# Geometric Constructions Worksheet

Geometry · Common Core 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; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

## Practice

Builds the skill step by step.

1. Which tools are used for a formal construction?
   A. a compass and a straightedge
   B. a ruler and a protractor
   C. a calculator
   D. graph paper only

2. How do you start copying segment AB?
   A. Draw a circle centered at the midpoint of AB.
   B. Measure AB with a ruler.
   C. Fold the paper in half.
   D. Draw a ray, set the compass to the length AB, and mark that length from the ray's endpoint.

3. To construct the perpendicular bisector of AB, you draw arcs centered at A and at B. What radius should you use?
   A. exactly AB ÷ 4
   B. the same radius, more than half of AB
   C. any two different radii
   D. the same radius, less than half of AB

4. A 70° angle is bisected. What is the measure of each new angle?

5. The perpendicular bisector of a 10 cm segment is constructed. How far is the midpoint from each endpoint?

6. In the perpendicular bisector construction, the two points where the arcs cross are
   A. equidistant from A and B
   B. on segment AB
   C. at the midpoint only
   D. the same as A and B

7. A 48° angle is copied with a compass and straightedge. What does the copy measure?

8. Which method constructs a line parallel to line $\ell$ through point P not on $\ell$?
   A. Copy the length of $\ell$.
   B. Draw a transversal through P and copy a corresponding angle at P.
   C. Bisect the segment from P to $\ell$.
   D. Draw a circle centered at P.

9. A line is constructed perpendicular to line $\ell$ through a point on $\ell$. What angle does it make with $\ell$?

10. Why must the compass width stay the same when you copy a segment?
    A. To make a right angle.
    B. So the copy is longer.
    C. It doesn't matter.
    D. So the copy has the same length as the original.

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## On Level

Grade-level practice.

1. Which order of steps constructs the bisector of ∠ABC?

   A. Arc from B crossing both sides; equal arcs from those two crossing points; ray from B through where those arcs meet.

   B. Ray from B; arc from A; arc from C.

   C. Measure the angle; divide by 2; draw the ray.

   D. Arc from A to C; draw segment AC; connect to B.

2. A 120° angle is bisected, and then one of the new angles is bisected again. What is the smallest angle formed?

3. Explain why the angle bisector construction works.

4. A(2, 1) and B(8, 1). The perpendicular bisector of AB is constructed. What is its equation?

5. Point P is not on line $\ell$. What is the first step to construct the line through P perpendicular to $\ell$?

   A. Measure from P to $\ell$.

   B. Draw a line through P parallel to $\ell$.

   C. Draw an arc centered at P that crosses $\ell$ at two points.

   D. Bisect line $\ell$.

6. A 14 cm strip of paper is folded so the ends match. How long is each half?

7. A line through P is constructed by copying an alternate interior angle. Why is it parallel to $\ell$?

   A. If alternate interior angles are congruent, the lines are parallel.

   B. Because P is far from $\ell$.

   C. Because all lines through P are parallel to $\ell$.

   D. Because vertical angles are congruent.

8. A right angle is bisected. What is each new angle?

9. A 60° angle is constructed from an equilateral triangle and then bisected. What is each new angle?

10. Which task cannot be done with only a compass and straightedge?

    A. bisecting any given angle

    B. trisecting any given angle

    C. constructing a perpendicular bisector

    D. copying any segment

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## Challenge

Multi-step and word problems that stretch it.

1. In the perpendicular bisector construction, explain why the points where the two arcs cross are equidistant from A and B.

2. A 60° angle is bisected twice in a row. What is the smallest angle formed?

3. A 4 cm segment is copied three times end to end along a ray. How long is the total segment?

4. To copy ∠ABC onto ray EF, you draw an arc centered at B crossing BA and BC, then the same arc centered at E. What do you set the compass to next?

   A. the length of BA

   B. the length of EF

   C. the radius of the first arc

   D. the distance between the two points where the first arc crossed BA and BC

5. The perpendicular bisectors of a right triangle's sides meet at the circumcenter, the midpoint of the hypotenuse. The hypotenuse is 10. What is the circumradius?

6. The angle bisectors of an equilateral triangle with side 6 meet at the incenter. What is the exact inradius?

7. To construct a square, after drawing side AB, what do you construct next?

   A. a circle with diameter AB

   B. the midpoint of AB

   C. perpendicular lines at A and at B

   D. a 60° angle at A

8. A line is constructed through P parallel to $\ell$. P is 4 cm from $\ell$. How far apart are the two parallel lines?

9. Why do geometers use constructions instead of measuring?

   A. Measuring changes the figure.

   B. Rulers are not allowed in math.

   C. Constructions are faster.

   D. A construction is exact; measuring always has some error.

10. Describe how to construct a line perpendicular to line $\ell$ through a point P on $\ell$.