

Learning Targets-

9/11/20

- I can define Construction, compass, segment, \cong , arc, \perp , radius, intersect, ray, line, straightedge, and point
- I can make formal geometric constructions using a compass and a straightedge (Copying a segment & copying an \angle).

Introduction to Constructions

9/11/20

Constructions: The drawing of various shapes using only a pair of compasses and straightedge or ruler. No measurement of lengths or angles is allowed.

The word construction in geometry has a very specific meaning: the drawing of geometric items such as lines and circles using only compasses and straightedge or ruler. Very importantly, you are not allowed to measure angles with a protractor, or measure lengths with a ruler.

Compasses

Compasses are a drawing instrument used for drawing circles and arcs. It has two legs, one with a point and the other with a pencil or lead. You can adjust the distance between the point and the pencil and that setting will remain until you change it.

This kind of compass has nothing to do with the kind used find the north direction when you are lost. A compass used to find the north direction is usually referred to in the singular - a compass. The kind we are talking about here is usually referred to in the plural - compasses. This plural reference is similar to the way we talk about scissors - with an 's' on the end.

Straightedge

A straightedge is simply a guide for the pencil when drawing straight lines. In most cases you will use a ruler for this, since it is the most likely to be available, *but you must not use the markings on the ruler during constructions*. If possible, turn the ruler over so you cannot see them.

Why we learn about constructions

The Greeks formulated much of what we think of as geometry over 2000 years ago. In particular, the mathematician Euclid documented it in his book titled "Elements", which is still regarded as an authoritative geometry reference. In that work, he uses these construction techniques extensively, and so they have become a part of the geometry field of study. They also provide insight into geometric concepts and give us tools to draw things when direct measurement is not appropriate.



Why did Euclid do it this way?

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 by two?

One theory is the the Greeks could not easily do arithmetic. They had only whole numbers, no zero, and no negative numbers. This meant 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. Also, their numbers did not use a positional system like ours, with units, tens , hundreds etc, but more like the Roman numerals. In short, it was quite difficult to do useful arithmetic.

So, faced with the problem of finding the midpoint of a line, it was very difficult to do the obvious - measure it and divide by two. This led 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 straight lines. Euclid and the Greeks solved problems graphically, by drawing shapes instead of using arithmetic.

Name Key

Period _____



Unit 1 - Constructions

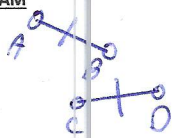
VOCABULARY LIST



Complete the following as we go through the different constructions

WORD Construction	DEFINITION A geometry figure created using only a pencil, compass, and straightedge
DIAGRAM There are many	

WORD Compass	DEFINITION An instrument for drawing circles and arcs and measuring distances between points
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WORD Segment or Line Segment	DEFINITION Part of a line that consists of 2 endpoints and all the points between them
DIAGRAM 	SYMBOL 

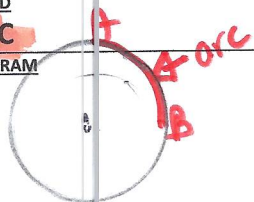

WORD Congruent	DEFINITION Having the same measure
DIAGRAM 	SYMBOL \cong $\times = \text{vs. } \cong$ • lengths are $=$ • segments are \cong proper notation ex $AB = CD$ ex $\overline{AB} \cong \overline{CD}$ Not $\overline{AB} \cong \overline{CD}$

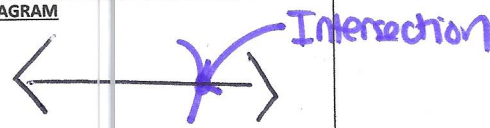
WORD Line	DEFINITION Geometric object that is straight and infinitely long
DIAGRAM 	SYMBOL  AB OR line l

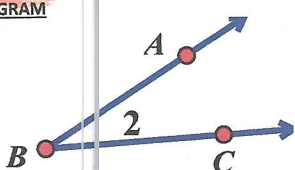
Equation - $d = \text{distance}$

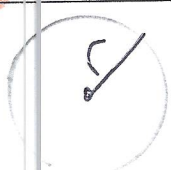
Straightedge - guide used to draw straight lines


WORD Vertex of an angle	DEFINITION Common endpoint of 2 rays
DIAGRAM 	


WORD ARC	DEFINITION part of the circumference of a circle
DIAGRAM 	SYMBOL 


WORD Intersection	DEFINITION where 2 things meet
DIAGRAM 	

WORD ANGLE	DEFINITION A figure that consists of two different rays that have the same initial point.
DIAGRAM 	SYMBOL $\angle ABC$ $\angle CBA$ $\angle B$ $\angle 2$

