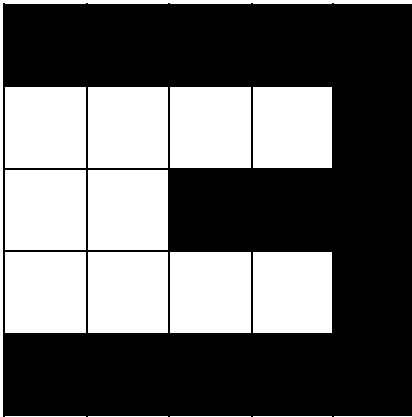
1 	2 	3 	4 	5
6 	7 	8 	9 	10
11 	12 	13 	14 	15
16 	17 	18 	19 	20
21 	22 	23 	24 	25



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Mystery Picture — answers

For the teacher



The finished picture is **the number 3**. Fifteen squares are filled.

To check a square, count the corners, check that every corner is on the circle, and check that the two arcs mark whole angles at corners that do not share a side. Only then must the two angles add to 180° . The table goes on over the page.

	The square	Answer	Why
1	A quadrilateral with all four corners on the circle. The arcs mark two opposite corners.	fill	All four corners are on the circle, and the arcs mark the whole angles at two opposite corners. Opposite angles of a cyclic quadrilateral add to 180° .
2	A quadrilateral with all four corners on the circle and a diagonal. The arcs mark two opposite corners.	fill	All four corners are on the circle, and the arcs mark the whole angles at two opposite corners. Opposite angles of a cyclic quadrilateral add to 180° .
3	A quadrilateral with all four corners on the circle and a diagonal. The arcs mark two opposite corners.	fill	All four corners are on the circle, and the arcs mark the whole angles at two opposite corners. Opposite angles of a cyclic quadrilateral add to 180° .
4	A quadrilateral with all four corners on the circle. The arcs mark two opposite corners.	fill	All four corners are on the circle, and the arcs mark the whole angles at two opposite corners. Opposite angles of a cyclic quadrilateral add to 180° .
5	A quadrilateral with all four corners on the circle and a diagonal. The arcs mark two opposite corners.	fill	All four corners are on the circle, and the arcs mark the whole angles at two opposite corners. Opposite angles of a cyclic quadrilateral add to 180° .
6	A quadrilateral with all four corners on the circle. The arcs mark two corners next to each other.	white	The two marked angles are next to each other (they share a side). Only opposite angles must add to 180° .
7	A quadrilateral with one corner inside the circle. The arcs mark two opposite corners.	white	One corner is not on the circle, so the rule does not apply. With the other three corners on the circle, the two angles cannot add to 180° .
8	A quadrilateral on the circle with a diagonal. One arc marks a whole angle at one end of the diagonal. The other marks only a part of the angle at the other end.	white	One arc marks only part of an angle, between the diagonal and a side. The whole angle at that corner is larger.
9	A pentagon with all five corners on the circle. The arcs mark two corners that do not share a side.	white	The shape has five corners. The rule is only for a quadrilateral, so these two angles do not have to add to 180° .
10	A quadrilateral with all four corners on the circle and a diagonal. The arcs mark two opposite corners.	fill	All four corners are on the circle, and the arcs mark the whole angles at two opposite corners. Opposite angles of a cyclic quadrilateral add to 180° .
11	A quadrilateral with one corner outside the circle. The arcs mark two opposite corners.	white	One corner is not on the circle, so the rule does not apply. With the other three corners on the circle, the two angles cannot add to 180° .
12	A quadrilateral with all four corners on the circle. The arcs mark two corners next to each other.	white	The two marked angles are next to each other (they share a side). Only opposite angles must add to 180° .

Mystery Picture — answers, squares 13 to 25

For the teacher

	The square	Answer	Why
13	A quadrilateral with all four corners on the circle. The arcs mark two opposite corners.	fill	All four corners are on the circle, and the arcs mark the whole angles at two opposite corners. Opposite angles of a cyclic quadrilateral add to 180° .
14	A quadrilateral with all four corners on the circle. The arcs mark two opposite corners.	fill	All four corners are on the circle, and the arcs mark the whole angles at two opposite corners. Opposite angles of a cyclic quadrilateral add to 180° .
15	A quadrilateral with all four corners on the circle and a diagonal. The arcs mark two opposite corners.	fill	All four corners are on the circle, and the arcs mark the whole angles at two opposite corners. Opposite angles of a cyclic quadrilateral add to 180° .
16	A quadrilateral on the circle with a diagonal. One arc marks a whole angle at one end of the diagonal. The other marks only a part of the angle at the other end.	white	One arc marks only part of an angle, between the diagonal and a side. The whole angle at that corner is larger.
17	A quadrilateral with all four corners on the circle. The arcs mark two corners next to each other.	white	The two marked angles are next to each other (they share a side). Only opposite angles must add to 180° .
18	A pentagon with all five corners on the circle. The arcs mark two corners that do not share a side.	white	The shape has five corners. The rule is only for a quadrilateral, so these two angles do not have to add to 180° .
19	A quadrilateral with all four corners on the circle. The arcs mark two corners next to each other.	white	The two marked angles are next to each other (they share a side). Only opposite angles must add to 180° .
20	A quadrilateral with all four corners on the circle and a diagonal. The arcs mark two opposite corners.	fill	All four corners are on the circle, and the arcs mark the whole angles at two opposite corners. Opposite angles of a cyclic quadrilateral add to 180° .
21	A quadrilateral with all four corners on the circle. The arcs mark two opposite corners.	fill	All four corners are on the circle, and the arcs mark the whole angles at two opposite corners. Opposite angles of a cyclic quadrilateral add to 180° .
22	A quadrilateral with all four corners on the circle. The arcs mark two opposite corners.	fill	All four corners are on the circle, and the arcs mark the whole angles at two opposite corners. Opposite angles of a cyclic quadrilateral add to 180° .
23	A quadrilateral with all four corners on the circle and a diagonal. The arcs mark two opposite corners.	fill	All four corners are on the circle, and the arcs mark the whole angles at two opposite corners. Opposite angles of a cyclic quadrilateral add to 180° .
24	A quadrilateral with all four corners on the circle. The arcs mark two opposite corners.	fill	All four corners are on the circle, and the arcs mark the whole angles at two opposite corners. Opposite angles of a cyclic quadrilateral add to 180° .
25	A quadrilateral with all four corners on the circle and a diagonal. The arcs mark two opposite corners.	fill	All four corners are on the circle, and the arcs mark the whole angles at two opposite corners. Opposite angles of a cyclic quadrilateral add to 180° .