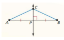
I. 6.1: Perpendicular and Angle Bisectors

A. Perpendicular Bisector Theorem [Converse also available]

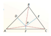

If there is a bisector, then CA = CB

B. Angle Bisector Theorem [Converse also available]

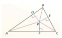

If AD bisects and AB/BD and AC/CD are perpendicular, then BD = CD

II. 6.2: Bisectors of Triangles

A. Circumcenter Theorem

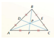

If the Blue Lines are perpendicular Bisectors, all the red lines are equal

B. Incenter Theorem


If the Red Lines are angle bisectors and if the blue lines are perpendicular, then the blue lines are equal

III. 6.3: Medians and Alititudes

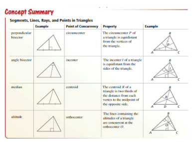
A. Centroid Theorem


Point P is always ⅔ the way from the longer side, and ⅓ away from the shorter side

B. Altitudes: A segment that is perpendicular to the angles opposite side and runs through the angle

C. Orthocenter: The point where all three Altitudes intersect

D. Summary:

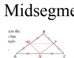

Concept Summary

Segments, Lines, Rays, and Points in Triangles

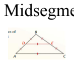
	Example	Point of Concurrency	Property	Example
perpendicular bisector		circumcenter	The circumcenter P of a triangle is equidistant from the vertices of the triangle.	
angle bisector		incenter	The incenter I of a triangle is equidistant from the sides of the triangle.	
median		centroid	The centroid R of a triangle is two thirds of the distance from each vertex to the midpoint of the opposite side.	
altitude		orthocenter	The lines containing the altitudes of a triangle are concurrent at the orthocenter O.	

IV. 6.4: Triangle Midsegment Theorem

A. Midsegment of a Triangle


The Red lines are midsegments

B. Midsegment Theorem


The Red lines is ½ of the Longer Side

V. 6.5: Indirect Proofs and Inequalities in One Triangle

A. Indirect Proof [How-To]

1. Assume the opposite
2. Prove with the opposite
3. Prove that it's wrong
4. Statement: The assumption ____ is false, which proves _____

B. Triangle Larger Side Theorem: If the Side is longer than the other, then the corresponding side has a larger angle than the other side's corresponding angle

C. Triangle Larger Angle Theorem: [Basically Triangle Larger Side Theorem but the opposite/converse]

D. Triangle Inequality Theorem: The side of the lengths of any two sides of a triangle will always be greater than one length of the triangle

VI. 6.6: Inequalities in Two Triangles

A. Hinge Theorem: If two sides on a triangle are congruent, and one angle is larger than the other angle, then the triangle with the larger angle has a longer side [Converse Available]

VII. 7.1: Angles of Polygons

A. Polygon Interior Angles Theorem
Find the sum of the interior angles by using: (n-2) x 180

B. Corollary to the Polygons Interior Angles Theorem: The sum of the measure of interior angles is 360 for a quadrilateral

C. Polygon Exterior Angles Theorem
The sum of a polygon's exterior angles will always be 360

VIII. 7.2: Properties of Polygons

A. Parallelogram Opposite Sides Theorem: The opposite sides on a parallelogram are congruent

B. Parallelogram Opposite Angles Theorem: The opposite angles on a parallelogram are congruent

C. Parallelogram Consecutive Angles Theorem: The parallelogram's consecutive angles are supplementary

D. Parallelogram Diagonals Theorem: The diagonals on a parallelogram always bisect each other

IX. 7.3: Proving That a Quadrilateral is a Parallelogram

A. Parallelogram Opposite Sides Theorem Converse: If the opposite sides are congruent, then it is a parallelogram

B. Parallelogram Opposite Angles Converse: If both pairs of opposite angles are congruent, then it is a parallelogram

C. Parallelogram Opposite Angles Converse: Opposite Sides Parallel and Congruent Theorem: If the opposite Sides are Parallel and Congruent, then it is a parallelogram

D. Parallelogram Diagonals Converse: If both diagonals bisect each other, then it is a parallelogram

X. 7.4: Properties of Special Parallelograms

A. Rhombus: A parallelogram with 4 congruent sides

B. Rectangle: A parallelogram with 4 right angles

C. Square: Rectangle + Rhombus

D. Collieries
1. Rhombus Corollary: A quadrilateral is a rhombus if and only if it has 4 congruent sides
2. Rectangle Corollary: A quadrilateral is a rectangle if and only if it has 4 right angles
3. Square Corollary: A quadrilateral is a square if and only if it is a rhombus and a rectangle

E. Rhombus Diagonals Theorems: The parallelogram is a rhombus if and only if its diagonals are perpendicular

F. Rhombus Opposite Angles Theorem: A parallelogram is a rhombus if and only if each diagonal bisects a pair of opposite angles

