Chapter 2 § 5
Postulates and Proofs

Definitions:

Axiom – a statement that describes a fundamental relationship between the basic terms of geometry.

Theorem – a statement or conjecture that has been shown to be true.

Proof – a logical argument in which each statement you make is supported by a statement that is accepted as true.

Paragraph proof (informal proof) – a type of proof written out in paragraph form to explain why a conjecture for a given situation is true.

Theorem:

Midpoint Theorem – If M is the midpoint of $\overline{AB}$, then $\overline{AM} \cong \overline{MB}$.

Postulate :

Postulate (2-1) – Through any two points, there is exactly one line.

Postulate (2-2) – Through any three points not on the same line, there is exactly one plane.

Postulate (2-3) – A line contains at least two points.

Postulate (2-4) – A plane contains at least three points not on the same line.

Postulate (2-5) – If two points lie in a plane, then the entire line containing those two points lies in that plane.

Postulate (2-6) - If two lines intersect, then their intersection is exactly one point

Postulate (2-7) – If two planes intersect, then their intersection is a line.

Determine whether each statement is *always, sometimes*, or *never* true.

If points A, B, and C lie in plane M, then they are collinear

Sometimes – A, B, and C does not necessarily have to be collinear to lie in plane M.

There is exactly one plane that contains noncollinear points P, Q, and R.

Always – Postulate (2-2) states that through any three noncollinear points, there is exactly one plane.

There are at least two lines through points M and N.

Never – Postulate (2-1) states that through any two points, there is exactly one line.

Determine whether each statement is *always, sometimes*, or *never* true.

If plane T contains $\overleftrightarrow{EF}$ and $\overleftrightarrow{EF}$ contains point G, then plane T contains point G.

Always; Postulate (2-5) states that if two points lie in a plane, then the entire line containing those points lies in the plane.

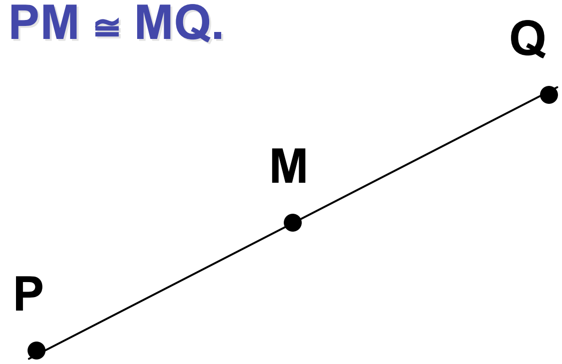
For $\overleftrightarrow{XY}$, if X lies in plane Q and Y lies in plane R, then plane Q intersects plane R.

Sometimes; planes Q and R can be parallel, and $\overleftrightarrow{XY}$ can intersect both planes.

$\overleftrightarrow{GH}$ contains three noncollinear points.

Never – Noncollinear points do not lie on the same line by definition.

Given that M is the midpoint of $\overline{PQ}$, write a paragraph proof to show that $\overline{PM} \cong \overline{MQ}$.



Given: M is the midpoint of $\overline{PQ}$.

Prove: $\overline{PM} \cong \overline{MQ}$

From the definition of midpoint of a segment, PM = MQ. This means that $\overline{PM}$ and $\overline{MQ}$ have the same measure. By the definition of congruence, if two segments have the same measure, then they are congruent. Thus $\overline{PM} \cong \overline{MQ}$.

Given $\overleftrightarrow{AC}$ intersecting $\overleftrightarrow{CD}$, write a paragraph proof to show that A, C, and D determine a plane.

Given: $\overleftrightarrow{AC}$ intersect $\overleftrightarrow{CD}$

Prove: A, C, and D determine a plane

$\overleftrightarrow{AC}$ and $\overleftrightarrow{CD}$ must intersect C because if two lines intersect, then their intersection is exactly one point. Point A is on $\overleftrightarrow{AC}$ and point D is on $\overleftrightarrow{CD}$. Therefore points A and D are not collinear. Therefore ACD is a plane as it contains three points not on the same line.