Postulates

1 **Ruler Postulate** The points on a line can be matched one to one with the real numbers. The real number that corresponds to a point is the coordinate of the point. The distance between points A and B, written as AB, is the absolute value of the difference between the coordinates of A and B. *(p. 9)*

2 **Segment Addition Postulate** If B is between A and C, then $AB + BC = AC$. If $AB + BC = AC$, then B is between A and C. *(p. 10)*

3 **Protractor Postulate** Consider $\overrightarrow{OB}$ and a point A on one side of $\overrightarrow{OB}$. The rays of the form $\overrightarrow{OA}$ can be matched one to one with the real numbers from 0 to 180. The measure of $\angle AOB$ is equal to the absolute value of the difference between the real numbers for $\overrightarrow{OA}$ and $\overrightarrow{OB}$. *(p. 24)*

4 **Angle Addition Postulate** If P is in the interior of $\angle RST$, then $m\angle RST = m\angle RSP + m\angle PST$. *(p. 25)*

5 Through any two points there exists exactly one line. *(p. 96)*

6 A line contains at least two points. *(p. 96)*

7 If two lines intersect, then their intersection is exactly one point. *(p. 96)*

8 Through any three noncollinear points there exists exactly one plane. *(p. 96)*

9 A plane contains at least three noncollinear points. *(p. 96)*

10 If two points lie in a plane, then the line containing them lies in the plane. *(p. 96)*

11 If two planes intersect, then their intersection is a line. *(p. 96)*

12 **Linear Pair Postulate** If two angles form a linear pair, then they are supplementary. *(p. 126)*

13 **Parallel Postulate** If there is a line and a point not on the line, then there is exactly one line through the point parallel to the given line. *(p. 148)*

14 **Perpendicular Postulate** If there is a line and a point not on the line, then there is exactly one line through the point perpendicular to the given line. *(p. 148)*

15 **Corresponding Angles Postulate** If two parallel lines are cut by a transversal, then the pairs of corresponding angles are congruent. *(p. 154)*

16 **Corresponding Angles Converse** If two lines are cut by a transversal so the corresponding angles are congruent, then the lines are parallel. *(p. 161)*

17 **Slopes of Parallel Lines** In a coordinate plane, two nonvertical lines are parallel if and only if they have the same slope. Any two vertical lines are parallel. *(p. 172)*

18 **Slopes of Perpendicular Lines** In a coordinate plane, two nonvertical lines are perpendicular if and only if the product of their slopes is -1. Horizontal lines are perpendicular to vertical lines. *(p. 172)*

19 **Side-Side-Side (SSS) Congruence Postulate** If three sides of one triangle are congruent to three sides of a second triangle, then the two triangles are congruent. *(p. 234)*

20 **Side-Angle-Side (SAS) Congruence Postulate** If two sides and the included angle of one triangle are congruent to two sides and the included angle of a second triangle, then the two triangles are congruent. *(p. 240)*

21 **Angle-Side-Angle (ASA) Congruence Postulate** If two angles and the included side of one triangle are congruent to two angles and the included side of a second triangle, then the two triangles are congruent. *(p. 249)*

22 **Angle-Angle (AA) Similarity Postulate** If two angles of one triangle are congruent to two angles of another triangle, then the two triangles are similar. *(p. 381)*

23 **Arc Addition Postulate** The measure of an arc formed by two adjacent arcs is the sum of the measures of the two arcs. *(p. 660)*

24 **Area of a Square Postulate** The area of a square is the square of the length of its side, or $A = s^2$. *(p. 720)*

25 **Area Congruence Postulate** If two polygons are congruent, then they have the same area. *(p. 720)*

26 **Area Addition Postulate** The area of a region is the sum of the areas of its nonoverlapping parts. *(p. 720)*

27 **Volume of a Cube** The volume of a cube is the cube of the length of its side, or $V = s^3$. *(p. 819)*

28 **Volume Congruence Postulate** If two polyhedra are congruent, then they have the same volume. *(p. 819)*

29 **Volume Addition Postulate** The volume of a solid is the sum of the volumes of all its nonoverlapping parts. *(p. 819)*

Theorems

2.1 Properties of Segment Congruence Segment congruence is reflexive, symmetric, and transitive.

Reflexive: For any segment AB, $\overline{AB} \cong \overline{AB}$.

