

Precision Pathways

Plan formal constructions with clear compass-and-straightedge steps.

HIGH SCHOOL • HSG-CO.D.12

CCSS.Math.Content.HSG-CO.D.12 "Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment..."

NAME _____

DATE _____

CONSTRUCTION PLAN

To copy an angle, draw an arc across both sides of the original angle, repeat that arc from the new vertex, transfer the chord between the arc marks, and draw the new ray. To make a perpendicular bisector, draw equal-radius arcs from both endpoints of a segment, then draw the line through the arc intersections.

WORKED EXAMPLE

Given $\angle DEF$ and ray RS , construct ray RT so that $\angle SRT$ is congruent to $\angle DEF$.

1. Draw an arc centered at E that crosses ED at U and EF at V .
2. Using the same radius, draw an arc centered at R that crosses ray RS at W .
3. Set the compass width to UV , mark T on the arc centered at R so that $WT = UV$, and draw ray RT .

Answer: $\angle SRT$ is congruent to $\angle DEF$.

PRACTICE 6 problems

- 1** Given segment AB and ray CK , construct a point L on ray CK so that $CL = AB$.

ANSWER _____

- 2** Construct the perpendicular bisector of segment MN .

ANSWER _____

- 3** Construct the angle bisector of $\angle GHI$.

ANSWER _____

- 4** Point O lies on line a . Construct a line through O perpendicular to line a .

ANSWER _____

- 5** Point Z is not on line b . Construct a line through Z perpendicular to line b .

ANSWER _____

- 6** Points A and B lie on line l , and P is not on line l . Construct a line through P parallel to l by copying an alternate interior angle.

ANSWER _____

APPLY IT Show your work

- 1** A student is designing a custom jacket patch. The design has a segment JK that shows the needed width of a fabric strip. A ray LM shows where the second strip will begin. Describe how to mark point N on ray LM so that LN has exactly the same width as JK.

WORK SPACE

ANSWER _____

- 2** The esports club is laying out a streaming backdrop. The top edge is line q , with points C and D on q . The club needs a stripe through point H, which is not on q , parallel to q . Describe an alternate-interior-angle construction that guarantees the stripe is parallel to q .

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Given line r and point W not on r , construct a line through W parallel to r by using two perpendicular constructions. Then explain why your final line is parallel to r .

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	Given segment AB and ray CK, construct a point L on ray CK so that $CL = AB$.	Set the compass width to AB. With center C, draw an arc that crosses ray CK at L. Then $CL = AB$.
2	Construct the perpendicular bisector of segment MN.	Draw equal-radius arcs centered at M and N, using a radius large enough for the arcs to intersect at X and Y. Draw line XY. Line XY is the perpendicular bisector of MN.
3	Construct the angle bisector of $\angle GHI$.	Draw an arc centered at H that crosses HG at J and HI at K. Draw equal-radius arcs centered at J and K that intersect at L inside the angle. Draw ray HL. Ray HL bisects $\angle GHI$.
4	Point O lies on line a. Construct a line through O perpendicular to line a.	Draw a circle centered at O that meets line a at U and V. Draw equal-radius arcs centered at U and V that meet at W. Draw line OW. Line OW is perpendicular to line a.
5	Point Z is not on line b. Construct a line through Z perpendicular to line b.	Draw a circle centered at Z with a radius large enough to meet line b at C and D. Construct the perpendicular bisector of CD. This bisector passes through Z and is perpendicular to line b.
6	Points A and B lie on line l, and P is not on line l. Construct a line through P parallel to l by copying an alternate interior angle.	Draw segment AP. At A, draw an arc that meets AB at C and AP at D. Copy this arc at P so it meets PA at E, then transfer chord CD from E onto the copied arc on the side of line AP opposite B to mark F. Draw line PF. Line PF is parallel to l.

PART 2 • APPLY IT

- 1. Set the compass width to JK. With center L, draw an arc that crosses ray LM at N. Then $LN = JK$.** This transfers the compass opening from segment JK to a segment beginning at L.
- 2. Draw segment CH. At C, draw an arc that meets CD at E and CH at F. Copy this arc at H so it meets HC at G, then transfer chord EF from G onto the copied arc on the side of line CH opposite D to mark J. Draw line HJ. Line HJ is parallel to q.**
The copied angles are alternate interior angles formed by transversal CH. Because they are congruent and placed on opposite sides of the transversal, HJ is parallel to q.

CHALLENGE

Choose a point X on line r and construct line s through X perpendicular to r. Construct line t through W perpendicular to s. Line t is parallel to r because two coplanar lines perpendicular to the same line are parallel.

Accept any valid compass-and-straightedge sequence that produces the required congruent, perpendicular, or parallel relationship. For the alternate-interior-angle constructions, the copied ray must be placed on the stated opposite side of the transversal.