

# Formulas for calculating the area and perimeter of an isosceles trapezoid.

What are the characteristics of an isosceles trapezoid? What are the formulas for calculating the area and perimeter of an isosceles trapezoid? This article will provide basic knowledge about isosceles trapezoids.

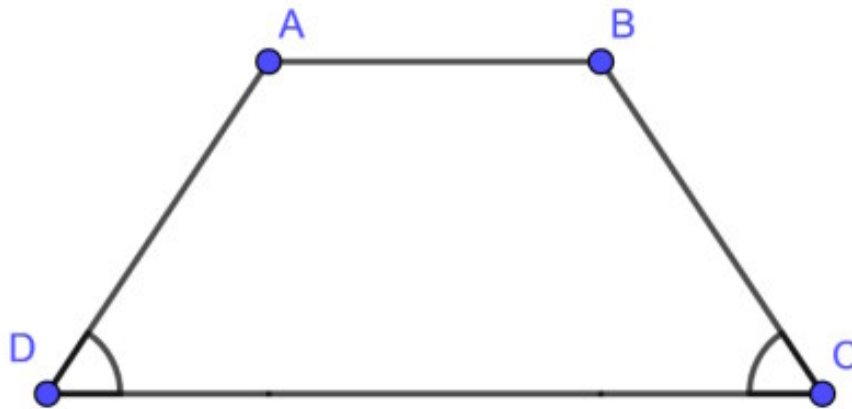
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## Isosceles Trapezoid Theory

### What is an isosceles trapezoid?

An isosceles trapezoid is a special type of quadrilateral in which two sides are parallel (like a trapezoid) and two angles adjacent to one of the bases are equal.

An isosceles trapezoid with  $AB \parallel CD$ , and angle C equals angle D.



### Characteristics of an isosceles trapezoid

An isosceles trapezoid has the following characteristics and properties:

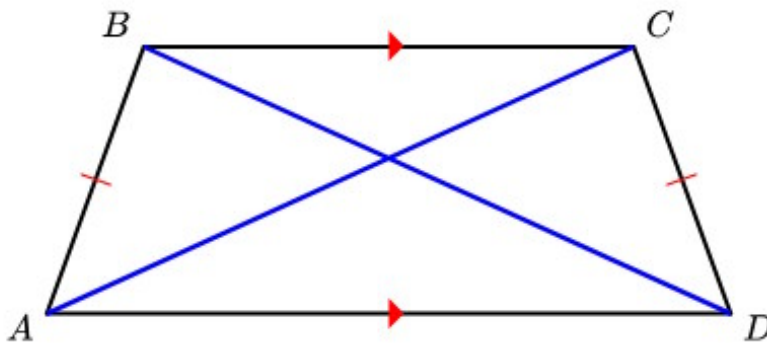
1. A trapezoid has two equal sides. For example, ABCD is an isosceles trapezoid (bases AB and CD)  $\Rightarrow AD = BC$

2. A trapezoid has two adjacent base angles that are equal. For example, ABCD is an isosceles trapezoid (bases AB and CD)  $\Rightarrow AC = BD$
3. A trapezoid has two equal diagonals. For example, ABCD is an isosceles trapezoid (bases AB and CD)  $\Rightarrow$  angle C = angle D and angle A = angle B.

### How to identify an isosceles trapezoid

1. There are several signs that can help you determine if it is an isosceles trapezoid.
2. A trapezoid with two angles adjacent to one base being equal is an isosceles trapezoid.
3. A trapezoid with two equal diagonals is an isosceles trapezoid.
4. A trapezoid inscribed in a circle is an isosceles trapezoid.

Note: An isosceles trapezoid has two equal sides, but the reverse is not always true. For example, a quadrilateral with two pairs of parallel sides and equal sides is not necessarily an isosceles trapezoid.



### Instructions for proving that a trapezoid is isosceles.

To prove that a trapezoid is isosceles, you rely on the following characteristics:

1. Prove that a trapezoid has two angles adjacent to one base that are equal.
2. Prove that a trapezoid has two equal diagonals.

