7

Mathematics

Quarter 3: Week 7 – Module 7
Construction of Polygons

AIRs - LM

Mathematics Grade 7

Quarter 3: Week 7 - Module 7: **Construction of Polygons**

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Target

The word polygon was derived from the Greek word poly means “many” and gon meaning angles.

In this module you are going to construct polygons with your own.

After going through this module, you are expected to:

Learning Competency:

Constructs triangles, squares, regular pentagons, and regular hexagons **(M7GE-lllh-i-1)**

Subtasks:

1. Use compass and straightedge in constructing polygons.
2. Construct triangles, squares, regular pentagons and regular hexagons using compass and straightedge.

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

Pre-assessment

Choose the letter of the correct answer. Write your answer on a separate sheet of paper.

1. Which of the following triangle has side lengths of 4cm, 6cm and 9cm?

   A. Equilateral B. Equiangular C. Isosceles D. Scalene

2. What type of triangle has angle measures of 40, 50, 90?

   A. Acute B. Obtuse C. Reflex D. Right

3. Which of the following is a closed figure formed by joining line segments that meet only at their endpoints?

   A. Line B. Plane C. Polygon D. Ray

4. Which of the following is a characteristic of a polygon?

   A. It has an opening. B. It has a curve side.

   C. It is a closed figure. D. It has overlapping sides.

5. Which of the following is a five-sided polygon?

   A. Hexagon B. Pentagon C. Square D. Triangle

6. What is the sum of the measures of the exterior angles of a convex polygon?

   A. 90^0 B. 180^0 C. 270^0 D. 360^0

7. Each exterior angle of a regular polygon has a measure of 40. How many sides does the regular polygon have?

A. 8 B. 9 C. 10 D. 11

8. Which segment of the given lengths ***CANNOT*** be the side of the triangle?

A. 3cm, 4cm, 9cm
B. 4cm, 5cm, 6cm
C. 7cm, 9cm, 10cm
D. 10cm, 15cm, 18cm

9. Which of the following is ***NOT*** a property of a regular polygon?

A. It is concave.
B. It is convex.
C. It is equilateral.
D. It is equiangular.

10. What instrument is used in constructing polygons?

A. Compass
B. Graduated cylinder
C. Tape measure
D. Weighing scale

11. A straightedge can create a straight line, but can't measure. What can you say about the statement?

A. False
B. True
C. Neither True nor False
D. Cannot be determined

12. There are 6 points evenly spaced on a circle. Each of the segments connecting the six points must be the same length. What figure is formed?

A. Pentagon B. Hexagon C. Heptagon D Octagon

13. Inscribed in a circle means all the vertices are on the same circle. What can you say about the statement?

A. False
B. True
C. Neither True nor False
D. Cannot be determined

14. Which of the following is a device that can help create a circle with a given radius and can also help copy distances?

A. Compass B. Paper C. Straightedge D. Thermometer

15. You can construct some regular polygons by hand if you remember these things _____. Which of the following will make the statement true?

I. definitions II. properties III. qualities

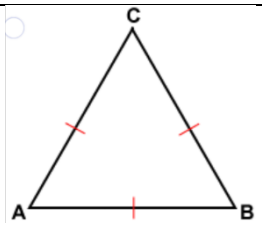
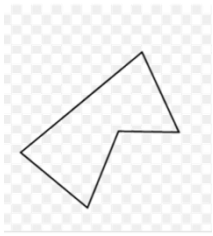
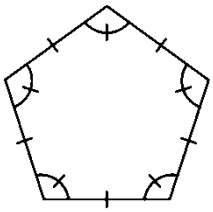
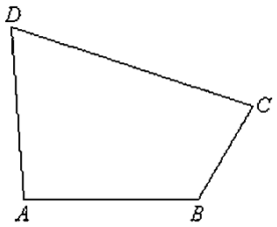
A. I and II B. I and III C. II and III D. I, II and III

Jumpstart

For you to understand the lesson well, a review on the different shapes is given as introduction in constructing a polygon.

Activity 1. Remember Me?

Directions: Complete the following table.

