## Geometric Properties in Writing Proofs

**Definitions:**

1. Betweenness: If $B$ is between $\overline{AC}$, then $\overline{AC} = AB + BC$.
2. Midpoint: If $B$ is the midpoint of $\overline{AC}$, then $AB = BC$.
3. Segment Bisector: If a line, ray or another segment bisects the segment $AB$ at $X$, then $AX \cong BX$.
4. Right Angle: If $\angle A$ is a right angle, then $m\angle A = 90^\circ$.
5. Acute Angle: If $\angle A$ is an acute angle, then $m\angle A < 90^\circ$.
6. Obtuse Angle: If $\angle A$ is an obtuse angle, then $m\angle A > 90^\circ$.
7. Perpendicular Line Segments: If $\overline{AB} \perp \overline{AC}$, then $\angle BAC$ is a right angle.
8. Complementary Angles: If $\angle A$ and $\angle B$ are complementary angles, then $m\angle A + m\angle B = 90^\circ$.
9. Supplementary Angles: If $\angle A$ and $\angle B$ are supplementary angles, then $m\angle A + m\angle B = 180^\circ$.
10. Linear Pair: If two angles are adjacent such that two of the rays are opposite, then they form a linear pair.
11. Angle Bisector: If $\overrightarrow{AD}$ bisects $\angle BAC$, then $\angle BAD \cong \angle DAC$.
12. Congruent Segments: If $\overline{AB} \cong \overline{CD}$, then $AB = CD$.
13. Congruent Angles: If $\angle A \cong \angle B$, then $m\angle A = m\angle B$.

**Properties of Equality:**

1. Addition Property of Equality: If $a = b$, then $a + c = b + c$.
2. Subtraction Property of Equality: If $a = b$, then $a - c = b - c$.
3. Multiplication Property of Equality: If $a = b$, then $ac = bc$.
4. Division Property of Equality: If $a = b$ and $c \neq 0$, then $\frac{a}{c} = \frac{b}{c}$.
5. Reflexive Property of Equality: If $a$ is any real number, then $a = a$.
6. Symmetric Property: If $a = b$,then $b = a$.
7. Transitive Property: If $a = b$ and $b = c$, then $a = c$.

**Law of Substitution:** If $a + b = c$ and $b = x$, then $a + x = c$.

**Postulates**

1. Supplement Postulate: If two angles form a linear pair, then they are supplementary.
2. Segment Addition Postulate: If $B$ lies on $\overline{AC}$, then $AC = AB + BC$.
3. Angle Addition Postulate: If $B$ is in the interior of $\angle AOC$, then $m\angle AOC = m\angle AOB + m\angle BOC$.

**Theorems**

1. Vertical Angle Theorem: If two angles are vertical, then they are congruent.
2. Complement Theorem: If two angles are complement of the same (or congruent) angles, then they are congruent.
3. Supplement Theorem: If two angles are supplement of the same (or congruent) angles, then they are congruent.

**Geometric Properties**

1. Supplement Postulate (SP): If two angles form a linear pair, then they are supplementary.
2. Vertical Angle Theorem (VAT): The measures of vertical angles are equal or vertical angles are congruent.
3. Angle Sum of a Point Postulate (ASPP): The sum of the measures of the angles at a point is 360.
4. Supplement Theorem (ST): Supplements of congruent angles are congruent.
5. Complement Theorem (CP): Complements of congruent angles are congruent.
6. PCAC Postulate: If two parallel lines are cut by a transversal, then corresponding angles are congruent.
7. PAIC Theorem: If two parallel lines are cut by a transversal, then alternate interior angles are congruent.
8. PAEC Theorem: If two parallel lines are cut by a transversal, then alternate exterior angles are congruent.
9. PSSIAS Theorem: If two parallel lines are cut by a transversal, then same-side interior angles are supplementary.
10. Triangle Interior Angle Theorem (TIAT): The sum of the degree measures of the angles of a triangle is 180.
11. Third Angles Theorem: If two angles of one triangle are congruent to two angles of another, then the third angles are congruent.
12. Exterior Angles Theorem (EAT): The measure of an exterior angle of a triangle is equal to the sum of the measures of its two remote interior angles.
13. Quadrilateral Interior Angle Theorem (QIAT): The sum of the measures of the angles of a convex quadrilateral is 360.
14. Polygon Interior Angle Theorem (PIAT): The sum of the measures of the angles of a convex polygon with $n$ sides is $(n-2)180$.
15. Regular Polygon Interior Angle Theorem (RPIA): The measure of each angle of a regular n-gon is $\frac{(n-2)180}{n}$.
16. Polygon Exterior Angles Theorem (PEAT): The sum of the measures of the exterior angles, one at each vertex, of any convex polygon is 360.
17. Right Angles Congruency Theorem: Any two right angles are congruent.

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