7

Mathematics

Quarter 3: Week 3 – Module 3

Basic Geometric Constructions

AIRs - LM

Mathematics Grade 7

Quarter 3: Week 3 - Module 3: **Basic Geometric Constructions**

First Edition, 2021

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Target

If you look around you will see different objects with different shapes. You are familiar with the different geometric shapes. How are these shapes constructed? Construction in geometry means to draw shapes, angles or lines accurately. These constructions use only compass, straightedge (i.e. ruler) and a pencil.

This module will help you master basic geometric constructions. The scope of this module will prepare you to understand higher Geometry.

After going through this module, you are expected to:

Learning Competency:

use a compass and straightedge to bisect line segments and angles and construct perpendiculars and parallels (**M7GE-IIId-e-1**)

Before going on, check how much you know about this topic.

PRE – ASSESSMENT

***Directions*:** Select the letter of the correct answer. Write your answer on a separate sheet of paper.

1. Which of the following is defined as drawing shapes, angles and lines accurately?

   A. building construction B. geometric construction
   C. industrial construction D. object construction

2. What instrument has two arms and is used for drawing circles and arcs?

   A. compass B. protractor C. ruler D. straightedge

3. Which object is an example of a straightedge used to draw straight lines?

   A. ball B. box C. needle D. ruler

4. It is a ray through the vertex and interior that divides an angle into two angles of equal measures. What is it?

   A. angle bisector B. angle pair
   C. perpendicular bisector D. segment bisector

5. Which of the following is a point that divides a line segment into two equal parts?

   A. endpoint B. interior C. midpoint D. vertex

6. What do you call a perpendicular line that bisects another line at its midpoint?

   A. perpendicular axis B. perpendicular bisector
   C. transversal line D. vertical line

7. What lines are equidistant from each other and never intersect?

   A. parallel B. perpendicular
   C. transversal D. vertical

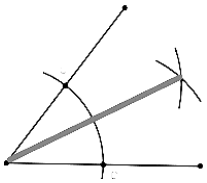
8. What is/are formed if you bisect an angle?

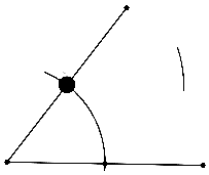
   A. a line crossed by another line
   B. an angle with line in the interior
   C. two angles with equal measures
   D. two line-segments with equal measures

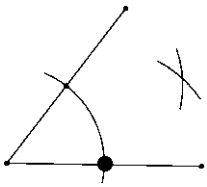
9. What is/are formed if you bisect a line-segment?

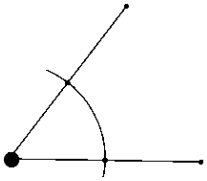
   A. a line crossed by another line
   B. an angle with line in the interior
   C. two angles with equal measures
   D. two line-segments with equal measures

10. Which picture illustrates a bisected angle?

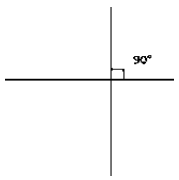
A. 

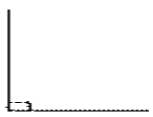
B. 

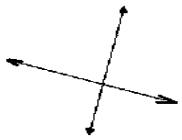
C. 

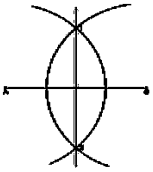
D. 

11. Which picture illustrates a perpendicular bisector?

A. 

B. 

C. 

D. 

12. Which picture illustrates parallel lines?

A. 

B. 

C. 

D. 

13. What will you do to bisect an angle?

I.	Draw a line from the vertex to the point where the arcs cross.
II.	Place the compasses' point on the angle's vertex. Draw an arc across each leg of the angle.
III.	Place the compasses' point on the point where one arc crosses a leg and draw an arc in the interior of the angle. Without changing the compasses' setting repeat for the other leg so that the two arcs cross.

A. I, II, III B. II, I, III C. II, III, I D. III, II, I

14. What are the steps in constructing a perpendicular bisector?

I.	Again, without changing the compasses' width, place the compasses' point on the other end of the line. Draw an arc above and below the line so that the arcs cross the first two.
II.	Set the compasses' width to approximately two thirds the line length. Without changing the compasses' width, draw an arc above and below the line.
III.	Using a straightedge, draw a line between the points where the arcs intersect.