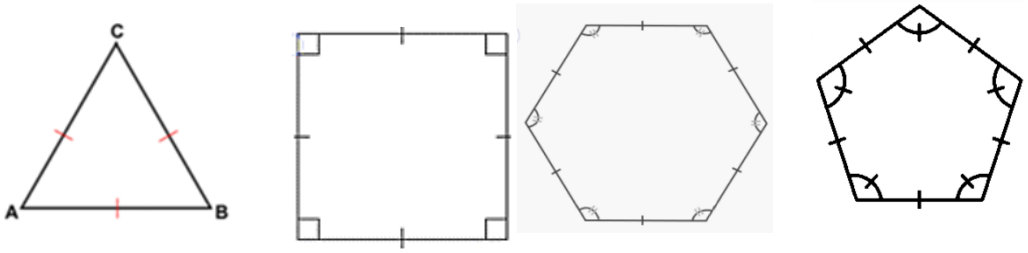
POLYGON	Regular or Irregular	Number of sides
		
		
		
		

Discover

This lesson will deal with construction of regular polygons using compass and straightedge.

WHAT IS A REGULAR POLYGON?

Regular polygons have equal sides and equal interior angles. Some examples of regular polygons are as follows:



HOW TO CONSTRUCT POLYGONS?

Constructions are step-by-step processes used to create accurate geometric figures. To create a construction by hand, there are some few tools that you can use:

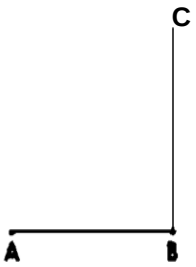
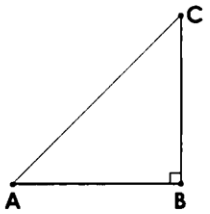
1. **Compass:** A device that allows you to create a circle with a given radius. Not only can compasses help you to create circles, but they can help you to copy distances.

2. **Straightedge:** Anything that allows you to produce a straight line. A straightedge should not be able to measure distances. An index card works well as a straightedge. You can also use a ruler as a straightedge, as long as you only use it to draw straight lines and not to measure.

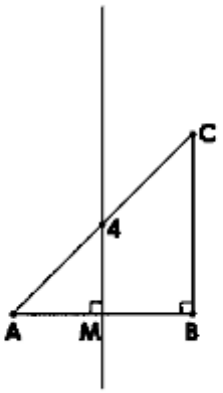
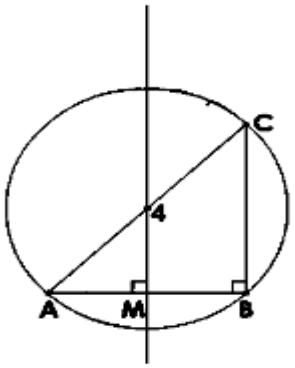
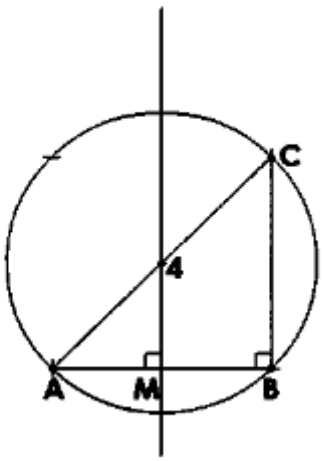
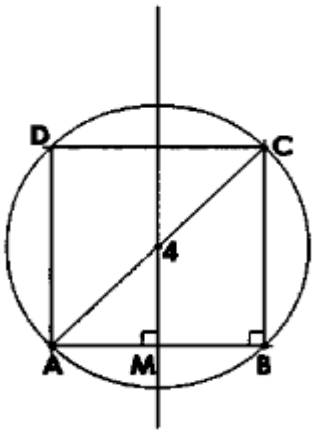
3. **Paper:** When a geometric figure is on a piece of paper, the paper itself can be folded in order to construct new lines.

You can construct **some** regular polygons by hand if you remember the definitions and properties of these regular polygons.

Construction of a Triangle

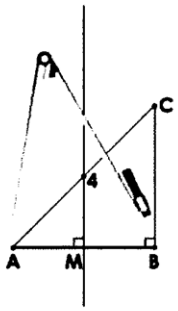
Draw line AB.  	Draw line perpendicular to AB and BC = AB. 
Join AC.  	

Construction of a Square

Copy the triangle (Construction of triangle). Draw a perpendicular bisector of AB at M. Name the point of intersection and AC as 4.  	Set a radius of A - 4 in a small bow compass/divider with 4 as center. Draw a circle. 
With A and B as centers, and radius AB draw arcs intersecting circle at C and D.  	Join ABCD to form a square. 

