

MYSTERY PICTURE

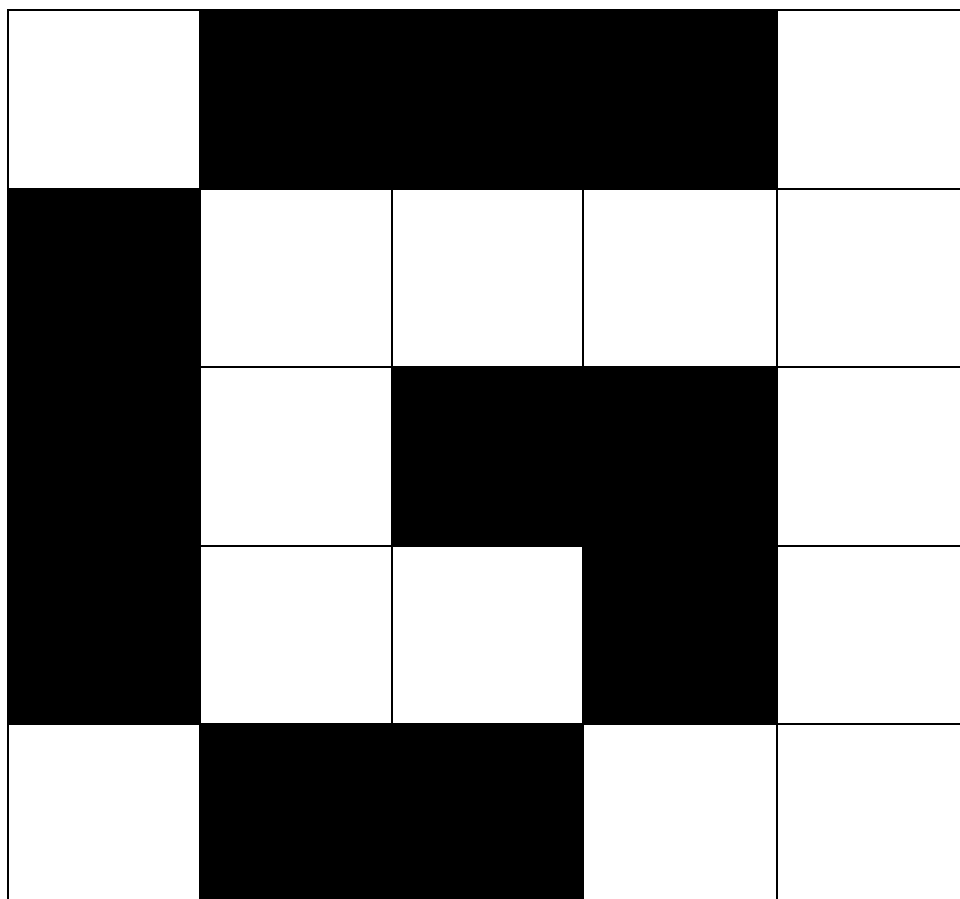


CONSTRUCTING A PERPENDICULAR BISECTOR

The Perpendicular Bisector: Do the Marks
Prove the Line?

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. A compass each helps. Nothing is measured. That is the whole preparation.
2. **Say this once:** *“A line that looks right proves nothing. It must run through two points where arcs of the same opening, one from each end, cross.”*
3. **Fill a square with slanted lines if its marks prove the line is the perpendicular bisector. Leave it white if they do not.** A picture appears. Eleven 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 fourteen white squares shows one mistake: arcs from the two ends with different openings (five), the opening exactly half, so the arcs touch once and the line is guessed through that one point (two), arcs on one side only, with the one crossing joined to a middle found by eye (two), the opening less than half, so the arcs never meet (two), and a line that misses one of the two crossings (three).

