

Properties, Postulates, and Theorems for Proofs- for Math B  
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PROPERTY	EQUALITY (numbers, variables, lengths, angle measurement)	CONGRUENCE (segments, angles, polygons)
Reflexive	A quantity is equal to itself. $DE = DE$ $m\angle 2 = m\angle 2$	A quantity is congruent to itself. $\overline{DE} \cong \overline{DE}$ $\angle 2 \cong \angle 2$
Symmetric	If $DE = AB$ , then $AB = DE$ If $m\angle 1 = m\angle 2$ , Then $m\angle 2 = m\angle 1$	If $\overline{DE} \cong \overline{AB}$ , then $\overline{AB} \cong \overline{DE}$ If $\angle 1 \cong \angle 2$ , then $\angle 2 \cong \angle 1$
Transitive	If $AB = DE$ and $CD = EF$ Then $AB = EF$ If $m\angle 1 = m\angle 2$ and $m\angle 2 = m\angle 3$ then $m\angle 1 = m\angle 3$ .	If $\overline{AB} \cong \overline{CD}$ and $\overline{CD} \cong \overline{EF}$ then $\overline{AB} \cong \overline{EF}$ If $m\angle 1 \cong m\angle 2$ and $m\angle 2 \cong m\angle 3$ then $m\angle 1 \cong m\angle 3$

## Postulates

Addition Postulate	If equal quantities are added to equal quantities, the sums are equal.
Subtraction Postulate	If equal quantities are subtracted from equal quantities, the differences are equal.
Multiplication Postulate	If equal quantities are multiplied by equal quantities, the products are equal. Doubles of equal quantities are equal.
Division Postulate	If equal quantities are divided by equal non-zero quantities, the quotients are equal. Halves of equal quantities are equal.
Substitute Postulate	A quantity may be substituted for its equal in any expression.
Parallel Postulate	If there is a line and a point non on the line, then there exists one line through the point parallel to the given line.
Corresponding Angles Postulate	If two parallel lines are cut by a transversal, then the pairs of corresponding angles are congruent.
Corresponding Angles Converse Postulate	If two lines are cut by a transversal and the corresponding angles are congruent, the lines are parallel.
Side-Side-Side (SSS) Congruence Postulate	If three sides of one triangle are congruent to three sides of another triangle, then the triangles are congruent.
Side-Angle-Side (SAS) Congruence Postulate	If two sides and the included angle of one triangle are congruent to the corresponding parts of another triangle, the triangles are congruent.
Angle-Side-Angle (ASA) Congruence Postulate	If two angles and the included side of one triangle are congruent to the corresponding parts of another triangle, the triangles are congruent.
Angle-Angle (AA) Similarity Postulate	If two angles of one triangle are congruent to two angles of another triangle, the triangles are similar.

## Theorems

Right Angles	All right angles are congruent.
Congruent Adjacent Angles	If two lines are perpendicular, then they form congruent adjacent angles.
Congruent Supplements	If two angles are supplementary to the same angle or to congruent angles, then the two angles are congruent.
Congruent Complements	If two angles are complementary to the same angle or to congruent angles then the two angles are congruent.
Vertical Angles	Vertical angles are congruent.
Alternate Interior Angles	If two parallel lines are cut by a transversal, then the alternate interior angles are congruent.
Alternate Exterior Angles	If two parallel lines are cut by a transversal, then the alternate exterior angles are congruent.
Interiors on Same Side	If two parallel lines are cut by a transversal, the interior angles on the same side of the transversal are supplementary.
Parallel Lines	Two lines parallel to a third line are parallel to each other.

## Converse Theorems

Alternate Interior Angles Converse	In a plane, if two lines are cut by a transversal and the alternate interior angles are congruent, the lines are parallel.
Alternate Exterior Angles Converse	In a plane, if two lines are cut by a transversal and the alternate exterior angles are congruent, the lines are parallel.
Congruent Adjacent Angles Converse	If two intersecting lines form congruent adjacent angles, then the lines are perpendicular.
Interiors on Same Side Converse	In a plane, if two lines are cut by a transversal and the interior angles on the same side of the transversal are supplementary, the lines are parallel.

## Theorems for Parallelograms

Opposite sides	If a quadrilateral is a parallelogram, the opposite sides are congruent.
Opposite angles	If a quadrilateral is a parallelogram, the opposite angles are congruent. If a quadrilateral is a parallelogram, any two consecutive angles are supplementary.
Diagonals	If a quadrilateral is a parallelogram, the diagonals bisect each other. If a quadrilateral is a parallelogram, a diagonal divides it into two triangles.

## Parallelogram Converses

Sides	If both pairs of opposite sides of a quadrilateral are congruent, the quadrilateral is a parallelogram.
Angles	If both pairs of opposite angles of a quadrilateral are congruent, the quadrilateral is a parallelogram. If all the points of the consecutive angles of a quadrilateral are supplementary, the quadrilateral is a parallelogram.
Diagonals	If the diagonals of a quadrilateral bisect each other, the quadrilateral is a parallelogram.

## WAYS TO PROVE LINES PARALLEL

- Show that a pair of corresponding angles are congruent.
- Show that a pair of alternate interior angles are congruent.
- Show that a pair of same side interior angles are supplementary.
- In a plane, show that both lines are perpendicular to a third line.
- Show both lines parallel to a third line.

## Triangles and Theorems

Triangle Sum	The sum of the interior angles of a triangle is $180^\circ$
Exterior Angles	The measurement of an exterior angles of a triangle is equal to the sum of the measurements of the two non-adjacent interior angles.
Angle-Angle-Side (AAS) Congruence	If two angles and the non-included sided of one triangle are congruent to the corresponding parts of another triangle, the triangles are congruent.
Base Angle Theorem (Isosceles Triangle)	If two sides of a triangle are congruent, the angles opposite these sides are congruent.
Base Angle Converse (Isosceles Triangle)	If two angles of a triangle are congruent, the sides opposite these angles are congruent.
Mid-segment Theorem	The segment connecting the midpoints of two sides of a triangle is parallel to the third side and is half as long.
Side Proportionality	If two triangles are similar, the corresponding sides are in proportion.

## METHODS OF PROVING TRIANGLES TO BE CONGRUENT

Method Symbol	Description
SSS	If three sides of one triangle are congruent to three sides of another triangle, the triangles are congruent.
SAS	If two sides and the included angle of one triangle are congruent to the corresponding parts of another triangle, the triangles are congruent.
ASA	If two angles and the included side of one triangle are congruent to the corresponding parts of another triangle, the triangles are congruent.
AAS	If two angles and the non-included side of one triangle are congruent to the corresponding parts of another triangle, the triangles are congruent.
HL	If the hypotenuse and leg of one right triangle are congruent to the corresponding parts of another right triangle, the right triangles are congruent.