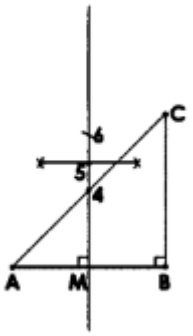
Construction of a Pentagon

Copy the triangle (Construction of triangle). With A or B as center, draw arc cutting bisector at 6.

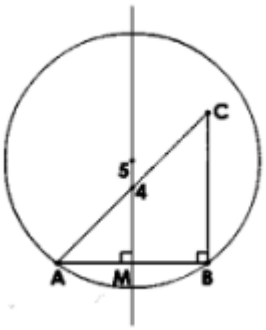


Find the midpoint of 4 and 6.

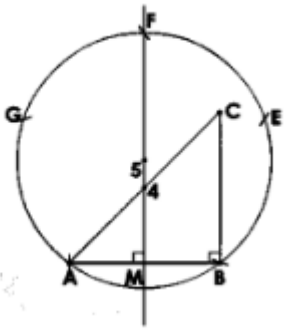
Name it as 5.



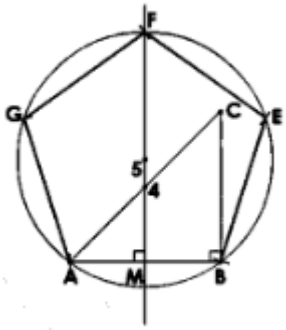
Set a radius of A - 5 in a small bow compass/divider with 5 as center. Draw a circle.



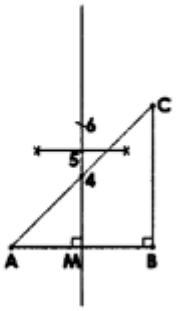
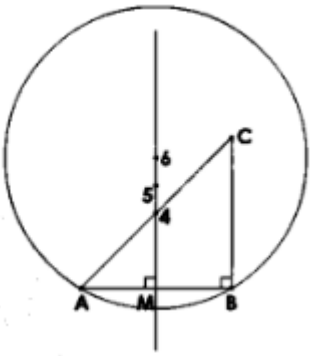
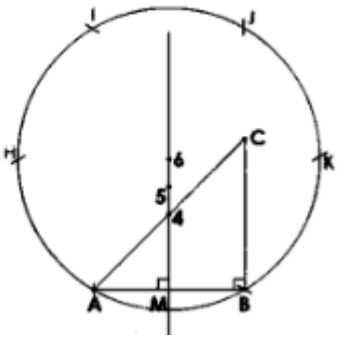
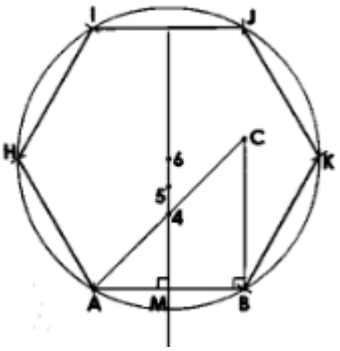
Move the compass point around the circle marking the remaining edges so that the circle now has 5 points. that are equidistant.



Join ABEFG to form a Pentagon.



Construction of Hexagon

Copy the triangle (Construction of triangle). With A or B as center, draw arc cutting bisector at 6. 	Set a radius of A - 5 in a small bow compass/divider with 5 as center. Draw a circle. 
Move the compass point around the circle marking the remaining edges so that the circle now has 6 points that are equidistant. 	Join ABKJIH to form a hexagon. 

If you noticed, it is easy for us to construct regular polygons if they are inscribed in a circle. “Inscribed in a circle” means all the vertices are on the same circle.

TRIVIA

Why didn’t Euclid just measure things with a ruler and calculate lengths?

For example, one of the basic constructions is bisecting a line (dividing it into two equal parts). Why not just measure it with a ruler and divide it into two?

The Greeks could not do arithmetic. They had only whole numbers, no zero, and no negative numbers. They could not for example divide 5 by 2 and get 2.5, because 2.5 is not a whole number – the only kind they had.