Ten white squares look exactly right. Five of them use different openings at the two ends, and the other five show one of the other mistakes above. When the two ends use different openings, the line through the crossings is still perpendicular to the segment. But it misses the middle, by too little for the eye to see. A student who fills every square whose line runs through two crossings gets five squares wrong. They are the five squares with different openings. Checking that both ends use the same opening is what makes the construction work.

Some filled squares look unusual on purpose. In two of them, the pair of arcs above the segment has one opening and the pair below has another. Each pair uses one opening, so each crossing is the same distance from both ends, and the line is correct.

Guessing does not work. Every simple guessing rule, such as filling every square that has four arcs, gets at least ten 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 line?

Name _____

Period _____

Date _____

Each square is somebody's finished attempt at the perpendicular bisector of a segment. Every arc was left on. Every point they marked has a dot. The segment stops at its two end dots. The line runs on past its dots. Do the marks prove the line is the perpendicular bisector? If yes, fill the square with slanted lines. If no, leave it white. A line 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 one rule in two parts. First, the opening from each end must be the *same*. This is what puts the line through the middle. If you get it wrong, the line is still perpendicular, so nothing looks wrong. Second, each opening must be *more than half* the segment. This is what makes the arcs cross. If you get it wrong, you can see it at once.

Last lesson: you copied a segment with one setting, never reopened. You copied an angle with two settings.

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

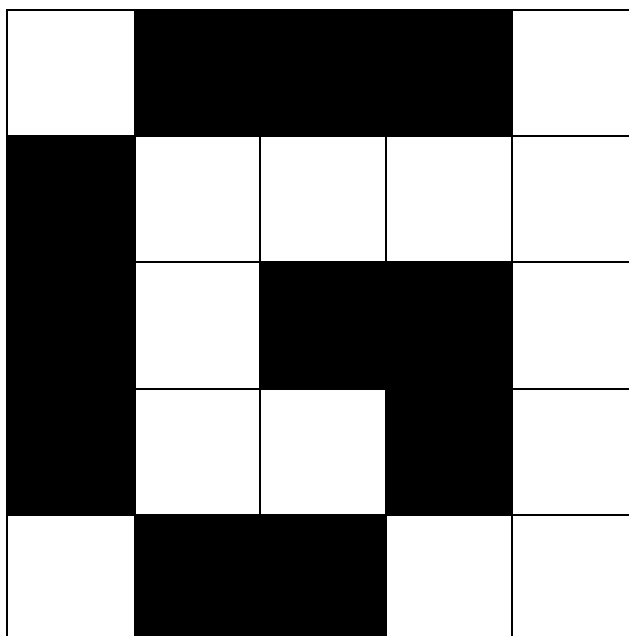


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Mystery Picture — answers

For the teacher

The finished sheet is **the letter G: an open ring from the top round the left side, with its bar turned in at the right of the middle row**. The table reads left to right, the way the sheet is read; the squares are numbered on the student's sheet.



1–5	white two different openings: line misses the middle	FILL same opening at both ends, line through both crossings	FILL each pair of arcs has one opening	FILL same opening at both ends, line through both crossings	white exactly half: arcs touch at one point only
6–10	FILL each pair of arcs has one opening	white arcs on one side only: one crossing	white less than half: arcs never meet	white line misses a crossing	white two different openings: line misses the middle
11–15	FILL same opening at both ends, line through both crossings	white exactly half: arcs touch at one point only	FILL same opening at both ends, line through both crossings	FILL same opening at both ends, line through both crossings	white arcs on one side only: one crossing
16–20	FILL same opening at both ends, line through both crossings	white less than half: arcs never meet	white line misses a crossing	FILL same opening at both ends, line through both crossings	white two different openings: line misses the middle
21–25	white line misses a crossing	FILL same opening at both ends, line through both crossings	FILL same opening at both ends, line through both crossings	white two different openings: line misses the middle	white two different openings: line misses the middle

No square depends on sharp eyes. Two arcs either have the same opening or differ by at least 3 mm. A dot is either on a line or arc, or at least 2.5 mm away from it.