

MYSTERY PICTURE

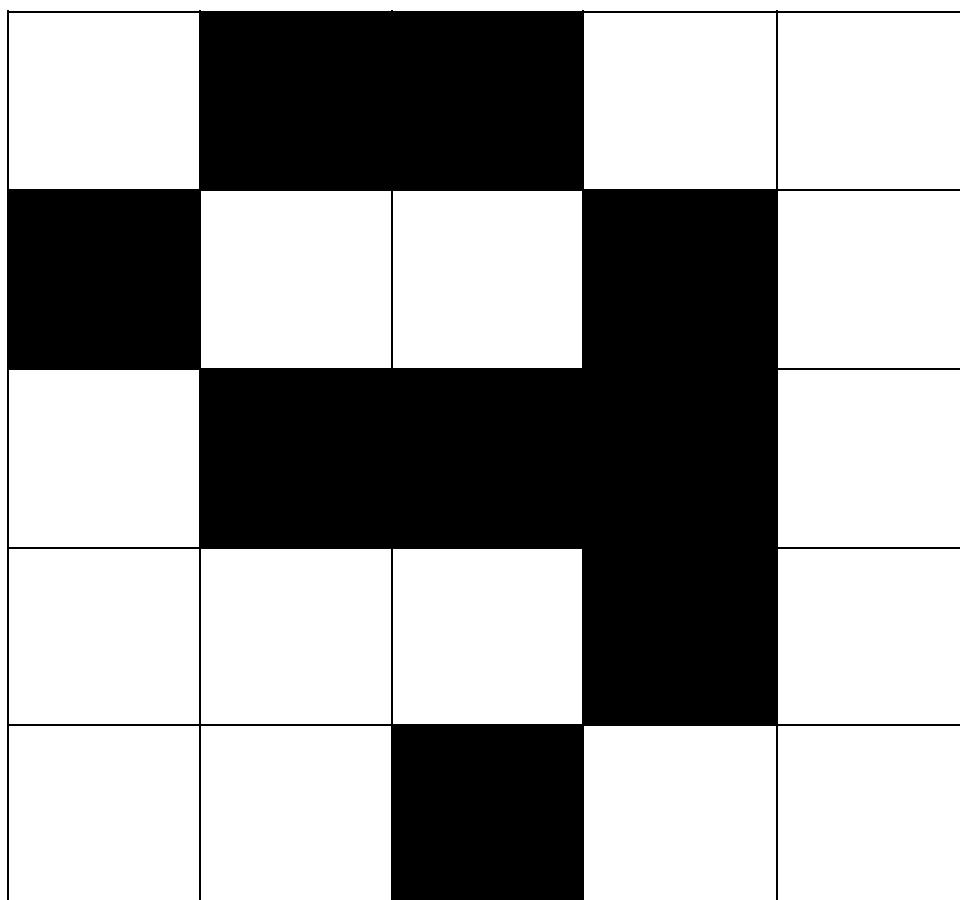


CONSTRUCTING AN ANGLE BISECTOR

Bisecting an Angle: Do the Marks Prove the Ray?

25 strangers' attempts · no numbers · a wrong square breaks the picture

FREE



25 squares · 1 student sheet · answer key · 4 pages

Geometry · Grades 8–10 · chooseyourlesson.com

1. **Hand out page 3**, one per student, and a compass each. Nothing is measured and no protractor is needed. That is the whole preparation.
2. **Say this once:** *“A ray that looks right proves nothing. It must start at the corner. It must run through where two arcs cross. Both arcs must have the same opening. Each arc starts from one of the two points where the first arc crossed the arms.”*
3. **Fill a square with slanted lines if its marks prove the ray is the bisector. Leave it white if they do not.** A picture appears. Nine of the 25 are filled.

Student sheet	page 3, one per student. The compass-opening box is printed on it.
Answers	page 4 — the finished picture and the reason for every square.

Each square is somebody else's finished attempt, and the student judges it. Each of the sixteen white squares shows one mistake: the last two arcs drawn with two different openings, because the compass was changed between them (four), the first arc drawn as two arcs with two different openings (two), all three arcs centered at the vertex (three), no arcs at all, because the angle was measured with a protractor and halved (three), a wide angle whose last two arcs never meet, with the ray put in by eye (two), and a ray drawn from the crossing that stops short of the vertex (two).

