

# MYSTERY PICTURE

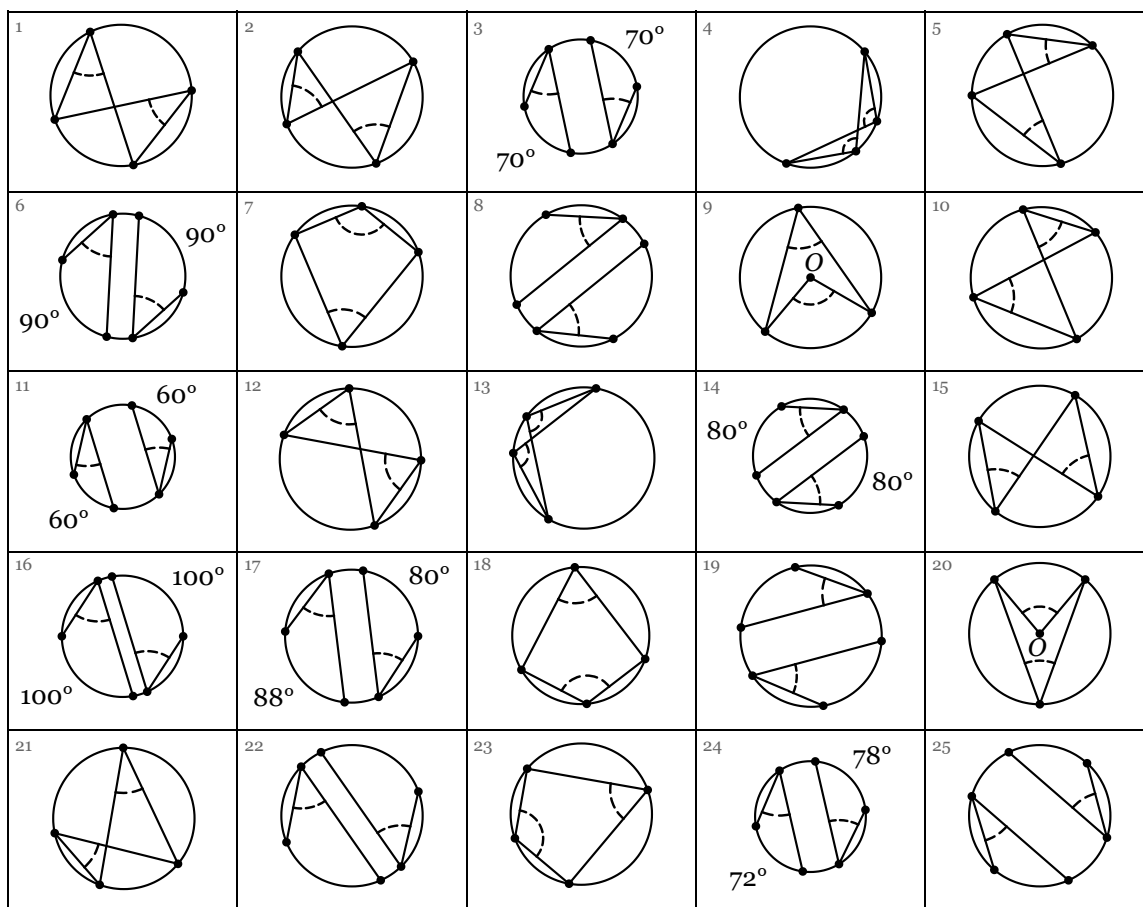


## INSCRIBED ANGLES

Inscribed Angles: Are the Two Angles Congruent?

25 circles · same arc or not? · no calculator · a picture appears

FREE



1. **Give each student page 3** and a pencil. No calculator is needed.
2. **Say this once:** *“In each square, two angles are marked. Find the arc inside each angle. If the marks and arcs prove the two angles are congruent, fill the square with slanted lines. If not, leave it white.”*
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 bottom shows what the marks mean.  
**Answers** pages 4–5, for you.

**The rule:** an inscribed angle is half of the arc inside it. So two inscribed angles on the same arc, or on arcs with the same measure, are congruent. Fourteen squares are filled.

