Theorems and Postulates

Postulate 2-A
Protractor Postulate

Given $\overrightarrow{AB}$ and a number r between 0 and 180, there is exactly one ray with endpoint A, extending on either side of $\overrightarrow{AB}$, such that the measure of the angle formed is r.

Definition of Right, Acute and Obtuse Angles

$\angle A$ is a right angle if $m\angle A$ is 90.
$\angle A$ is an acute angle if $m\angle A$ is less than 90.
$\angle A$ is an obtuse angle if $m\angle A$ is greater than 90 and less than 180.

Postulate 2-B
Angle Addition

If R is in the interior of $\angle PQS$, then $m\angle PQR + m\angle RQS = m\angle PQS$.
If $m\angle PQR + m\angle RQS = m\angle PQS$, then R is in the interior of $\angle PQS$.

Vertical angles are congruent.

The sum of the measures of the angles in a linear pair is 180°.

The sum of the measures of complementary angles is 90°.

Postulate 3-A
Ruler

Two points on a line can be paired with real numbers so that, given any two points R and S on the line, R corresponds to zero, and S corresponds to a positive number.

Point R could be paired with 0, and S could be paired with 10.
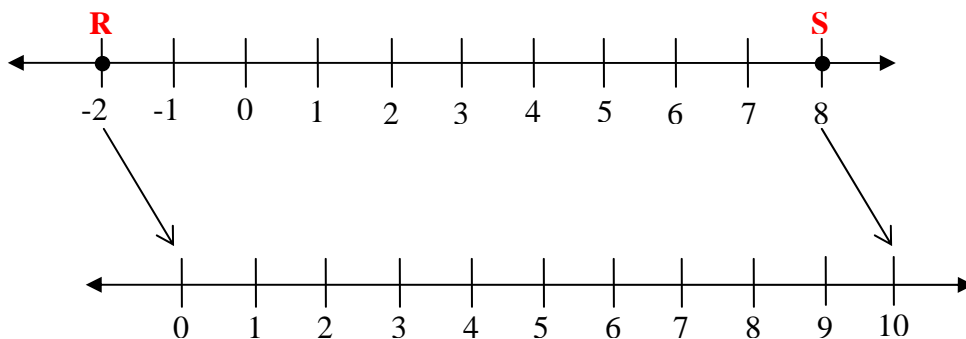
Postulate 3-B
Segment Addition

If N is between M and P, then MN + NP = MP.
Conversely, if MN + NP = MP, then N is between M and P.

Theorem 4-A Pythagorean Theorem	In a right triangle, the sum of the squares of the measures of the legs equals the square of the measure of the hypotenuse.
Distance Formula	The distance d between any two points with coordinates (x_1, y_1) and (x_2, y_2) is given by the formula $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.
Midpoint Definition	The midpoint, **M**, of $\overline{AB}$ is the point between **A** and **B** such that **AM** = **MB**.
Midpoint Formula Number Line	With endpoints of A and B on a number line, the midpoint of $\overline{AB}$ is $\dfrac{A+B}{2}$.
Midpoint Formula Coordinate Plane	In the coordinate plane, the coordinates of the midpoint of a segment whose endpoints have coordinates (x_1, y_1) and (x_2, y_2) are $(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2})$.
Theorem 4-B Midpoint Theorem	If M is the midpoint of $\overline{PQ}$, then $\overline{PM} \cong \overline{MQ}$.
Postulate 5-A Law of Detachment	If $p \Rightarrow q$ is true, and p is true, then q is true.
Postulate 5-B Law of Syllogism	If $p \Rightarrow q$ is true and $q \Rightarrow r$ is true, then $p \Rightarrow r$ is true.
Postulate 6-A Reflexive Property	Any segment or angle is congruent to itself. $\overline{QS} \cong \overline{QS}$

