### Distance Learning Adaptation (DLA) Document\* \*\*Weekly Assignment Template: The Paper Inch Cover Page: Student Version

# **Recommended Pacing Guide:**

Review opening instructions by **Monday morning** Participated in optional Zoom conversation for Q and A on **Tuesday afternoon** Complete Check for Understanding questions on **Wednesday afternoon** Participate in optional Zoom conversation to close on **Friday morning** Complete all work by **Friday afternoon** 

Lesson Title:	Geometry Constructions (Math / CTE)
Objectives [standards-aligned]:	<ul> <li>Next Generation Science Standards</li> <li>SEP.UMCT.MKS.U Use mathematical representations of phenomena or design solutions to support and revise explanations.</li> <li>California English Common Core Standards</li> <li>RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text</li> <li>RST.9-10.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9—10 texts and topics.</li> <li>Math Common Core Standards</li> <li>CCSS.Math.Content.HSG-MG.A.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).★</li> <li>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; bisector of a line segment; and constructing a line parallel to a given line through a point not on the line</li> <li>Related Instructional Objectives (SWBAT)</li> <li>Upon successful completion, students will be able to use geometric shapes to describe objects and create the main Geometry Constructions.</li> </ul>
Essential Question:	Can you construct a line or a triangle without a ruler?
Attachments and Resources	<ol> <li>Learn three basic constructions video</li> <li>Worksheet on Geometry Constructions, Bisecting an Angle</li> <li>Worksheet on Geometry Constructions, Perpendicular Bisector</li> <li>Constructions, Create Triangles</li> <li>Constructions, Parallel Lines</li> <li>Multiple Choice Constructions Quiz</li> </ol>
Tools for implementation	<ol> <li>Compass</li> <li>Straight Edge or stiff object with straight edge (3X5 card)</li> <li>Pencil and Paper</li> <li>Tape and String</li> </ol>
Deliverables and due dates:	<ol> <li>Worksheet on Geometry Constructions, Bisecting an Angle</li> <li>Worksheet on Geometry Constructions, Perpendicular Bisector</li> <li>Constructions, Create Triangles</li> <li>Constructions, Parallel Lines</li> </ol>

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## Hook: Bisecting an Angle With String

Estimated time: 5 to 10 minutes

**Opening Instructions:** 

- 1. Use the tape and create a few different angles on the desk or table where you are working (2 to 3 feet long). **Note:** The tape can be any angle and make the tape pieces as long as possible.
- 2. Now bisect the angle accurately.
- Note: You can try to use a compass or protractors but they may be inaccurate on angles of this size
- 3. If you cannot be accurate may I suggest you use string pull the string tight while holding it fixed on the vertex of the angle.
- 4. With the string stretched tight use, you pencil to mark equidistant points on each side of the angle with an arc.
- 5. From these marks, create another set of equal arcs using the string that cross in the inside of the angle. Note: Where these arcs bisect will be the midpoint of the angle.
- 6. Now that they have found this point, place a piece of tape from this point to the vertex of the angle.
- If you can take pictures of your bisected angles and ask, other classmates if they look correct in a text or email. Note: You may also use the Google Classroom or other collaborative classroom applications to get feedback from all of your classmates. Your instructor will see this also.

# **Reference Terminology:**

Bisecting an Angle

To draw an arc that is centered at the vertex of the angle. This arc can have a radius of any length. However, it must intersect both sides of the angle. We will call these intersection points P and Q This provides a point on each line that is an equal distance from the vertex of the angle.

## Optional class meeting [day], [time] and [link\_\_\_\_\_\_

**Variability and Accessibility:** Students can read printed instructions and send a message or call teacher and/or peers with questions.

# Guided Practice: Main Activity and/or Project Instructions

Activity/Project: Creating a Drawing Creating Constructions Estimated time: 45 to 90 minutes Instructions:

There are many different types of compasses; you should find one that works well for you.

I like to put a folder under my work before I use the compass. Hold the compass lightly and if you are having trouble drawing arcs, keep the compass steady and rotate the paper.







The straightedge is only for drawing straight lines; if you use a ruler ignore the markings on the ruler. A drafting triangle is great to use as a straight edge.

**Note:** If you do not have a straight edge or ruler, any stiff item with straight sides may be used (large piece of cardboard or construction paper, piece of wood or metal)

In this video you will learn three of the basic constructions:

- 1. Construct an equilateral triangle
- 2. Bisect an angle
- 3. Construct parallel lines given a transversal
- Watch the video to see how to do these three constructions

Note: If you do not have video access the lessons below are instructions for the same activities.

## **Students Construct Three Basic Constructions**

Using you compass and straight edge perform the following constructions as guided by the instructions

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• Line segment copy 1. Start by drawing line segment PQ that we will copy. Þ Ρ 2. Mark a point R that will be one endpoint of the new line segment. Ř 3. Set the compasses' point on the point P of the line segment to be copied. Ř 4. Adjust the compasses' width to the point Q. The compasses' width is now equal to the length of the line segment PQ.

