Unit 1-1 Geometric Definitions and Constructions
SUMMARY

Geometric Symbol	Interpretation	Example
$\angle$ or $\measuredangle$ or $\sphericalangle$	Angle	$\measuredangle ABC$
$\vartriangle$ or Δ	Triangle	ΔDEF
capital letter	Point	point A
$\leftrightarrow$	Line	$\overleftrightarrow{AB}$
$—$	Line Segment	$\overline{AB}$
$\rightarrow$	Ray	$\overrightarrow{AB}$
$\parallel$	Parallel	$\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$
$\perp$	Perpendicular	$\overline{AB} \perp \overline{CD}$
$\cong$	Congruent	$\overline{AB} \cong \overline{CD}$

Figures are congruent. Numerical values are equal.

Figures are congruent ($\cong$).
Segments are congruent. Angles are congruent. Triangles are congruent. The congruent symbol is used when referring to the actual physical entities (diagrams).

$$\overline{AB} \cong \overline{CD}$$
$$\sphericalangle ABC \cong \sphericalangle DEF$$
$$\Delta ABC \cong \Delta DEF$$

Numerical values are equal. ($=$)
When referring to a length or measure, the equal sign should be used. You speak of numbers as being equal (or not equal).

$$AB = CD$$
$$m\sphericalangle ABC = m\sphericalangle DEF$$

POINT

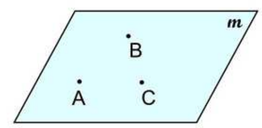
- a point indicates a location (or position) in space.
- a point has no dimension (actual size).
- a point has no length, no width, and no height (thickness).
- a point is usually named with a capital letter.

LINE (straight line)

- a line has no thickness.
- a line's length extends in one dimension.
- a line goes on forever in both directions.
- a line has infinite length, zero width, and zero height.
- a line is assumed to be straight.
- a line is drawn with arrowheads on both ends.
- a line is named by a single lowercase script letter, or by any two (or more) points which lie on the line.

PLANE

- a plane has two dimensions.
- a plane forms a flat surface extending indefinitely in all directions.
- a plane has infinite length, infinite width and zero height (thickness).
- a plane is drawn as a four-sided figure resembling a tabletop or a parallelogram.
- a plane is named by a single letter (plane m) or by three coplanar, but non-collinear,* points (plane ABC).

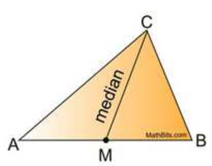


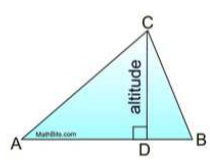
Plane *m* or Plane *ABC*.

Collinear points are points that lie on the same straight line.
Coplanar points are points that line in the same plane.

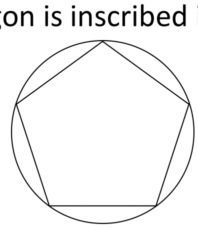
Definition: A median of a triangle is a segment joining any vertex of the triangle to the midpoint of the opposite side.

Definition: An altitude of a triangle is a segment from any vertex perpendicular to the line containing the opposite side.

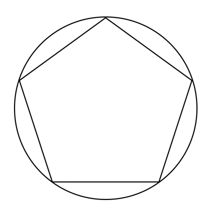




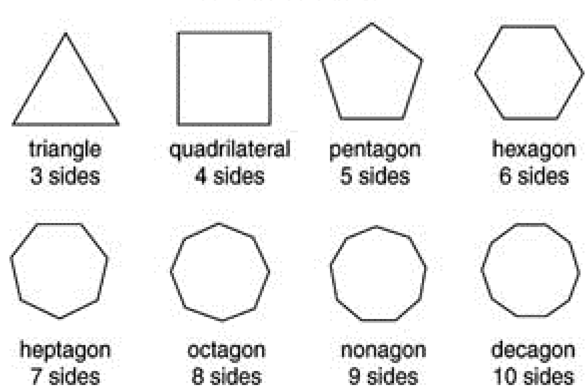
Inscribed:
The pentagon is inscribed in the circle.



Circumscribed:
The circle circumscribes the pentagon



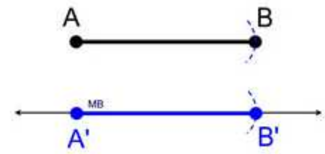
regular polygons



Constructions:

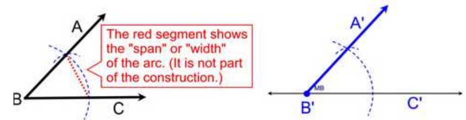
Copy a line segment

STEPS:
1. Using a straightedge, draw a reference line, if one is not provided.
2. Draw a dot on the reference line to mark your starting point for the construction.
3. Place the point of the compass on point *A* on the given figure.
4. Stretch the compass so that the pencil is exactly on *B*. Make a small arc through *B*.
(This small arc will show that you measured the length of the segment with your compass.)
5. Without changing the span of the compass, place the compass point on the starting point (dot) on the reference line and swing the pencil to create an arc crossing the reference line.



