

Area and Perimeter of Triangles and Quadrilaterals

Introduction

In geometry, triangles and quadrilaterals are among the most fundamental shapes. Understanding their *area* and *perimeter* allows us to solve many practical problems, such as calculating land size or building materials. Let's explore how to measure these properties.

1. Area and Perimeter of Triangles

Perimeter of a Triangle

The **perimeter** of a triangle is the sum of the lengths of its three sides.

- **Formula:**

$$P = a + b + c$$

where a , b , and c are the lengths of the triangle's sides.

- **Example:**

A triangle has sides $a = 5$ cm, $b = 6$ cm, $c = 7$ cm:

$$P = 5 + 6 + 7 = 18 \text{ cm}$$

.2 Area of a Triangle

The area of a triangle depends on its base and height.

- **Formula:**

$$A = \frac{1}{2} \times b \times h$$

where b is the base and h is the height (the perpendicular distance from the base to the opposite vertex).

- **Example:**

A triangle with $b = 8$ m, $h = 5$ m:

$$A = \frac{1}{2} \times 8 \times 5 = 20 \text{ m}^2$$

- **Special Case: Heron's Formula** (when side lengths are known):

$$A = \sqrt{s(s-a)(s-b)(s-c)}$$

where $s = \frac{a+b+c}{2}$ is the semi-perimeter.

- **Example:** For a triangle with sides $a = 6$, $b = 8$, $c = 10$:

$$s = \frac{6 + 8 + 10}{2} = 12$$

$$A = \sqrt{12(12-6)(12-8)(12-10)} = \sqrt{12 \cdot 6 \cdot 4 \cdot 2} = \sqrt{576} = 24$$

2. Area and Perimeter of Quadrilaterals

2.1 Perimeter of Quadrilaterals

The **perimeter** is the sum of the lengths of all sides.

- **Formula:**

For any quadrilateral:

$$P = a + b + c + d$$

where a , b , c , and d are the lengths of the sides.

- **Example:**

A quadrilateral with sides $a = 4$ cm, $b = 6$ cm, $c = 7$ cm, $d = 5$ cm:

$$P = 4 + 6 + 7 + 5 = 22 \text{ cm}$$

2.2 Area of Quadrilaterals

The **area** formula varies depending on the type of quadrilateral:

a) Rectangle:

- Formula:

$$A = l \times w$$

where l = length, w = width.

- Example:

A rectangle with $l = 10$ m, $w = 6$ m:

$$A = 10 \times 6 = 60 \text{ m}^2$$

b) Square:

- Formula:

$$A = s^2$$

where s = side length.

- Example:

A square with side length $s = 4$ cm:

$$A = 4^2 = 16 \text{ cm}^2$$

c) Parallelogram:

- Formula:

$$A = b \times h$$

where b = base, h = height (the perpendicular distance between parallel sides).

- Example:

A parallelogram with $b = 8$ cm, $h = 5$ cm:

$$A = 8 \times 5 = 40 \text{ cm}^2$$

d) Trapezium (or Trapezoid):

- Formula:

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

where a and b are the lengths of the parallel sides, and h is the height.

- Example:

A trapezium with $a = 6$ cm, $b = 10$ cm, $h = 4$ cm:

$$A = \frac{1}{2} \times (6 + 10) \times 4 = \frac{1}{2} \times 16 \times 4 = 32 \text{ cm}^2$$

3. Key Differences Between Area and Perimeter

Concept	Definition	Units
Perimeter	Distance around the boundary of a shape	Units (e.g., cm, m)
Area	Space enclosed within the shape	Square units (e.g., cm ² , m ²)

Summary

- Use appropriate formulas depending on the shape.

- Always include the correct units.
- Recognize whether you're measuring *around* (perimeter) or *inside* (area) the shape.