A. I, II, III B. II, I, III C II, III, I D. III, II, I

15. To construct a line parallel to another line through a given point, what will you do?

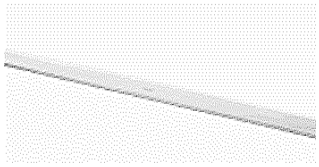
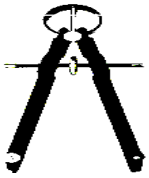
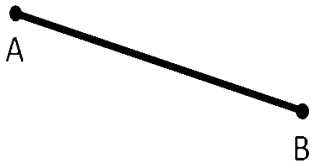
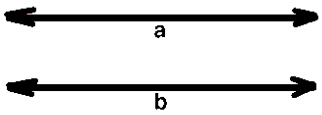
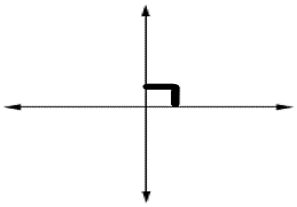
I.	Draw a transverse line through the given point and any point on the given line.
II.	Construct a copy of the angle formed by the transversal and the given line such that the vertex is the given point.
III.	Draw the line to complete the angle. This line is parallel to the given line.

A. I, II, III B. II, I, III C. III, I, II D. III, II, I

Jumpstart

Match Me!

Directions: *Match the terms in column A to its corresponding picture in column B. Write the letter of the picture on the corresponding number. Do this on a separate sheet of paper.*

A		**B**
1. Line segment	A.	
2. Parallel lines	B.	
3. Perpendicular lines	C.	
4. Compass	D.	
5. Straightedge	E.	

Discover

Lesson 1	**Basic Geometric Constructions**

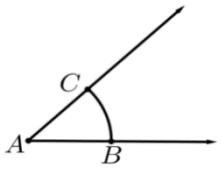
A **compass** is an instrument used for drawing circles and arcs. It consists of two legs, one with a pencil and one with a pointy part. A **straightedge** is a tool used to draw straight lines. Using a compass and a straightedge, you can do basic construction in Geometry.

Construction 1: Angle-Bisector

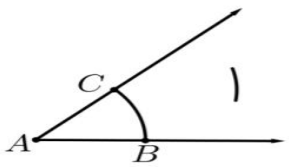
The **bisector of an angle** is the ray through the vertex and interior of the angle which divides the angle into two angles of equal measures.

Given: $\angle A$

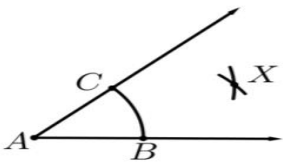
Locate points B and C on each side of $\angle A$ so that $AB = AC$. This can be done by drawing an arc of a circle with center at A.



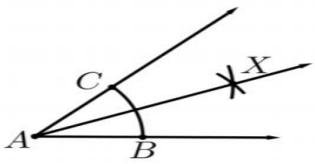
Construct: Ray AX such that X is in the interior of ∠BAC and ∠BAX =∠XAC



Step 1: Using C as the center and any radius r which is more than half of arc BC, draw an arc of a circle in the interior of ∠A



Step 2: Using B as center, construct an arc of the circle with the same radius r and intersecting the arc in the preceding step at point X.

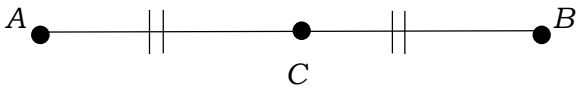


Step 3: The bisector of ∠BAC is ray AX.

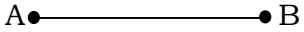
Construction 2: Perpendicular Bisector of a Line-Segment

A **line segment** has two endpoints. It has a starting point and an ending point. A **bisector** divides in halves or two equal parts. Thus, a **line segment bisector** is a point, a line, a ray, or a segment that divides another line segment at its midpoint.

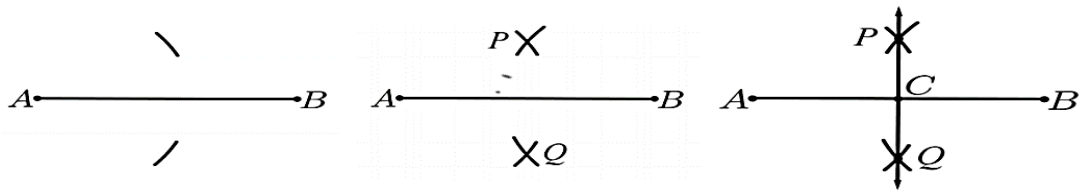
The **midpoint** of a line segment is the point on the line segment that divides it into two equal parts. This means that the midpoint of the segment *AB* is the point *C* on *AB* such that *AC* = *CB*.