Postulate 6-B **Symmetric** **Property**	**If** $\overline{AB} \cong \overline{CD}$, **then** $\overline{CD} \cong \overline{AB}$. **If** $\angle CAB \cong \angle DOE$, **then** $\angle DOE \cong \angle CAB$.
Theorem 6-A **Transitive** **Property**	**If any segments or angles are congruent to the same angle, then they are congruent to each other.** **If** $\overline{AB} \cong \overline{CD}$ **and** $\overline{CD} \cong \overline{EF}$, **then** $\overline{AB} \cong \overline{EF}$. **If** $\angle 1 \cong \angle 2$ **and** $\angle 2 \cong \angle 3$, **then** $\angle 1 \cong \angle 3$.
Theorem 6-B **Transitive** **Property**	**If any segments or angles are congruent to each other, then they are congruent to the same angle. (This statement is the converse of Theorem 6-A.)**
Theorem 7-A **Addition** **Property**	**If a segment is added to two congruent segments, then the sums are congruent.**
Theorem 7-B **Addition** **Property**	**If an angle is added to two congruent angles, then the sums are congruent.**
Theorem 7-C **Addition** **Property**	**If congruent segments are added to congruent segments, then the sums are congruent.**
Theorem 7-D **Addition** **Property**	**If congruent angles are added to congruent angles, then the sums are congruent.**
Theorem 7-E **Subtraction** **Property**	**If a segment is subtracted from congruent segments, then the differences are congruent.**

Theorem 7-F Subtraction Property	If an angle is subtracted from congruent angles, then the differences are congruent.
Theorem 7-G Subtraction Property	If congruent segments are subtracted from congruent segments, then the differences are congruent.
Theorem 7-H Subtraction Property	If congruent angles are subtracted from congruent angles, then the differences are congruent.
Theorem 7-I Multiplication Property	If segments are congruent, then their like multiples are congruent.
Theorem 7-J Multiplication Property	If angles are congruent, then their like multiples are congruent.
Theorem 7-K Division Property	If segments are congruent, then their like divisions are congruent.
Theorem 7-L Division Property	If angles are congruent, then their like divisions are congruent.
Theorem 10-A	Congruence of angles is reflexive, symmetric, and transitive.
Theorem 10-B	If two angles form a linear pair, then they are supplementary angles.

Theorem 10-C	Angles supplementary to the same angle are congruent.
Theorem 10-D	Angles supplementary to congruent angles are congruent.
Theorem 10-E	Angles complementary to the same angle are congruent.
Theorem 10-F	Angles complementary to congruent angles are congruent.
Theorem 10-G	Right angles are congruent.
Theorem 10-H	Vertical angles are congruent.
Theorem 10-I	Perpendicular lines intersect to form right angles.
Postulate 10-A	If two parallel lines are cut by a transversal, then each pair of corresponding angles is congruent.
Theorem 10-J	If two parallel lines are cut by a transversal, then each of the pair of alternate interior angles is congruent.

Theorem 10-K	If two parallel lines are cut by a transversal, then each pair of alternate exterior angles is congruent.

Theorem 10-L	If two parallel lines are cut by a transversal, then each pair of consecutive interior angles is supplementary.

Theorem 10-M	If two parallel lines are cut by a transversal that is perpendicular to one of the parallel lines, then the transversal is perpendicular to the other parallel line.

The definition of slope states that, given two points (x_1, y_1) and (x_2, y_2), the slope of a line containing the points can be determined using this formula:

$$m = \frac{y_2 - y_1}{x_2 - x_1} \text{ when } x_2 - x_1 \neq 0$$

Postulate 11-A	Two non-vertical lines have the same slope if and only if they are parallel.

Postulate 11-B	Two non-vertical lines are perpendicular if and only if the product of their slopes is –1.

Postulate 11-C	If two lines in a plane are cut by a transversal and the corresponding angles are congruent, then the lines are parallel.

Postulate 11-D	If there is a line and a point that is not on the line, then there exists exactly one line that passes through the point that is parallel to the given line.

Theorem 11-A	If two lines in a plane are cut by a transversal and the alternate interior angles are congruent, then the lines are parallel.

Theorem 11-B	If two lines in a plane are cut by a transversal and the alternate exterior angles are congruent, then the lines are parallel.

Theorem 11-C	If two lines in a plane are cut by a transversal and the consecutive interior angles are supplementary, then the lines are parallel.
Theorem 11-D	If two lines in a plane are perpendicular to the same line, then the lines are parallel.

The distance from a point, which is not on a line, and a line is the length of a line segment that is perpendicular from the point to the line.

The distance between two parallel lines is the distance between one line and any point on the other line.