

1/7/16  
Analytic Geometry

Constructing Perpendicular & Parallel Lines


**EQ:** How can you justify a construction was done correctly?

MCC9-12.G.CO.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.

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**Warm-up:**

Mason would like to create a soccer field in the rectangular field behind his house. To do so, he needs to make a midline that is created when the midpoint of the longer sides of the field are connected. He must also create the center circle of the field that has its center at the midpoint of the midline and is equidistant from both the longer sides. Using a compass and straightedge construct the soccer field.



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**Key Concepts:**

Perpendicular Lines are two lines that intersect at a right angle ( $90^\circ$ ).

A perpendicular line can be constructed through the midpoint of a segment. This line is called the perpendicular bisector of the line segment.

Parallel Lines are lines in the same plane that either do not share any points and never intersect, or share all points.

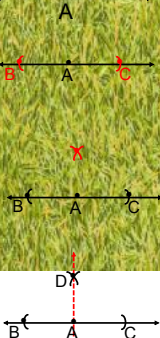
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**Example 1:**  
Use a compass and a straightedge to construct a line perpendicular to line  $l$  through point  $A$ .

- Begin with a line that has a point on it.
- Put your compass on the point and draw two arcs on the line, label these new points, B & C.
- Open your compass wider than the distance between B and A.
- Put your compass on B and draw an arc above the line.
- Don't change your compass. Put it on C and draw an arc that intercepts the last arc. This is point D.
- Use your straight edge to connect D and A.

**For patty paper:**

- Use your straight edge to draw a line on patty paper.
- Put a point, A on the line.
- Fold the paper at point A and make sure the line folds onto itself.
- Crease the paper.
- Unfold and use a straight edge to mark the creased line.



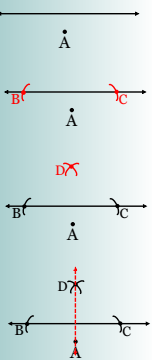
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**Example 2:**  
Use a compass and a straightedge to construct a line perpendicular to the line given through point A that is not on the line.  
(similar to the last example)

- Begin with a line that has a point near it but not on the line.
- Put your compass on the point and draw two arcs on the line, label these new points, B & C.
- Open your compass wider than the distance between B and A.
- Put your compass on B and draw an arc on the opposite side of the line as the point, A.
- Don't change your compass. Put it on C and draw an arc that intercepts the last arc. This is point D.
- Use your straight edge to connect D and A.

**For patty paper:**

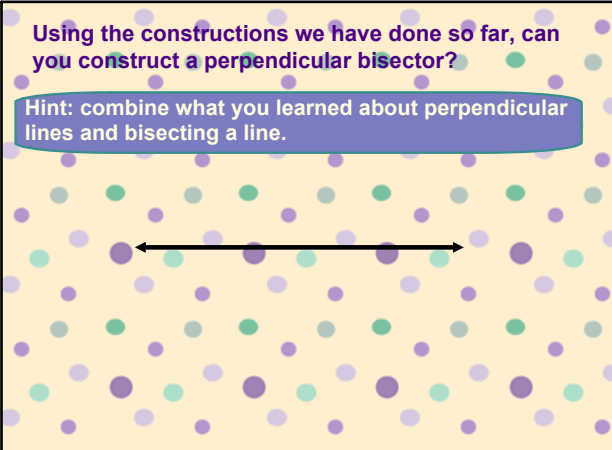
- Use your straight edge to draw a line on patty paper.
- Draw a point, A not on the line.
- Fold the paper at point A and make sure the line folds onto itself.
- Crease the paper.
- Unfold and use a straight edge to mark the creased line.



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Using the constructions we have done so far, can you construct a perpendicular bisector?

**Hint:** combine what you learned about perpendicular lines and bisecting a line.



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**Example 3:**  
Use a compass and a straightedge to construct the perpendicular bisector of AB.

Begin with a line that endpoints A & B.

Open your compass more than half the size of AB.

Put your compass on the endpoint A and draw an arc above the line and an arc below the line.

Put your compass on the endpoint B and draw an arc above the line and an arc below the line that intersect with the last arcs you drew.

Draw your perpendicular bisector through the two intersections.

**For patty paper:**

- Use your straight edge to draw a line with endpoints A and B on patty paper.
- Fold the paper so that the line folds on itself and A and B overlap.
- Crease the paper.
- Unfold and use a straight edge to mark the creased line.

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**Example 4:**  
Use a compass and straightedge to construct a line parallel to another line and through a point that is not on the line.

Begin with a line that has a point near it but not on the line.

Draw a new line that goes through the original line and the point. Name the point where the two lines intersect B.

Place the compass on point B and draw an arc that goes through both lines.

Keep the compass at the same setting. Place the compass on point A and draw an arc that goes through both lines.

Set your compass for the distance where the lower arc crosses the two lines. Without changing the setting move the compass to where the upper arc crosses the upper line. Draw a small arc that crosses the big arc.

Draw a straight line through point A and the small arc.

**For patty paper:**

- Use your straight edge to draw a line on patty paper.
- Draw a point, A, not on the line.
- Fold the paper at point A and make sure the line folds onto itself.
- Crease the paper.
- Unfold the patty paper.
- Fold the patty paper the other way at point A and make sure the new line folds onto itself.
- Crease the paper.
- Unfold and use a straight edge to mark the creased line.

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## Homework:

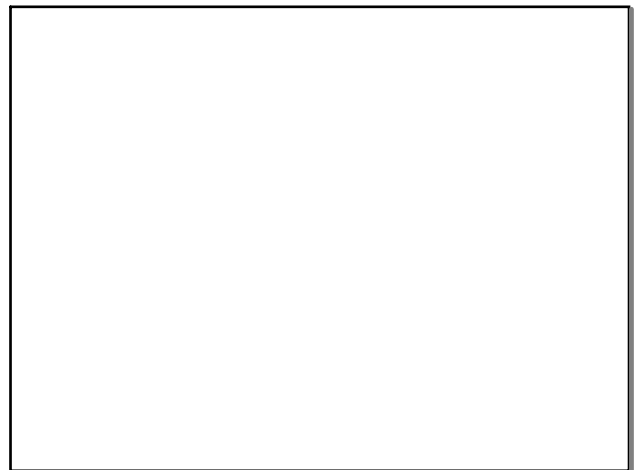
**Complete Next Pages in Construction Notebook:**

- Perpendicular Line Through a Point on a given line
- Perpendicular Line Through a Point not on a given line
- Perpendicular Bisector of a Line Segment
- Parallel Line

On-line and textbook help references: p. 3-10

- <<http://www.mathopenref.com/tocs/constructiontoc.html>>
- <<http://www.mathopenref.com/constructions.html>>
- <<https://www.khanacademy.org/math/geometry/geometric-constructions>>

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