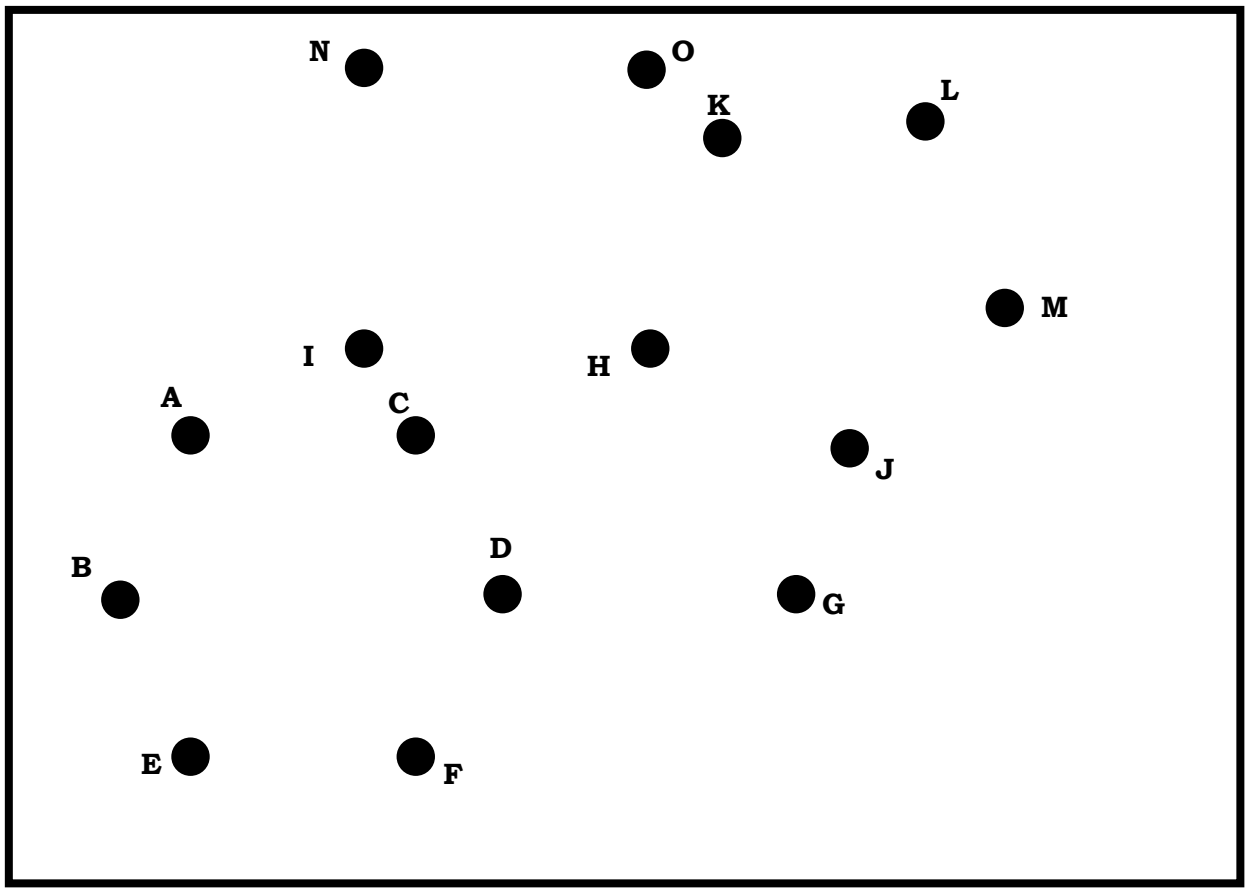
So, faced with the problem of finding the midpoint of a line, they could not measure it and divide by two. They had to have other ways, and this lead to the constructions using compass and straightedge or ruler. It is also why the straightedge has no markings. It is definitely not a graduated ruler, but simply a pencil guide for making a straight line. Euclid and the Greeks solved problems graphically, by drawing shapes, as a substitute for using arithmetic.

Explore

Here are some enrichment activities for you to work on to master and strengthen the basic concepts you have learned from this lesson.

Activity 2: **What Figure Am I?**

Connect the dots by a line a segment to form a figure. Answer the questions that follow.