WORD Radius of a circle	DEFINITION Distance from center of the circle to any point on the circle
DIAGRAM 	

WORD Ray	DEFINITION line with an endpoint that extends infinitely in one direction
DIAGRAM 	SYMBOL \overrightarrow{AB}

WORD Altitude of a Triangle <i>height</i>	DEFINITION Segment through a vertex and \perp to the opposite side of the Δ .
DIAGRAM 	

WORD Point	DEFINITION Location represented by a dot
DIAGRAM 	

Name _____

Basic Constructions

Construction 1

To Copy a line segment

Given: \overline{AB}

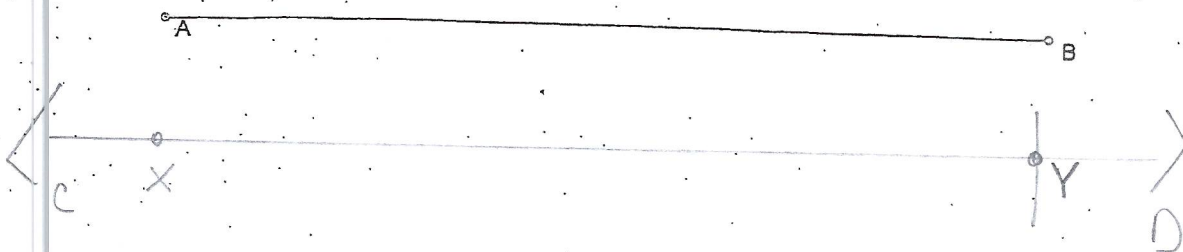
Construct: A line segment, \overline{XY} , congruent to \overline{AB}

Definition: Congruent -

How to proceed:

1. With a straightedge draw any line \overleftrightarrow{CD} , and mark a point, X on it.
2. On \overline{AB} , place the compass so that the point is at A and the pencil point is at B.
3. Keeping the setting on your compass, place the point at X and draw an arc intersecting \overleftrightarrow{CD} at Y.

Conclusion: $\overline{XY} \cong \overline{AB}$



Construction 2 To Copy an angle

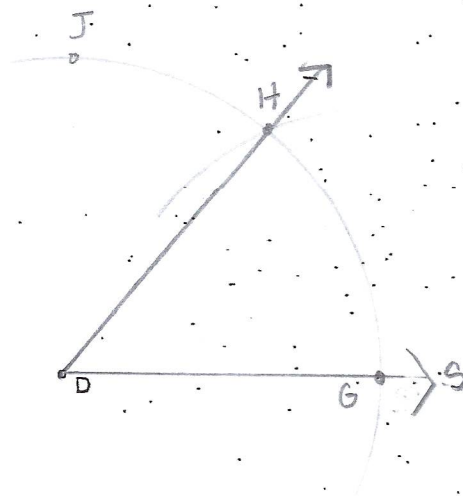
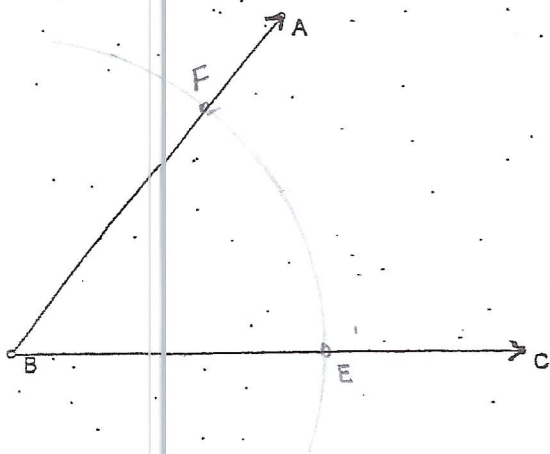
Given: $\angle ABC$ and point D

Construct: At a point D , an angle congruent to $\angle ABC$

How to proceed:

1. Through point D , draw any ray \overrightarrow{DS} .
2. With B as a center and any convenient radius, draw an arc that intersects \overrightarrow{BC} at E and \overrightarrow{BA} at F .
3. With D as a center and using the same radius as in step 2, draw an arc that intersects \overrightarrow{DS} at G . Label this arc \widehat{GJ} .
4. With the compass, measure distance EF . With G as a center and a radius whose length is EF , draw an arc that intersects \widehat{GJ} at H .
5. Draw \overrightarrow{DH} .

Conclusion: $\angle HDS \cong \angle ABC$



H.W. 1-3 Leave all construction marks

NAME: _____

1. Construct a line segment congruent to the given segment.



2. Construct an angle congruent to the given angle.



3. Construct an angle which is congruent to $\angle ABC$