5. Without changing the compasses' width, place the compasses' point on the point R on the line you drew in step 1



6. Without changing the compasses' width, draw an arc roughly where the other endpoint will be.

7. Pick a point S on the arc that will be the other endpoint of the new line segment.

8. Draw a line from R to S.

9. Done. The line segment RS is equal in length (congruent to) the line segment PQ.

- 1. Start by drawing a line and point K on that line.
- 2. Set the compasses' width to a medium setting. The actual width does not matter.
- 3. Without changing the compasses' width, mark a short arc on the line at each side of the point K, forming the points P,Q. These two points are thus the same distance from K.
- 4. Increase the compasses to almost double the width (again, the exact setting is not important).

6. Without changing the compasses' width repeat from the point Q so that the two arcs cross each

Using the straight edge, draw a line from

other, creating the point R.

K to where the arcs cross.

5. From P, mark off a short arc above K



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line at K

- Equilateral Triangle
- 1. Start by drawing line segment AB, this will be the length of the sides of the desired equilateral triangle.

2. Pick a point P that will be one vertex of the finished triangle.

3. Place the point of the compasses on the point A and set its drawing end to point B. The compass is now set to the length of the sides of the finished triangle.

Note: Do not change the compass from here on.

4. With the compasses' point on P, make two arcs, each roughly where the other two vertices of the triangle will be.



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5. On one of the arcs, mark a point Q that will be a second vertex of the triangle. It does not matter which arc you pick, or where on the arc you draw the point.

6. Place the compasses' point on Q and draw an arc that crosses the other arc, creating point R.

7. Using the straightedge, draw three lines linking the points P, Q and R.

8. Done. The triangle PQR is an equilateral triangle. Its side length is equal to the distance AB.



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#### • Angle Bisector

1. Start by drawing angle PQR that we will bisect. **Note:** It can be any angle

2. Place the compasses' point on the angle's vertex Q.



3. Adjust the compasses to a medium wide setting. The exact width is not important.

4. Without changing the compasses' width, draw an arc across each leg of the angle.

5. The compasses' width can be changed here if desired. **Recommended:** leave it the same.

Place the compasses on the point where one arc crosses a leg and draw an arc in the interior of the angle.

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6. Without changing the compasses setting, repeat for the other leg so that the two arcs cross.



R

7. Using a straightedge or ruler, draw a line from the vertex Q to the point where the arcs cross

8. Done. This is the bisector of the angle PQR



#### • Parallel Lines

1. Start by drawing line PQ and a point R off the line.

- Draw a transverse line through R and across the line PQ at an angle, forming the point J where it intersects the line PQ.
   Note: The exact angle is not important.
- 3. With the compasses' width set to about half the distance between R and J, place the point on J, and draw an arc across both lines.
- 4. Without adjusting the compasses' width, move the compasses to R and draw a similar arc to the one in step 2.

- 5. Set compasses' width to the distance where the lower arc crosses the two lines.
- 6. Move the compasses to where the upper arc crosses the transverse line and draw an arc across the upper arc, forming point S.



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7. Draw a straight line through points R and S.



8. Done. The line RS is parallel to the line PQ

## More Practice with Constructions

Students will complete the attached worksheet: **Constructions Bisect an angle**. Students will only use a compass and straightedge and show all the arcs needed to create the bisectors.

### **Reference Terminology:**

Concurrency in geometry means a place where three or more lines cross at a single point. If all lines do then the lines are considered concurrent.

The Incenter if a triangel is a the point where the three angle bisectors intersect. It is also the center of the triangles incircle.

Students will complete the attached worksheet: Constructions Triangles.

Students will complete the attached worksheet: Constructions Parallel Lines.

Variability and Accessibility: Students can read printed instructions and complete assigned activities in a notebook.

## Check for Understanding and Engagement

#### Key questions:

- 1. What is Geometric Construction?
- 2. Can you construct these geometric elements?
- Copy a line segment
- Perpendicular Bisector
- Equilateral Triangle
- Bisect an angle
- Parallel lines

Variability and Accessibility: Students can record responses in a notebook, or a voice recording.

# **Closing and Extension Activities**

Closing Activity: Multiple Choice Constructions Quiz

Estimated time: 15 to 30 minutes Assessment

1. Complete the "Multiple Choice Constructions Quiz"

Optional class meeting [day], [time] and [link\_\_\_\_\_]

**Variability and Accessibility:** Students can read printed instructions. Students are provided with printed extension activities and able record responses in a notebook.

### **Additional Resources:**

#### **Resources and Materials**

- 1. ZOOM Meetings or other video meeting application as noted in the lesson plan (make this a link to the online video meeting)
- 2. Email [Teachers email here]
- 3. Google Classroom or other collaborative classroom applications (make this a link to the classroom application)

Variability and Accessibility: Students can read relatable articles / worksheets that are printable.