What figure is formed if you connect

1. N → O → H → I → N?

   _____

2. B → A → C → D → F → E → B?

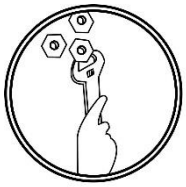
   _____

3. H → G → D → H?

   _____

4. H → J → M → L → K → H?

   _____



Deepen

Activity 3: **I Can Do This!**

Directions: Construct a polygon using the given measure.

1. Construct a triangle ABC with side lengths AB = 9cm, AC = 5cm and BC = 7cm.	4. Construct a triangle with side equal to 3 inches.
2. Construct a square with side equal to 3 inches.	5. Construct a regular pentagon with side equal to 3 inches.
3. Construct a regular hexagon with side equal to 3 inches.	

Gauge

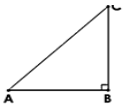
Directions:

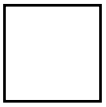
For numbers 1 – 3, Use the following figure to construct the required figure.

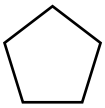
a = 0.5 in *b = 1 in* *c = 1.5 in*

1. Which of the following is an equilateral triangle whose sides have lengths equal to a?

A. 

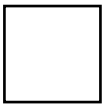
B. 

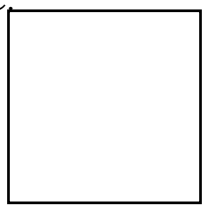
C. 

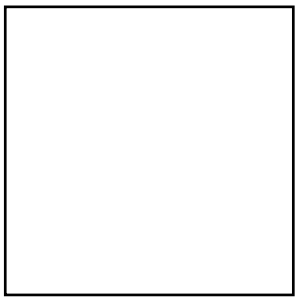
D. 

2. Which of the following is a square whose length is equal to c?

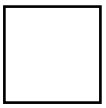
A. 

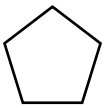
B. 

C. 

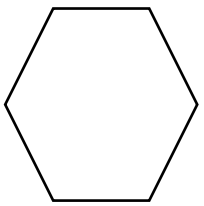
D. 

3. Which of the following a hexagon with side lengths equal to b?

A. 

B. 

C. 

D. 

4. Which is a step-by-step processes used to create accurate geometric figures?

A. Art B. Construction C. Drawing D. Sketching

5. You can construct some regular polygons by hand if you remember these things _____. Which of the following will make the statement true?

I. definitions II. properties III. qualities IV. quantities

A. I B. I and II C.III D. III and IV

6. Which of the following is used to create a construction by hand?

A. Compass B. Paper C. Straightedge D. Thermometer

7. A straightedge can be a/an _____. Which of the following will make the statement true?

A. Compass B. Folder C. Index Card D. ruler

8. Construction of a polygon will be easy if they are inscribed in a _____. Which of the following will make the statement true?

A. Circle B. Hexagon C. Square D. Triangle

9. Which device can help you create a circle with a given radius and can also help you copy distances?

A. Compass B. Paper C. Straightedge D. Thermometer

10. Draw line DJ. Draw line perpendicular to DJ and JG = DJ. Join DG. What kind of triangle is formed?

A. Equilateral triangle B. Isosceles triangle

C. Right triangle D. Scalene triangle

11. There are 8 points evenly spaced on a circle. Each of the segments connecting the eight points must be the same length. What figure is formed?

A. Pentagon B. Hexagon C. Heptagon D. Octagon

12. How do you arrange the steps in constructing triangles?

I. Draw line perpendicular to BC and CD = BC.
II. Draw line BC.
III. Join BD.

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

13. How many points will you evenly spaced on a circle to draw a heptagon?

A. 5 B. 6 C. 7 D. 8

14. Which the following is ***NOT*** a step in constructing hexagon?

A. Draw a circle.

B. Join the 8 points to form a hexagon.

C. Set a radius in a small bow compass.

D. Move the compass point around the circle marking the remaining edges so that the circle now has 6 points.

15. What device are you going to use to connect the points on a circle to form a polygon?

A. Compass B. Watch C. Straightedge D. Thermometer

Great job! You are done with this module.

References

A. Printed Materials

E- Math Worktext in Mathematics Revised Edition by Orlando A. Oronce and Marilyn O. Mendoza

Mathematics in Focus, Grade 7, Workbook in Math Based on the K to 12 Curriculum by Dilao, Herrera and Tesorio

B. Online Resources

https://youtu.be/TAHczLelUTc