**The white squares are of two kinds.** In seven of them the angles are not congruent. In three, the two angles share their ends but the vertices are on opposite arcs, so the angles add to  $180^\circ$ . In two, one angle is a central angle, which is twice the other. In two, the printed arcs differ by a few degrees. In the other four, the angles open onto two different arcs and nothing gives their measures. These look congruent on purpose. A student must not trust the look of a drawing.

**This sheet calls an angle inscribed when its vertex is on the circle and each side meets the circle again. The arc an angle intercepts is the arc inside the angle.** Some textbooks use other definitions, so tell the class which ones this sheet uses.

If part of a student’s picture looks wrong, the mistake is in that square. Ask: *“Where is each vertex? Which arc is inside each angle? Is it the same arc?”* Guessing does not work. Every simple guessing rule, such as filling every square where the angles look the same, 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 — are the two angles congruent?

Inscribed angles

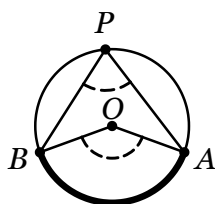
Name \_\_\_\_\_

Period \_\_\_\_\_

Date \_\_\_\_\_

Each square has two marked angles. Find the arc inside each angle. **If the marks show the two angles are congruent, fill the square with slanted lines. If they show the angles are not, leave it white.** Leave it white also when you cannot tell. A picture appears. If part of it is missing, check that square again.

|    |    |    |    |    |
|----|----|----|----|----|
| 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 |



A dashed arc marks an angle. O is the center. A number outside the circle is the measure of the arc beside it.

The arc inside an angle (thick in this drawing) does not pass through the vertex.

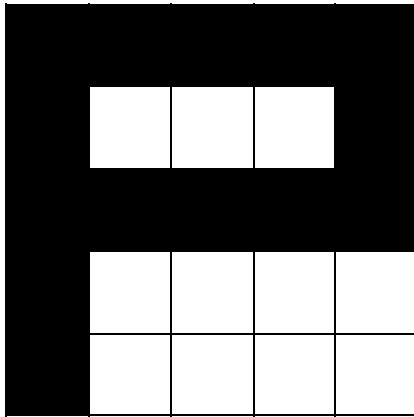
An inscribed angle (vertex on the circle) is half of the arc inside it. A central angle (vertex at O) equals its arc.



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# Mystery Picture — answers

For the teacher



The finished picture is **the letter P**. Fourteen squares are filled.

To check a square, ask two things. Where is each vertex, and which arc is inside each angle? Then: is it the same arc, or two arcs with the same printed measure? The table gives the reason for every square. It goes on over the page.

|    | The square                                              | Answer | Why                                                                                                                                                               |
|----|---------------------------------------------------------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Same two ends, both vertices on the long arc.           | fill   | Both vertices are on the long arc, so both angles open onto the same short arc. Inscribed angles on the same arc are congruent (each is $40^\circ$ ).             |
| 2  | Same two ends, both vertices on the long arc.           | fill   | Both vertices are on the long arc, so both angles open onto the same short arc. Inscribed angles on the same arc are congruent (each is $55^\circ$ ).             |
| 3  | Two different arcs, marked $70^\circ$ and $70^\circ$ .  | fill   | The two angles open onto different arcs, but both arcs are marked $70^\circ$ . Each angle is half of its arc, so they are congruent.                              |
| 4  | Same two ends, both vertices on the short arc.          | fill   | Both vertices are on the short arc, so both angles open onto the same long arc. They are congruent (each is $105^\circ$ , obtuse).                                |
| 5  | Same two ends, both vertices on the long arc.           | fill   | Both vertices are on the long arc, so both angles open onto the same short arc. Inscribed angles on the same arc are congruent (each is $30^\circ$ ).             |
| 6  | Two different arcs, marked $90^\circ$ and $90^\circ$ .  | fill   | The two angles open onto different arcs, but both arcs are marked $90^\circ$ . Each angle is half of its arc, so they are congruent.                              |
| 7  | Same two ends, vertices on opposite arcs.               | white  | The vertices are on opposite arcs, so the angles open onto different arcs. They add to $180^\circ$ (here $62^\circ$ and $118^\circ$ ), so they are not congruent. |
| 8  | Two different arcs, nothing marked.                     | white  | The angles open onto two different arcs, and nothing gives the measure of either arc. They only look congruent, and a drawing is not a measurement.               |
| 9  | A central angle and an inscribed angle on the same arc. | white  | One angle is at the center O. A central angle is twice the inscribed angle on the same arc ( $100^\circ$ and $50^\circ$ ), so they are not congruent.             |
| 10 | Same two ends, both vertices on the long arc.           | fill   | Both vertices are on the long arc, so both angles open onto the same short arc. Inscribed angles on the same arc are congruent (each is $50^\circ$ ).             |
| 11 | Two different arcs, marked $60^\circ$ and $60^\circ$ .  | fill   | The two angles open onto different arcs, but both arcs are marked $60^\circ$ . Each angle is half of its arc, so they are congruent.                              |
| 12 | Same two ends, both vertices on the long arc.           | fill   | Both vertices are on the long arc, so both angles open onto the same short arc. Inscribed angles on the same arc are congruent (each is $65^\circ$ ).             |