G. Rectangle Diagonals Theorem: A parallelogram is a rectangle if and only if its diagonals are congruent

XI. 7.5 Properties of Trapezoids and Kites

A. Isosceles Trapezoid Base Angles Theorem: If a trapezoid is isosceles, then each pair of base angles is congruent

B. Isosceles Trapezoid Base Angles Converse: If there is a pair of congruent base angles, then it is an isosceles trapezoid

C. Isosceles Trapezoid Diagonals Theorem: A trapezoid is isosceles if and only if its diagonals are congruent

D. Trapezoid Midsegment Theorem: The midsegment of a trapezoid is parallel it each base and the length is the average of the 2 bases

E. Kite Diagonals Theorem: If a quadrilateral is a kite, then its diagonals are perpendicular

F. Kite Opposite Angles Theorem: If a quadrilateral is a kite, then exactly one pair of opposite angles are congruent

XII. 8.1: Similar Polygons

A. Perimeters of Similar Polygons: The ratio of the lengths of the similar polygons is equal to the ratio of the perimeter of the two polygons

B. Areas of Similar Polygons: The ratio of the areas is equal to the squares of the ratios

XIII. 8.2: Proving Triangle Similarity by AA

A. AA Similarity Theorem: If 2 angles of one triangle are congruent to two angles of another triangle, then the two triangles are similar

XIV. 8.3: Proving Triangle Similarity by SSS and SAS

A. SSS Theorem: If the corresponding side lengths of two triangles are proportional, then the triangles are similar

B. SAS 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

XV. 8.4: Proportionality Theorems

A. 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

B. Converse of the Triangle Proportionality Theorem: If a line divides two sides of a triangle proportionally, then it is parallel to the third side

C. Three Parallel Lines Theorem: If three parallel lines intersect two transversals, then they divide the transversal proportionally

D. Triangle Angle Bisector Theorem: If a ray bisects the angle of a triangle, then it divides the opposite side into segments whose lengths are proportional to the lengths of the other 2 sides

XVI. 9.1: The Pythagorean Theorem

A. Pythagorean Theorem: Used to find the length of any side of a right triangle using $a^2 + b^2 = c^2$

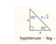
B. Pythagorean Triple: A set of 3 positive integers that satisfy the Pythagorean Theorem

C. Converse of the Pythagorean Theorem: If the triangle matches the Pythogaoren Theoreom's equation, then the triangle is a right triangle

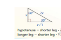
D. Pythagorean Inequalities Theorem: If the hypotenuse squared is larger than the 2 legs squared, then it is an obtuse triangle. If the hypotenuse squared is less than the 2 legs squared, then it is an acute triangle

XVII. 9.2: Special Right Triangles

A. 45-45-90 Triangle Theorem:



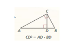
B. 30-60-90 Triangle Theorem:



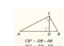
XVIII. 9.3: Similar Right Triangles

A. Right Triangle Similarity Theorem: If the Altitude is drawn to the hypotenuse of a right triangle, then the two triangle formed are similar to the original triangle and to each other

B. Geometric Mean (Altitude)



C. Geometric Mean (Leg)



XIX. 9.4: The Tangent Ratio

A. Tangent Ratio: Tan Theta = opposite/adjacent

XX. 9.5: The Sine and Cosine Ratios

A. Sine Ratio: sin theta = opposite/hypotenuse

B. Cos Ratio: cos theta = adjacent/hypotenuse

XXI. 9.6: Solving Right Triangles

A. Using Inverse

B. To solve means to find all side lengths and angle measures

XXII. 9.7: The Law of Sines and Cosines

A. Area of a triangle:

$\text{Area} = \frac{1}{2}bc \sin A \qquad \text{Area} = \frac{1}{2}ac \sin B \qquad \text{Area} = \frac{1}{2}ab \sin C$

B. Law of Sines:

$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c} \qquad \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

C. Law of Cosines:

$$a^2 = b^2 + c^2 - 2bc \cos A$$
$$b^2 = a^2 + c^2 - 2ac \cos B$$
$$c^2 = a^2 + b^2 - 2ab \cos C$$

XXIII. 10.1: Lines and Segments

A. Core Concepts:

A **chord** is a segment whose endpoints are on a circle. A **diameter** is a chord that contains the center of the circle.

A **secant** is a line that intersects a circle in two points.

A **tangent** is a line in the plane of a circle that intersects the circle in exactly one point, the **point of tangency**. The *tangent ray* $\overrightarrow{AB}$ and the *tangent segment* $\overline{AB}$ are also called tangents.