The **perpendicular bisector** of a line segment is the line perpendicular to the line segment at its midpoint.

Given: Segment AB 

Construct: The midpoint *C* of *AB* and the perpendicular bisector of *AB*.



Step 1: Using center *A* and radius *r* which is more than half of *AB*, draw two arcs on both sides of $\overline{AB}$.

Step 2: Using center *B* and radius *r*, draw arcs crossing the two previously drawn arcs at points *P* and *Q*.

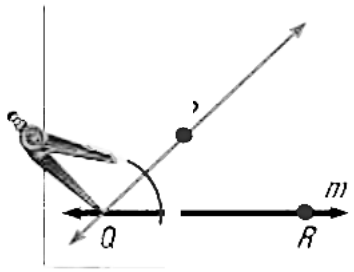
Step 3: Line segment PQ is the perpendicular bisector of $\overline{AB}$ and the intersection of $\overline{PQ}$ with $\overline{AB}$ is the midpoint C.

Construction 3: Parallel Lines

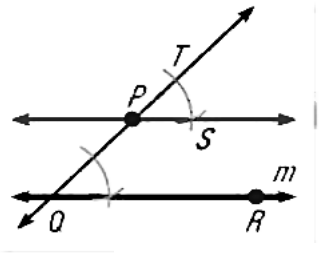
Lines are **parallel** if they keep fixed distance and never meet.

Given: line ***m***

Construct: line parallel to ***m*** through a given point ***p***



Step 1: Draw points Q and R on m. Draw $\overleftrightarrow{PQ}$. Draw an arc with the compass point at Q so it crosses $\overleftrightarrow{QP}$ and line $\overleftrightarrow{QR}$.



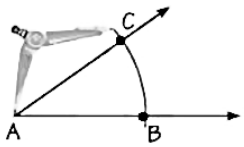
Step 2: Copy $\angle PQR$ on $\overleftrightarrow{QP}$. Be sure the two angles are corresponding. Label the new angle $\angle TPS$. Draw $\overleftrightarrow{PS}$. $\overleftrightarrow{PS} \parallel \overleftrightarrow{QR}$.

Explore

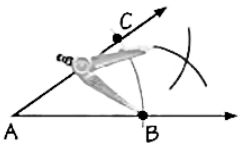
Activity 1: Try this!

***Directions*:** *Use a compass and a straightedge to do the following. Do these on short bond paper.*

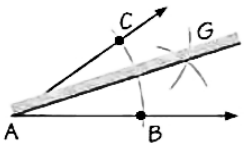
A. Use the following steps to bisect the given angles.



Step 1

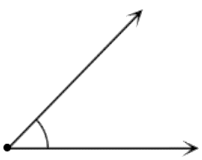


Step 2

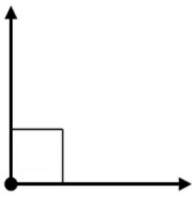


Step 3

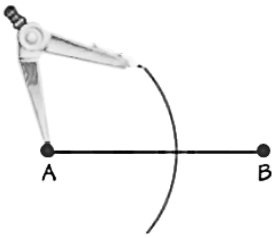
1.



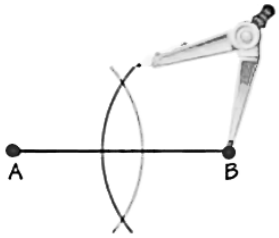
2.



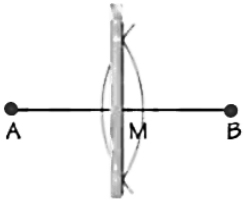
B. Use the following steps to bisect the given segments.



