Theorems and Postulates

Postulate 1-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 1-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.

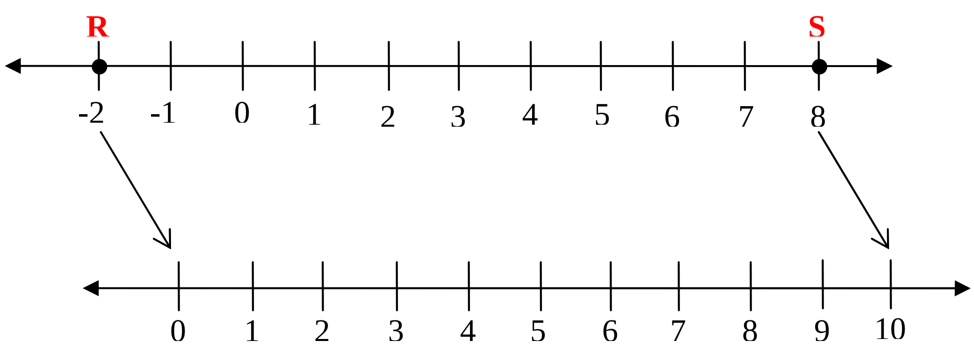
The sum of the measures of the angles in a linear pair is 180°.

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

Postulate 2-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 2-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 2-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** $\frac{A+B}{2}$**.**
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** $(\frac{x_1+x_2}{2},\frac{y_1+y_2}{2})$**.**
Theorem 2-B Midpoint Theorem	If M is the midpoint of $\overline{PQ}$, then $\overline{PM} \cong \overline{MQ}$.
Postulate 3-A Law of Detachment	**If** $p \Rightarrow q$ **is true, and** p **is true, then** q **is true.**
Postulate 3-B Law of Syllogism	**If** $p \Rightarrow q$ **is true and** $q \Rightarrow r$ **is true, then** $p \Rightarrow r$ **is true.**
Postulate 4-A Reflexive Property	**Any segment or angle is congruent to itself.** $\overline{QS} \cong \overline{QS}$
Postulate 4-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 4-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 4-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 4-A.)**
Theorem 5-A Addition Property	**If a segment is added to two congruent segments, then the sums are congruent.**
Theorem 5-B Addition Property	**If an angle is added to two congruent angles, then the sums are congruent.**
Theorem 5-C Addition Property	**If congruent segments are added to congruent segments, then the sums are congruent.**
Theorem 5-D Addition Property	**If congruent angles are added to congruent angles, then the sums are congruent.**
Theorem 5-E Subtraction Property	**If a segment is subtracted from congruent segments, then the differences are congruent.**
Theorem 5-F Subtraction Property	**If an angle is subtracted from congruent angles, then the differences are congruent.**
Theorem 5-G Subtraction Property	**If congruent segments are subtracted from congruent segments, then the differences are congruent.**

Theorem 5-H Subtraction Property	**If congruent angles are subtracted from congruent angles, then the differences are congruent.**
Theorem 5-I Multiplication Property	**If segments are congruent, then their like multiples are congruent.**
Theorem 5-J Multiplication Property	**If angles are congruent, then their like multiples are congruent.**
Theorem 5-K Division Property	**If segments are congruent, then their like divisions are congruent.**
Theorem 5-L Division Property	**If angles are congruent, then their like divisions are congruent.**
Theorem 7-A	**Congruence of angles is reflexive, symmetric, and transitive.**
Theorem 7-B	**If two angles form a linear pair, then they are supplementary angles.**
Theorem 7-C	**Angles supplementary to the same angle are congruent.**
Theorem 7-D	**Angles supplementary to congruent angles are congruent.**

Theorem 7-E	**Angles complementary to the same angle are congruent.**
Theorem 7-F	**Angles complementary to congruent angles are congruent.**
Theorem 7-G	**Right angles are congruent.**
Theorem 7-H	**Vertical angles are congruent.**
Theorem 7-I	**Perpendicular lines intersect to form right angles.**
Postulate 7-A	**If two parallel lines are cut by a transversal, then each pair of corresponding angles is congruent.**
Theorem 7-J	**If two parallel lines are cut by a transversal, then each of the pair of alternate interior angles is congruent.**
Theorem 7-K	**If two parallel lines are cut by a transversal, then each pair of alternate exterior angles is congruent.**
Theorem 7-L	**If two parallel lines are cut by a transversal, then each pair of consecutive interior angles is supplementary.**

Theorem 7-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 8-A

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

Postulate 8-B

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

Postulate 8-C

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

Postulate 8-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 8-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 8-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 8-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 8-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.