

## Parallelogram and Rhombus: Properties and Surface

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**Abstract.** *This annotation analyzes the main properties of a parallelogram and a rhombus, the formulas for calculating their surface area, and their place in geometry. Properties such as parallel sides of a parallelogram, the division of diagonals into two equal parts, and the equality of all sides of a rhombus and the perpendicularity of its diagonals are covered on a scientific basis. The topic gives students a deeper understanding of geometric figures and improves their ability to apply theoretical knowledge in practical tasks.*

**Keywords:** *Parallelogram, rhombus, surface, diagonals, geometry, properties, mathematical shapes.*

Parallelograms and rhombuses are important plane shapes in geometry, which are widely used in many theoretical laws, problems, and practical processes. This article extensively covers the main geometric properties of a parallelogram and a rhombus, their differences and similarities, methods for calculating surface area, and areas of application. This branch of mathematics is important not only for theoretical knowledge, but also in practice - in construction, engineering, design and drawing. Therefore, it is necessary to thoroughly study the exact description of shapes, the relationship between them, the properties of diagonals and angles. A parallelogram is a quadrilateral whose opposite sides are parallel and equal. Its main properties include the equality of opposite sides, the equality of opposite angles, the sum of the angles being  $180^\circ$ , and the division of the diagonals into two equal parts at the intersection point. These properties distinguish a parallelogram from other quadrilaterals and make it a convenient shape in geometric calculations.

There are also several methods for finding the area of a parallelogram, the most commonly used

$$S = a \cdot h$$

is the formula.

Where

a is the length of the base,

h is the height dropped to it.

Another way to find the area of a parallelogram is related to the diagonal,

$$S = ab \cdot \sin(\alpha)$$

is expressed in the form of.

This formula allows you to find the area using the lengths of two adjacent sides and the angle between them. In practical problems, this method is often convenient. Another important aspect of a parallelogram in geometry is that it can be easily determined in coordinate geometry by constructing it through points on the plane. In analytical geometry, there are also formulas for finding the area of a

parallelogram using vectors. A rhombus is a special form of a parallelogram, all of whose sides are equal. At the same time, the diagonals of a rhombus are perpendicular to each other and divide the angles into equal halves. This makes the geometric properties of a rhombus even more unique.

In a rhombus, the length of the diagonals is one of the main measurements, since its surface

$$S = (d_1 \cdot d_2) / 2$$

can be calculated using the formula. This formula is more simply used in cases where the diagonals of a rhombus are located in the vertical and horizontal directions. The angles of a rhombus are also discussed separately. In this shape, where all sides are equal, the opposite angles are equal, and the sum of the adjacent angles is  $180^\circ$ .

The diagonals divide the rhombus into four unequal triangles, but their shape is the same. Another of the most important advantages of a rhombus is its strength. Therefore, the rhombus shape is widely used in engineering and architecture. For example, the basic shape of some structural elements used in railway trains is taken from the rhombus. If we analyze the main differences between a parallelogram and a rhombus, in a rhombus all sides are equal, while in a parallelogram only opposite sides are equal.

In a rhombus, the diagonals are perpendicular to each other, while in a parallelogram this is not always necessary. However, both shapes have many common features - for example, the equal division of the diagonals at the intersection point, the sum of the angles, and the presence of parallel sides.

In practice, parallelograms and rhombuses are used in many areas. For example, in technical drawings, structures that represent tensile and compressive forces are often depicted in the form of parallelograms. The rhombus shape is also widely found in polygonal lattices, metal structures, decorative patterns, and national ornaments. In patterns, the rhombus has long been used as a symbol of stability, protection, and purity.

In modern design and architecture, rhombus shapes are used to enhance visual dynamics. The properties of these shapes are widely used in solving mathematical problems. For example, the diagonals of a parallelogram make it possible to determine the lengths of the sides and the sizes of the angles. In a rhombus, the diagonals make it easier to construct triangles, measure angles, and find the area. The relationship between the parallelogram and the rhombus, the relationship between their sizes and angles, is of great importance in solving many complex problems.

In conclusion, it can be said that the parallelogram and the rhombus are the basic shapes of geometry, and their theoretical properties and practical applications are extremely wide. Knowing the formulas for calculating their area, understanding the properties of diagonals, and correctly applying geometric relationships is of particular importance for students and specialists. These shapes play a key role not only in mathematics, but also in everyday life, architecture, construction, and technology.

## References

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