Step 1



Step 2

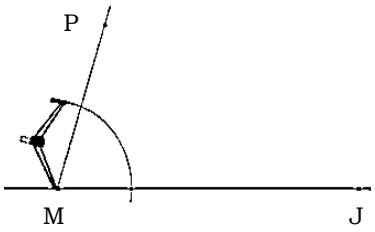


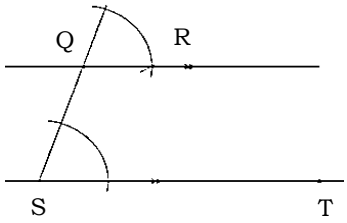
Step 3

3. *C* *D*

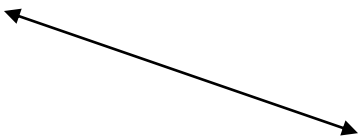
4. *E* *F*

C. Use the following steps to draw a line parallel to *n*.





5. *n*



Activity 2: Step by step!

Directions: Arrange the following steps by writing numbers 1,2, or 3 before the sentence. Do this on a separate sheet of paper.

A. To bisect an angle,

____Draw a line from the vertex to the point where the arcs cross.

____Place the compasses' point on the angle's vertex. Draw an arc across each leg of the angle.

____Place the compasses' point on the point where one arc crosses a leg and draw an arc in the interior of the angle. Without changing the compasses' setting repeat for the other leg so that the two arcs cross.

B. To construct a perpendicular bisector,

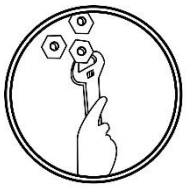
____ Again, without changing the compasses' width, place the compasses' point on the other end of the line. Draw an arc above and below the line so that the arcs cross the first two.

____ Set the compasses' width to approximately two thirds the line length. Without changing the compasses' width, draw an arc above and below the line.

____ Using a straightedge, draw a line between the points where the arcs intersect.

C. To construct a line parallel to another line through a given point,

____ Draw a transverse line through the given point and any point on the given line.
____ Construct a copy of the angle formed by the transversal and the given line such that the vertex is the given point.
____Draw the line to complete the angle. This line is parallel to the given line.



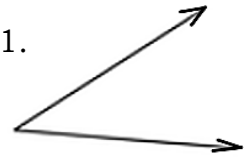
Deepen

It's Construction Time!

Directions: Use a compass and a straightedge to do the following. Do these on short bond paper.

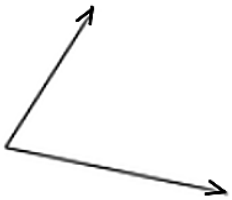
A. Construct the bisector of each angle.

1.

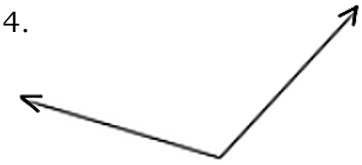


2.

3.



4.



B. Construct the perpendicular bisector of each flat bar.

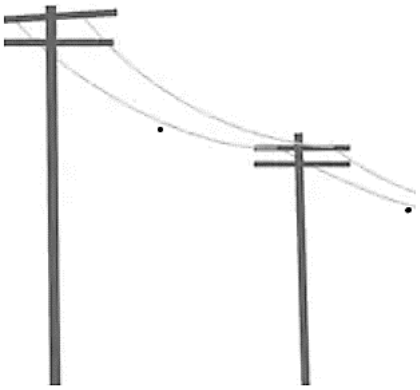
5.

6.

7.

8.

C. Draw a line parallel to the post through the given point.



9. 10.

Gauge

Directions: Read each statement below carefully. Choose the letter of the correct answer answer. Write your answer on a separate sheet of paper.

1. Which of the following is a two-legged instrument used for drawing circles and arcs?

   A. compass B. protractor C. ruler D. straightedge

2. Which of the following object is used to draw straight lines?

   A. ball B. box C. straightedge D. table

3. What do you call a ray through the vertex and interior that divides the angle into two angles of equal measures?

   A. adjacent angle B. angle bisector

   C. perpendicular bisector D. segment bisector

4. What of the following divides a line segment into two equal parts?

   A. endpoint B. interior C. midpoint D. vertex

5. What perpendicular line bisects another line at its midpoint?

   A. perpendicular axis B. perpendicular bisector
   B. transversal line D. vertical line

6. What do you call lines that keep a fixed distance from each other and never intersect?

A. parallel B. perpendicular

C. transversal D. vertical

7. If you bisect an angle, what is/are formed?

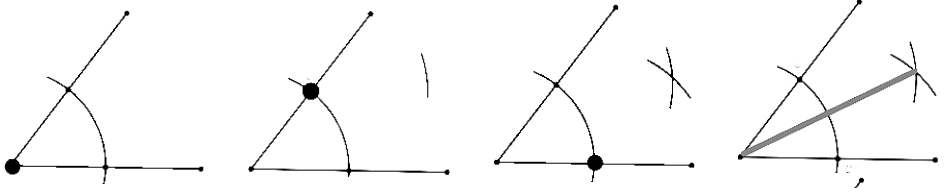
A. a line crossed by another line
B. an angle with line in the interior
C. two angles with equal measures
D. two line-segments with equal measures

