

Bisect It Right

Use midpoints, perpendicular lines, and equal arcs to locate exact halves.

HIGH SCHOOL • MA.912.GR.5.2

MA.912.GR.5.2 "Construct the bisector of a segment or an angle, including the perpendicular bisector of a line segment."

NAME _____

DATE _____

CONSTRUCTION RULES

A perpendicular bisector crosses a segment at its midpoint and forms a right angle with the segment. To construct one, draw equal-radius arcs centered at both endpoints so the arcs intersect twice, then draw the line through the intersections; to construct an angle bisector, draw an arc centered at the vertex, draw equal-radius arcs centered at the two marks where that arc meets the rays, and draw a ray from the vertex through the arcs' intersection.

WORKED EXAMPLE

Describe how to construct the bisector of angle PQR.

1. Draw an arc centered at Q that meets ray QP at X and ray QR at Y.
2. Choose a compass width that allows arcs from X and Y to meet inside the angle.
3. Draw an arc centered at X, then draw an equal-radius arc centered at Y so the arcs intersect at Z.
4. Draw ray QZ.

Answer: Ray QZ is the angle bisector.

PRACTICE 6 problems

- 1** Segment AB has endpoints A(-2, 1) and B(4, 5). Find the equation of its perpendicular bisector.

ANSWER _____

- 2** Segment CD has endpoints C(0, -4) and D(8, -4). Find the equation of its perpendicular bisector.

ANSWER _____

- 3** Segment EF has endpoints E(-6, 3) and F(-6, 11). Find the equation of its perpendicular bisector.

ANSWER _____

- 4** In an angle-bisector construction, an arc centered at V meets the two rays at M and N. What two arcs must you draw next?

ANSWER _____

- 5** Segment GH has endpoints G(1, -1) and H(7, 3). Does point (4, 1) lie on the perpendicular bisector of GH?

ANSWER _____

- 6** Segment UV has endpoints U(-1, 2) and V(3, 8). Which equation is its perpendicular bisector?

ANSWER _____

APPLY IT Show your work

- 1** At a school festival, two charging stations are located at $(2, 0)$ and $(10, 0)$. An organizer wants to place a help table so it is equally far from both stations. What is the equation of the line where the table can be placed?

WORK SPACE

ANSWER _____

- 2** A student is filming a skateboard trick. Two light beams form angle LKM, and the camera must point exactly halfway between the beams. Describe the construction for the camera direction.

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Segment AB has endpoints $A(-4, -1)$ and $B(8, 7)$. Find the equation of its perpendicular bisector. Then explain in one sentence why every point on this line is equidistant from A and B.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Segment AB has endpoints A(-2, 1) and B(4, 5). Find the equation of its perpendicular bisector.	$y - 3 = -3/2(x - 1)$
2	Segment CD has endpoints C(0, -4) and D(8, -4). Find the equation of its perpendicular bisector.	$x = 4$
3	Segment EF has endpoints E(-6, 3) and F(-6, 11). Find the equation of its perpendicular bisector.	$y = 7$
4	In an angle-bisector construction, an arc centered at V meets the two rays at M and N. What two arcs must you draw next?	Draw equal-radius arcs centered at M and N so they intersect at P.
5	Segment GH has endpoints G(1, -1) and H(7, 3). Does point (4, 1) lie on the perpendicular bisector of GH?	Yes, because (4, 1) is equidistant from G and H.
6	Segment UV has endpoints U(-1, 2) and V(3, 8). Which equation is its perpendicular bisector?	$y - 5 = -2/3(x - 1)$

PART 2 • APPLY IT

1. $x = 6$ The midpoint of the stations is (6, 0). Because the segment is horizontal, its perpendicular bisector is the vertical line $x = 6$.
2. **Draw an arc centered at K that meets rays KL and KM at R and S. Draw equal-radius arcs centered at R and S that intersect at T, then use ray KT as the camera direction.** The equal-radius arcs from R and S create point T. Ray KT bisects angle LKM.

CHALLENGE

$y - 3 = -3/2(x - 2)$. Every point on this perpendicular bisector is equidistant from A and B because the line passes through the midpoint of AB at a right angle.

Accept equivalent equations of each perpendicular bisector, including standard form. For construction descriptions, accept any correct sequence that uses equal-radius arcs from the two marked points and connects the appropriate intersection to the vertex or to the other arc intersection.