Postulates, Theorem,and Practice Problems

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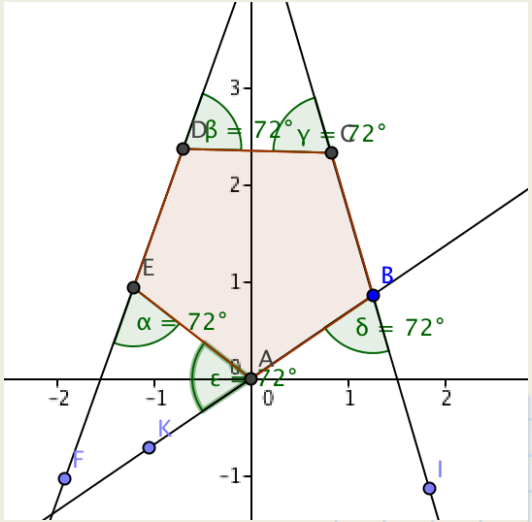
Polygon Exterior Angle Sum Theorem

The sum of the exterior angle measures of a convex polygon is 360°.

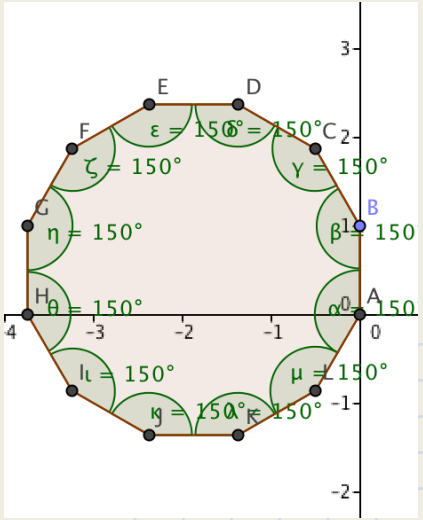
In the diagram, the exterior angles of pentagon ABCDE add up to be 360°.



Polygon Angle Sums Theorems

The sum of the interior angle measures of a convex polygon with n sides is (n – 2)180°.

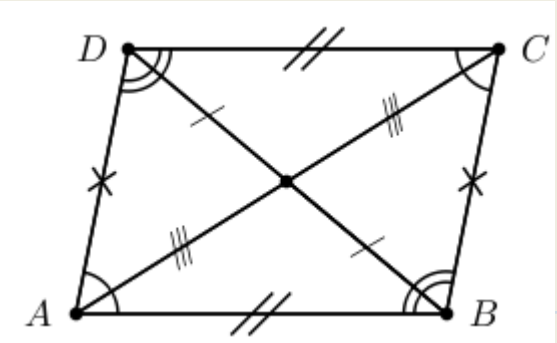
In the diagram, we can see it is a dodecagon, and inherently has 12 sides. Using (n - 2)180, we get 1800 total interior degrees. If we divide that by 12 angles, we get 150 degrees per angles, as seen in the diagram.



Parallelogram Theorems

If a quadrilateral is a parallelogram, then its opposite sides are congruent.
If a quadrilateral is a parallelogram, then its opposite angles are congruent.
If a quadrilateral is a parallelogram, then its consecutive angles are supplementary.
If a quadrilateral is a parallelogram, then its diagonals bisect each other.

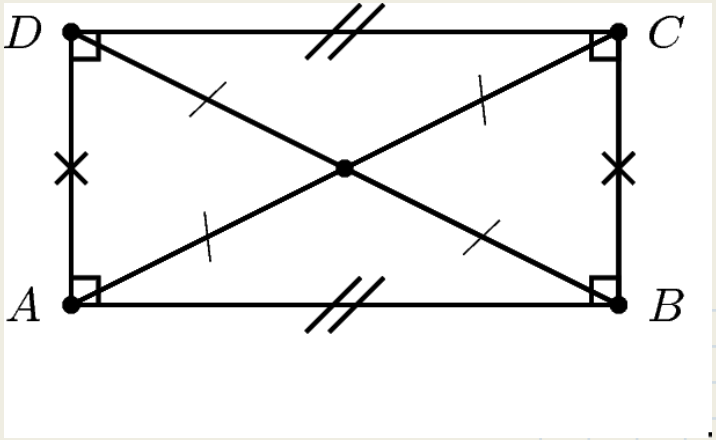
In the diagram, it has congruent opposite sides, congruent opposite angles, supplementary consecutive angles, and diagonals bisect each other.



Rectangle Properties

If a quadrilateral is a rectangle, then it is a parallelogram.
If a parallelogram is a rectangle, then its diagonals are congruent.

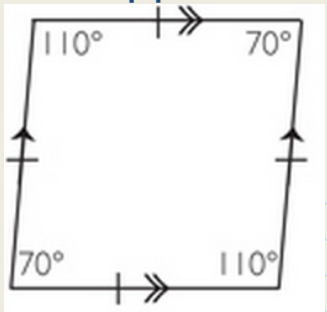
As you can see, rectangles have all of the properties of parallelograms, accept diagonals like DB and AC in the picture, are also congruent.