Symmetric: If $\overline{AB} \cong \overline{CD}$, then $\overline{CD} \cong \overline{AB}$.

Transitive: If $\overline{AB} \cong \overline{CD}$ and $\overline{CD} \cong \overline{EF}$, then $\overline{AB} \cong \overline{EF}$. *(p. 113)*

2.2 Properties of Angles Congruence Angle congruence is reflexive, symmetric, and transitive.

Reflexive: For any angle A, $\angle A \cong \angle A$.

Symmetric: If $\angle A \cong \angle B$, then $\angle B \cong \angle A$.

Transitive: If $\angle A \cong \angle B$ and $\angle B \cong \angle C$, then $\angle A \cong \angle C$. *(p. 113)*

2.3 Right Angles Congruence Theorem All right angles are congruent. *(p. 124)*

2.4 Congruent Supplements Theorem If two angles are supplementary to the same angle (or to congruent angles), then the two angles are congruent. *(p. 125)*

2.5 Congruent Complements Theorem If two angles are complementary to the same angle (or to congruent angles), then the two angles are congruent. *(p. 125)*

2.6 Vertical Angles Congruence Theorem Vertical angles are congruent. *(p. 126)*

3.1 Alternate Interior Angles Theorem If two parallel lines are cut by a transversal, then the pairs of alternate interior angles are congruent. *(p. 155)*

3.2 Alternate Exterior Angles Theorem If two parallel lines are cut by a transversal, then the pairs of alternate exterior angles are congruent. *(p. 155)*

3.3 Consecutive Interior Angles Theorem If two parallel lines are cut by a transversal, then the pairs of consecutive interior angles are supplementary. *(p. 155)*

3.4 Alternate Interior Angles Converse If two lines are cut by a transversal so the alternate interior angles are congruent, then the lines are parallel. *(p. 162)*

3.5 Alternate Exterior Angles Converse If two lines are cut by a transversal so the alternate exterior angles are congruent, then the lines are parallel. *(p. 162)*

3.6 Consecutive Interior Angles Converse If two lines are cut by a transversal so the consecutive interior angles are supplementary, then the lines are parallel. *(p. 162)*

3.7 Transitive Property of Parallel Lines If two lines are parallel to the same line, then they are parallel to each other. *(p. 164)*

3.8 If two lines intersect to form a linear pair of congruent angles, then the lines are perpendicular. *(p. 190)*

3.9 If two lines are perpendicular, then they intersect to form four right angles. *(p. 190)*

3.10 If two sides of two adjacent acute angles are perpendicular, then the angles are complementary. *(p. 191)*

3.11 Perpendicular Transversal Theorem If a transversal is perpendicular to one of two parallel lines, then it is perpendicular to the other. *(p. 192)*

3.12 Lines Perpendicular to a Transversal Theorem In a plane, if two lines are perpendicular to the same line, then they are parallel to each other. *(p. 192)*

4.1 Triangle Sum Theorem The sum of the measures of the interior angles of a triangle is 180°. *(p. 218)*

Corollary The acute angles of a right triangle are complementary. *(p. 220)*

4.2 Exterior Angle Theorem The measure of an exterior angle of a triangle is equal to the sum of the measures of the two nonadjacent interior angles. *(p. 219)*

4.3 Third Angles Theorem If two angles of one triangle are congruent to two angles of another triangle, then the third angles are also congruent. *(p. 227)*

4.4 Properties of Triangle Congruence Triangle congruence is reflexive, symmetric, and transitive.

Reflexive: For any $\triangle ABC$, $\triangle ABC \cong \triangle ABC$.

Symmetric: If $\triangle ABC \cong \triangle DEF$, then $\triangle DEF \cong \triangle ABC$.