Copy an angle

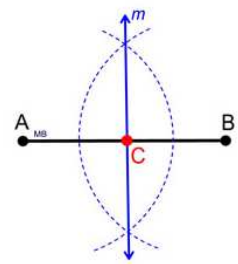
STEPS:
1. Using a straightedge, draw a reference line, if one is not provided.
2. Place a dot (starting point) on the reference line.
3. Place the point of the compass on the vertex of the given angle, $\angle ABC$ (vertex at point *B*).
4. Stretch the compass to any length that will stay "on" the angle.
5. Swing an arc so the pencil will cross BOTH sides (rays) of the angle.
6. Without changing the size of the compass, place the compass point on the starting point (dot) on the reference line and swing an arc that will intersect the reference line and go above the reference line.
7. Go back to the given angle $\angle ABC$ and measure the span (width) of the arc from where it crosses one side of the angle to where it crosses the other side of the angle. (Place a small arc to show you measured this distance.)
8. Using this width, place the compass point on the reference line where the previous arc crosses the reference line and mark off this new width on your new arc.
9. Connect this new intersection point to the starting point (dot) on your reference line.
10. Label your copy.



Bisect a line segment

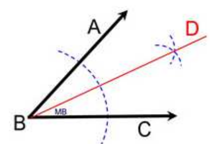
Note: This construction is also the construction for **Perpendicular Bisector of a Segment.**

STEPS:
1. Place your compass point on *A* and stretch the compass MORE THAN half way to point *B* (you may also stretch to point *B*).
2. With this length, swing a large arc that will go above and below $\overline{AB}$.
3. Without changing the span on the compass, place the compass point on *B* and swing the arc again. The two arcs need to be extended sufficiently so they will intersect in two locations.
4. Using your straightedge, connect the two points of intersection with a line or segment to locate point *C* which bisects the segment.



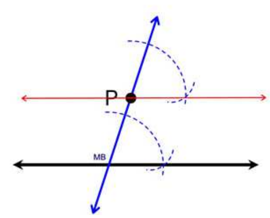
Bisect an angle

STEPS:
1. Place compass point on the vertex of the angle (point *B*).
2. Stretch the compass to any length that will stay ON the angle.
3. Swing an arc so the pencil crosses both sides (rays) of the given angle. You should now have two intersection points with the sides (rays) of the angle.
4. Place the compass point on one of these new intersection points on the sides of the angle. If needed, stretch the compass to a sufficient length to place your pencil well into the interior of the angle. Stay between the sides (rays) of the angle. Place an arc in this interior (it is not necessary to cross the sides of the angle).
5. Without changing the span on the compass, place the point of the compass on the other intersection point on the side of the angle and make a similar arc. The two small arcs in the interior of the angle should be intersecting.
6. Connect the vertex of the angle (point *B*) to this intersection of the two small arcs.
You now have two new angles of equal measure, with each being half of the original given angle.



Parallel - through a point

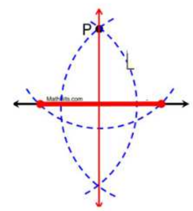
STEPS:
1. Using your straightedge, draw a transversal through point *P*. This is simply a straight line which passes through *P* and intersects with given line. Drawing the line slanted will make the construction easier than if you draw the line vertical. Be sure to draw the line well above *P*.
2. Using the construction COPY AN ANGLE, construct a copy of the angle formed by the transversal and the given line such that the copy will be located UP at point *P*. The vertex of the copied angle will be point *P*.
3. When you draw the line to complete the angle copy, you will be drawing a line parallel to the given line.



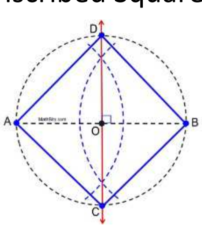
Perpendicular from a point ON a line.

Perpendicular from a point OFF a line.

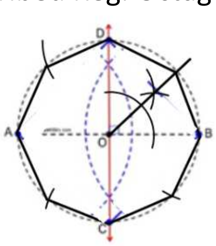
STEPS:
1. Place your compass point on *P* and swing an arc of any size that crosses the line twice.
2. Place the compass point on one of the two locations where the arc crossed the line and make a small arc below the line (on the side where *P* is not located).
3. Without changing the span on the compass, place the compass point on the other location where the first arc crossed the line and make another small arc below the line. The two small arcs should be intersecting (on the side of the line opposite of point *P*).
4. Using a straightedge, connect the intersection of the two small arcs to point *P*.



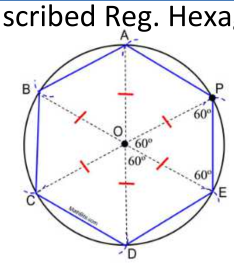
Inscribed Square



Inscribed Reg. Octagon



Inscribed Reg. Hexagon



Inscribed Equilateral Triangle