Rhombus Theorems

If a quadrilateral is a rhombus, then it is a parallelogram.
If a parallelogram is a rhombus, then its diagonals are perpendicular.
If a parallelogram is a rhombus, then each diagonal bisects a pair of opposite angles.
If a parallelogram is a rhombus, then it has four congruent sides.

In the diagram, we can see that a rhombus inherits the properties of parallelograms, and also gets perpendicular diagonals that bisect the opposite angles, and four congruent sides.

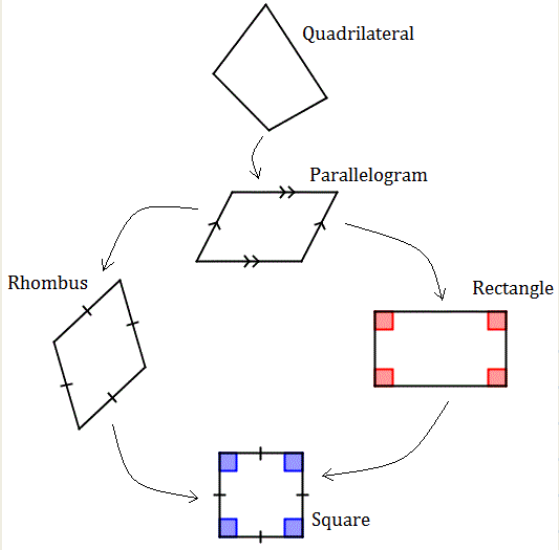


Square Theorems

The diagram shows that squares inherit all of the traits from quadrilaterals, parallelograms, rhombi, and rectangles.

Here is a brief list

If a quadrilateral is a parallelogram, then its opposite sides are congruent.
If a quadrilateral is a parallelogram, then its opposite angles are congruent.
If a quadrilateral is a parallelogram, then its consecutive angles are supplementary.
If a quadrilateral is a parallelogram, then its diagonals bisect each other.
If a quadrilateral is a rhombus, then it is a parallelogram.
If a parallelogram is a rhombus, then its diagonals are perpendicular.
If a parallelogram is a rhombus, then each diagonal bisects a pair of opposite angles.
If a parallelogram is a rhombus, then it has four congruent sides.
If a quadrilateral is a rectangle, then it is a parallelogram.
If a parallelogram is a rectangle, then its diagonals are congruent.
If a quadrilateral is a rectangle and rhombus, it is a square.



Why Those Theorems?

I chose the theorems that I did, because they were earlier in the unit, and I understood them more. Sometimes it takes a while to sink in, but I commit the theorems and postulates to memory. I tried to use as many as I could, and use GeoGebra (instead of Geometer's SketchPad) for diagrams. Thank you for seeing my work, and don't forget to read my practice problems on the next slides.

Zach’s Dilemma

One day Zach found a Darth Vader jacket on the ground. On the tag it said that it would allow him to lift objects inside of a regular hexagon with a perimeter of 30 feet. It said that the jacket is the center of the hexagon. Zach is wondering if he can lift his pencil from 5 feet away. Can he?

Ok, we know that the perimeter is 30. That means that each side is 6. If we form a 30-60-90 triangle with the radius as the hypotenuse, the short side is 3, because it is the midpoint of one side of the hexagon. The hypotenuse is 6, because of the 30-60-90 triangles theorem. Basically, Zach can reach the pencil, and probably won’t fail whatever he is working on. He can reach 6 feet in any direction.

Caillou's Lucky Day

Caillou heard that there is a wig (he really wants one) in a field shaped like a parallelogram, with an area of 30,000 square feet. He heard that it is 750 feet long, but Rosie was wondering how tall it is (Caillou is forcing her to find the wig).

To start of, we know that the formula for parallelogram area is A =b*h. With an area of 30,000, and a base of 750 feet, we can plug in it to the equation. 30,000 = 750 * h. To simplify, we can divide 30,000 by 750, and get the height. In conclusion, the field is 40 feet tall, if you solve the equation. There you go Rosie.

Jim’s Adventure

Jim was asked to look for a salmon feeding from walnuts, somewhere in the area of a regular hexagon with a perimeter of 240 miles. He was told catch it and bring it straight back to his mentor. However, Jim got tired, and decided to eat this fish swimming under a tree he was resting by. After eating it, he gained incredible knowledge (that is why his mentor wanted it). He now realized he had eaten the salmon that he was told to bring back, and freaked out. If he runs at 10 miles per hour, about how long will it take him (maximum) to get out of the hexagon (assuming he runs the fastest route), and escape his angry mentor.

Jim’s hexagon a perimeter of 240 miles, meaning each side is 40 miles. If we do the 30-60-90 triangle on the inside, we can see the apothem (shortest way out from the center), is 20 radical 3 miles. Since that is about 34.7 miles, it would take him about 3.5 hours, if he is in the exact center of the hexagon, if he wishes to escape his mentor’s wrath.