Transitive: If $\triangle ABC \cong \triangle DEF$ and $\triangle DEF \cong \triangle JKL$, then $\triangle ABC \cong \triangle JKL$. *(p. 228)*

POSTULATES AND THEOREMS

4.5 Hypotenuse-Leg (HL) Congruence Theorem If the hypotenuse and a leg of a right triangle are congruent to the hypotenuse and a leg of a second right triangle, then the two triangles are congruent. *(p. 241)*

4.6 Angle-Angle-Side (AAS) Congruence Theorem If two angles and a non-included side of one triangle are congruent to two angles and the corresponding non-included side of a second triangle, then the two triangles are congruent. *(p. 249)*

4.7 Base Angles Theorem If two sides of a triangle are congruent, then the angles opposite them are congruent. *(p. 264)*

Corollary If a triangle is equilateral, then it is equiangular. *(p. 265)*

4.8 Converse of the Base Angles Theorem If two angles of a triangle are congruent, then the sides opposite them are congruent. *(p. 264)*

Corollary If a triangle is equiangular, then it is equilateral. *(p. 265)*

5.1 Midsegment Theorem The segment connecting the midpoints of two sides of a triangle is parallel to the third side and is half as long as that side. *(p. 295)*

5.2 Perpendicular Bisector Theorem If a point is on a perpendicular bisector of a segment, then it is equidistant from the endpoints of the segment. *(p. 303)*

5.3 Converse of the Perpendicular Bisector Theorem If a point is equidistant from the endpoints of a segment, then it is on the perpendicular bisector of the segment. *(p. 303)*

5.4 Concurrency of Perpendicular Bisectors Theorem The perpendicular bisectors of a triangle intersect at a point that is equidistant from the vertices of the triangle. *(p. 305)*

5.5 Angle Bisector Theorem If a point is on the bisector of an angle, then it is equidistant from the two sides of the angle. *(p. 310)*

5.6 Converse of the Angle Bisector Theorem If a point is in the interior of an angle and is equidistant from the sides of the angle, then it lies on the bisector of the angle. *(p. 310)*

5.7 Concurrency of Angle Bisectors of a Triangle The angle bisectors of a triangle intersect at a point that is equidistant from the sides of the triangle. *(p. 312)*

5.8 Concurrency of Medians of a Triangle The medians of a triangle intersect at a point that is two thirds of the distance from each vertex to the midpoint of the opposite side. *(p. 319)*

5.9 Concurrency of Altitudes of a Triangle The lines containing the altitudes of a triangle are concurrent. *(p. 320)*

5.10 If one side of a triangle is longer than another side, then the angle opposite the longer side is larger than the angle opposite the shorter side. *(p. 328)*

5.11 If one angle of a triangle is larger than another angle, then the side opposite the larger angle is longer than the side opposite the smaller angle. *(p. 328)*

5.12 Triangle Inequality Theorem The sum of the lengths of any two sides of a triangle is greater than the length of the third side. *(p. 330)*

5.13 Hinge Theorem If two sides of one triangle are congruent to two sides of another triangle, and the included angle of the first is larger than the included angle of the second, then the third side of the first is longer than the third side of the second. *(p. 335)*

5.14 Converse of the Hinge Theorem If two sides of one triangle are congruent to two sides of another triangle, and the third side of the first is longer than the third side of the second, then the included angle of the first is larger than the included angle of the second. *(p. 335)*

6.1 If two polygons are similar, then the ratio of their perimeters is equal to the ratios of their corresponding side lengths. *(p. 374)*

6.2 Side-Side-Side (SSS) Similarity Theorem If the corresponding side lengths of two triangles are proportional, then the triangles are similar. *(p. 388)*

6.3 Side-Angle-Side (SAS) Similarity Theorem If an angle of one triangle is congruent to an angle of a second triangle and the lengths of the sides including these angles are proportional, then the triangles are similar. *(p. 390)*

6.4 Triangle Proportionality Theorem If a line parallel to one side of a triangle intersects the other two sides, then it divides the two sides proportionally. *(p. 397)*

6.5 Converse of the Triangle Proportionality Theorem If a line divides two sides of a triangle proportionally, then it is parallel to the third side. *(p. 397)*

6.6 If three parallel lines intersect two transversals, then they divide the transversals proportionally. *(p. 398)*

6.7 If a ray bisects an angle of a triangle, then it divides the opposite side into segments whose lengths are proportional to the lengths of the other two sides. *(p. 398)*