# Mystery Picture — answers, squares 13 to 25

For the teacher

|    | The square                                               | Answer       | Why                                                                                                                                                               |
|----|----------------------------------------------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13 | Same two ends, both vertices on the short arc.           | <b>fill</b>  | Both vertices are on the short arc, so both angles open onto the same long arc. They are congruent (each is $100^\circ$ , obtuse).                                |
| 14 | Two different arcs, marked $80^\circ$ and $80^\circ$ .   | <b>fill</b>  | The two angles open onto different arcs, but both arcs are marked $80^\circ$ . Each angle is half of its arc, so they are congruent.                              |
| 15 | Same two ends, both vertices on the long arc.            | <b>fill</b>  | Both vertices are on the long arc, so both angles open onto the same short arc. Inscribed angles on the same arc are congruent (each is $45^\circ$ ).             |
| 16 | Two different arcs, marked $100^\circ$ and $100^\circ$ . | <b>fill</b>  | The two angles open onto different arcs, but both arcs are marked $100^\circ$ . Each angle is half of its arc, so they are congruent.                             |
| 17 | Two different arcs, marked $80^\circ$ and $88^\circ$ .   | <b>white</b> | The arcs are marked $80^\circ$ and $88^\circ$ . They look alike, but the angles are half of each: $40^\circ$ and $44^\circ$ . Not congruent.                      |
| 18 | Same two ends, vertices on opposite arcs.                | <b>white</b> | The vertices are on opposite arcs, so the angles open onto different arcs. They add to $180^\circ$ (here $65^\circ$ and $115^\circ$ ), so they are not congruent. |
| 19 | Two different arcs, nothing marked.                      | <b>white</b> | The angles open onto two different arcs, and nothing gives the measure of either arc. They only look congruent, and a drawing is not a measurement.               |
| 20 | A central angle and an inscribed angle on the same arc.  | <b>white</b> | One angle is at the center O. A central angle is twice the inscribed angle on the same arc ( $80^\circ$ and $40^\circ$ ), so they are not congruent.              |
| 21 | Same two ends, both vertices on the long arc.            | <b>fill</b>  | Both vertices are on the long arc, so both angles open onto the same short arc. Inscribed angles on the same arc are congruent (each is $35^\circ$ ).             |
| 22 | Two different arcs, nothing marked.                      | <b>white</b> | The angles open onto two different arcs, and nothing gives the measure of either arc. They only look congruent, and a drawing is not a measurement.               |
| 23 | Same two ends, vertices on opposite arcs.                | <b>white</b> | The vertices are on opposite arcs, so the angles open onto different arcs. They add to $180^\circ$ (here $60^\circ$ and $120^\circ$ ), so they are not congruent. |
| 24 | Two different arcs, marked $72^\circ$ and $78^\circ$ .   | <b>white</b> | The arcs are marked $72^\circ$ and $78^\circ$ . They look alike, but the angles are half of each: $36^\circ$ and $39^\circ$ . Not congruent.                      |
| 25 | Two different arcs, nothing marked.                      | <b>white</b> | The angles open onto two different arcs, and nothing gives the measure of either arc. They only look congruent, and a drawing is not a measurement.               |