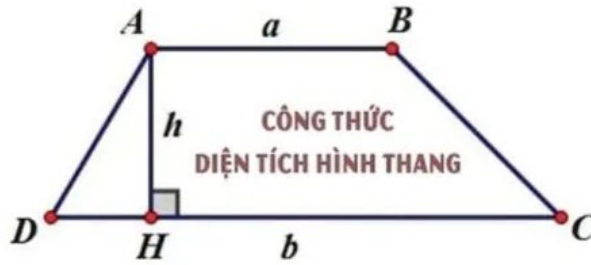
### Formula for the area of an isosceles trapezoid

To calculate the area of an isosceles trapezoid, we multiply the height by the average of the two bases. The height here is the side perpendicular to both bases.

**Formula:**  $S = (a + b)/2 \times h$

In there:

1. S is the area of the trapezoid.
2. a and b are the lengths of the two base sides.
3. h is the length of the side perpendicular to the two bases.



$$S = \frac{1}{2}h(a + b)$$

## Formula for calculating the perimeter of an isosceles trapezoid

To calculate the perimeter of an isosceles trapezoid, you add up the lengths of its four sides: the two bases and the two sides.

Formula:  $P = a + b + c + d$  (where a, b are the two bases, c, d are the two sides) or

$P = (\text{large base} + \text{small base}) + (2 \times \text{side edge})$  (because side edge  $c = d$ ).

## Exercises on the area and perimeter of an isosceles trapezoid

**Exercise 1: Calculate the perimeter of an isosceles trapezoid given the lengths of the base and the side.**

Given an isosceles trapezoid ABCD, with the longer base being 23 cm, the shorter base 15 cm, and the two non-parallel sides measuring 7 cm and 8 cm respectively, calculate the perimeter of trapezoid ABCD.

Applying the formula, we have the solution:  $23 + 15 + 7 + 8 = 53$  (cm)

**Exercise 2: Calculate the length of the side of an isosceles trapezoid given its perimeter.**

Given an isosceles trapezoid ABCD with two equal sides, its perimeter is 56cm, and the lengths of its two bases are 18cm and 10cm respectively. Calculate the length of the isosceles trapezoid ABCD.

The total length of the two sides of the isosceles trapezoid ABCD is:  $56 - 18 - 10 = 28$  (cm)

The lengths of the two sides of the isosceles trapezoid are:  $28 : 2 = 14$  (cm)

**Exercise 3: Calculate the area of an isosceles trapezoid given the lengths of its two bases and its height.**

Given an isosceles trapezoid ABCD, with the shorter base measuring 12cm and the longer base measuring 18cm. The height of the trapezoid is 8cm. Calculate the area of trapezoid ABCD.

Area of the isosceles trapezoid:  $(18 + 12) \times 8 : 2 = 120$  (cm<sup>2</sup>)

**Exercise 4: Calculate the height given the lengths of the two bases and the area of an isosceles trapezoid.**

Given a trapezoid ABCD with an area of  $128 \text{ cm}^2$ , a shorter base of 12 cm, and a longer base of 20 cm. Calculate the height of the trapezoid.

From the formula for the area of an isosceles trapezoid, the height of an isosceles trapezoid is calculated as  $h = \frac{S \times 2}{a + b}$ .

The height of the trapezoid is:  $128 \times 2 : (20 + 12) = 8 \text{ cm}$

**Exercise 5: Calculate the area of an isosceles trapezoid when the lengths of the two bases and the height are unknown.**

Given an isosceles trapezoid ABCD with a height of 56cm. The longer base is 24cm longer than the shorter base, and the shorter base is  $\frac{2}{5}$  of the longer base. Calculate the area of trapezoid ABCD.

The difference in the number of equal parts is:  $5 - 2 = 3$  (parts)

The length of the longer base is:  $24 : 3 \times 5 = 40$  (cm)

The length of the smaller base is:  $40 - 24 = 16$  (cm)

The area of the trapezoid is:  $(16 + 40) \times 56 : 2 = 1568$  (cm<sup>2</sup>)

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