7.1 **Pythagorean Theorem** In a right triangle, the square of the length of the hypotenuse is equal to the sum of the squares of the lengths of the legs. *(p. 433)*

7.2 **Converse of the Pythagorean Theorem** If the square of the length of the longest side of a triangle is equal to the sum of the squares of the lengths of the other two sides, then the triangle is a right triangle. *(p. 441)*

7.3 If the square of the length of the longest side of a triangle is less than the sum of the squares of the lengths of the other two sides, then the triangle is an acute triangle. *(p. 442)*

7.4 If the square of the length of the longest side of a triangle is greater than the sum of the squares of the lengths of the other two sides, then the triangle is an obtuse triangle. *(p. 442)*

7.5 If the altitude is drawn to the hypotenuse of a right triangle, then the two triangles formed are similar to the original triangle and to each other. *(p. 449)*

7.6 **Geometric Mean (Altitude) Theorem** In a right triangle, the altitude from the right angle to the hypotenuse divides the hypotenuse into two segments. The length of the altitude is the geometric mean of the lengths of the two segments. *(p. 452)*

7.7 **Geometric Mean (Leg) Theorem** In a right triangle, the altitude from the right angle to the hypotenuse divides the hypotenuse into two segments. The length of each leg of the right triangle is the geometric mean of the lengths of hypotenuse and the segment of the hypotenuse that is adjacent to the leg. *(p. 452)*

7.8 **45°-45°-90° Triangle Theorem** In a 45°-45°-90° triangle, the hypotenuse is $\sqrt{2}$ times as long as each leg. *(p. 457)*

7.9 **30°-60°-90° Triangle Theorem** In a 30°-60°-90° triangle, the hypotenuse is twice as long as the shorter leg, and the longer leg is $\sqrt{3}$ times as long as the shorter leg. *(p. 459)*

8.1 **Polygon Interior Angles Theorem** The sum of the measures of the interior angles of a convex n-gon is $(n - 2) \cdot 180°$. *(p. 507)*

Corollary The sum of the measures of the interior angles of a quadrilateral is 360°. *(p. 507)*

8.2 **Polygon Exterior Angles Theorem** The sum of the measures of the exterior angles of a convex polygon, one angle at each vertex, is 360°. *(p. 509)*

8.3 If a quadrilateral is a parallelogram, then its opposite sides are congruent. *(p. 515)*

8.4 If a quadrilateral is a parallelogram, then its opposite angles are congruent. *(p. 515)*

8.5 If a quadrilateral is a parallelogram, then its consecutive angles are supplementary. *(p. 516)*

8.6 If a quadrilateral is a parallelogram, then its diagonals bisect each other. *(p. 517)*

8.7 If both pairs of opposite sides of a quadrilateral are congruent, then the quadrilateral is a parallelogram. *(p. 522)*

8.8 If both pairs of opposite angles of a quadrilateral are congruent, then the quadrilateral is a parallelogram. *(p. 522)*

8.9 If one pair of opposite sides of a quadrilateral are congruent and parallel, then the quadrilateral is a parallelogram. *(p. 523)*

8.10 If the diagonals of a quadrilateral bisect each other, then the quadrilateral is a parallelogram. *(p. 523)*

Rhombus Corollary A quadrilateral is a rhombus if and only if it has four congruent sides. *(p. 533)*

Rectangle Corollary A quadrilateral is a rectangle if and only if it has four right angles. *(p. 533)*

Square Corollary A quadrilateral is a square if and only if it is a rhombus and a rectangle. *(p. 533)*

8.11 A parallelogram is a rhombus if and only if its diagonals are perpendicular. *(p. 535)*

8.12 A parallelogram is a rhombus if and only if each diagonal bisects a pair of opposite angles. *(p. 535)*

8.13 A parallelogram is a rectangle if and only if its diagonals are congruent. *(p. 535)*

8.14 If a trapezoid is isosceles, then both pairs of base angles are congruent. *(p. 543)*

8.15 If a trapezoid has a pair of congruent base angles, then it is an isosceles trapezoid. *(p. 543)*