8. If you bisect a line segment what is/are formed?

A. a line crossed by another line
B. an angle with line in the interior
C. two angles with equal measures
D. two line-segments with equal measures

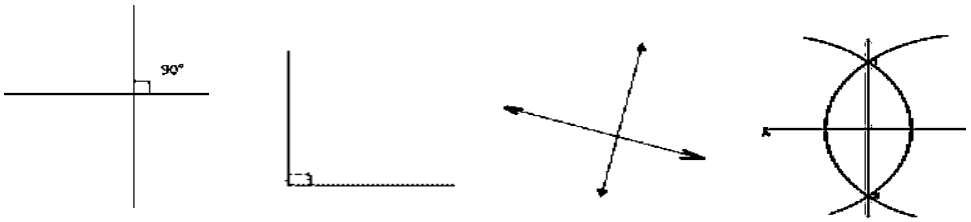
9. You are asked to bisect an angle. What should it look like?

A. B. C. D.



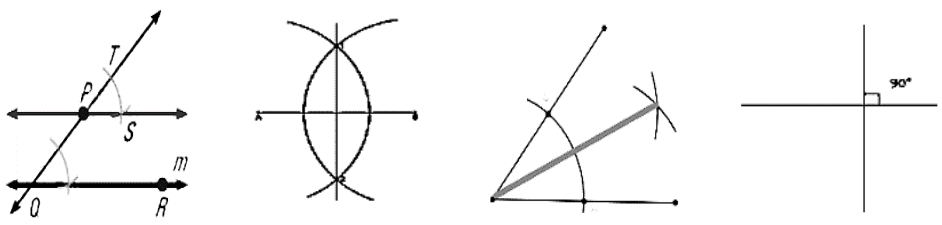
10. You are asked to construct a perpendicular bisector. What should it look like?

A. B. C. D.



11. You are asked to draw a line parallel to a given line through a given point? What should it look like?

A. B. C. D.



12. How do you bisect an angle?

I.	Place the compasses' point on the angle's vertex. Draw an arc across each leg of the angle.
II.	Draw a line from the vertex to the point where the arcs cross.
III.	Place the compasses' point on the point where one arc crosses a leg and draw an arc in the interior of the angle. Without changing the compasses' setting repeat for the other leg so that the two arcs cross.

A. I, II, III B. I, III, II C. II, III, I D. III, II, I

13. How do you construct a perpendicular bisector?

I.	Again, without changing the compasses' width, place the compasses' point on the other end of the line. Draw an arc above and below the line so that the arcs cross the first two.
II.	Using a straightedge, draw a line between the points where the arcs intersect.
III.	Set the compasses' width to approximately two thirds the line length. Without changing the compasses' width, draw an arc above and below the line.

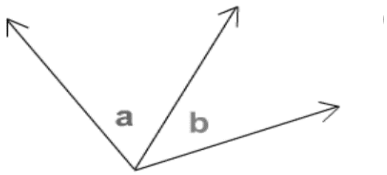
A. I, II, III B. II, III, I C. III, I, II D. III, II, I

14. How do you construct a line parallel to another line through a given point?

I.	Construct a copy of the angle formed by the transversal and the given line such that the vertex is the given point.
II.	Draw a transverse line through the given point and any point on the given line.
III.	Draw the line to complete the angle. This line is parallel to the given line.

A. I, II, III B. II, I, III C. III, I, II D. III, II, I

15. Juan bisected an angle, and it looked like the figure below. Is his drawing correct?



A. Yes, it is perfectly done.
B. Yes, but there should be marks.
C. No, the angl bisector should be in center.
D. No, the angles formed are not of equal measures.

References

A. Books

Mathematics – Grade 7 Learners' Material. DepEdIMCS, First Edition, 2013. ISBN:978-971-9990-60-4

B. Online Resources

https://www.mathleague.com

https://www.mathsisfun.com

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