Nine white squares look exactly right. For example, when the last two arcs have different openings, the ray can look right, but it does not bisect the angle. A student who fills every square whose ray runs from the corner through a crossing of two arcs gets six squares wrong. Those are exactly the squares where an opening was not kept the same. Checking the openings with the compass is what catches this mistake.

Every filled square is the construction done correctly, at acute, obtuse and narrow angles. Some use the first opening again for the last two arcs, and some do not. Both are correct. The first opening can be anything, and the last two arcs can have any opening, as long as it is the same for both.

Guessing does not work. Every simple guessing rule, such as filling every square whose ray starts at the corner, gets at least seven squares wrong. The picture then has holes that a student can see from their own desk.



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

Do the marks prove the ray?

Name _____

Period _____

Date _____

Each square is somebody's finished attempt to bisect an angle. Every arc was left on. Every point they marked has a dot. The two arms start at the corner dot. The ray is the line between them. Do the marks prove the ray is the bisector? If yes, fill the square with slanted lines. If no, leave it white. A ray that only looks right is white. Use your compass to compare two arcs. You do not measure anything. When you finish, look at the picture. If it does not look right, check a square again.

This lesson has two settings, with two different rules. *First arc, from the vertex:* use any opening, as long as the arc crosses both arms. On a narrow angle, use a bigger opening. You may lengthen an arm if you need to. *Second and third arcs, from the two points it made:* use the same opening for both. Make it big enough for the two arcs to meet. On a wide angle, that means a big opening. Then rule the ray from the vertex, through the crossing, and on.

Last lesson: you built the perpendicular bisector. The two openings are equal. Each is more than half the segment.

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

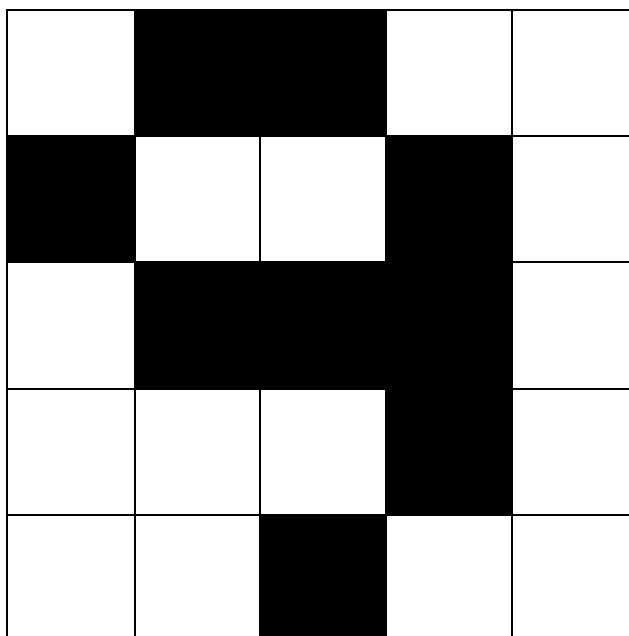


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Mystery Picture — answers

For the teacher

The finished sheet is **the figure 9: a loop at the top left, its right side running down into a tail that curls back left**. The table reads left to right, the way the sheet is read; the squares are numbered on the student's sheet.



1–5	white last two arcs have different openings	FILL correct: each opening kept the same	FILL correct: each opening kept the same	white first arc drawn with two openings	white all arcs centered at the vertex
6–10	FILL correct: each opening kept the same	white no arcs: a protractor was used	white last two arcs never meet	FILL correct: each opening kept the same	white ray does not start at the vertex
11–15	white last two arcs have different openings	FILL correct: each opening kept the same	FILL correct: each opening kept the same	FILL correct: each opening kept the same	white first arc drawn with two openings
16–20	white all arcs centered at the vertex	white no arcs: a protractor was used	white last two arcs never meet	FILL correct: each opening kept the same	white ray does not start at the vertex
21–25	white last two arcs have different openings	white all arcs centered at the vertex	FILL correct: each opening kept the same	white no arcs: a protractor was used	white last two arcs have different openings

No square depends on sharp eyes. Two arcs either have the same opening or differ by at least 4 mm and at least 30% of the smaller one. So a compass set on one arc clearly misses the other. A dot is either on a line or arc, or at least 2.5 mm away from it. A ray either starts at the corner or stops at least 2.5 mm short of it.