

Heron's Formula

Introduction

Heron's Formula is used to find the **area of a triangle** when the lengths of all three sides are known. It is especially useful when the height of the triangle is not given. This chapter also explains how Heron's Formula can be applied to solve practical problems involving triangles and other shapes.

What is Heron's Formula?

Definition

Heron's Formula gives the area of a triangle using only the lengths of its three sides.

Let the sides of a triangle be **a, b, and c**.

First, find the **semi-perimeter (s)**:

$$s = (a + b + c) / 2$$

Then, the area of the triangle is:

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

Semi-Perimeter

Meaning

The semi-perimeter of a triangle is **half of its perimeter**.

$$\text{Perimeter} = a + b + c$$

$$\text{Semi-Perimeter} = (a + b + c) / 2$$

The value of **s** must always be calculated before applying Heron's Formula.

Steps to Apply Heron's Formula

Procedure

1. Write the lengths of all three sides.
2. Find the semi-perimeter (**s**).
3. Substitute the values into Heron's Formula.

4. Simplify the expression carefully.
5. Write the area in square units.

Following these steps helps avoid calculation mistakes.

Applications of Heron's Formula

Uses

Heron's Formula is useful for finding the area of:

- A triangle when only the side lengths are known.
- Parks, fields, and plots of triangular shape.
- Quadrilaterals by dividing them into two triangles.
- Various real-life construction and surveying problems.

Finding the Area of a Quadrilateral

Method

A quadrilateral can often be divided into **two triangles** using a diagonal.

The area of each triangle is found using Heron's Formula, and the total area is obtained by adding the two areas.

Total Area = Area of Triangle 1 + Area of Triangle 2

Important Points

- Heron's Formula can be used only when **all three sides** of the triangle are known.
- Always calculate the **semi-perimeter** first.
- The area is always expressed in **square units**.
- Check that the given sides can actually form a triangle before applying the formula.
- Write the final answer in the correct unit.

Chapter Summary

In this chapter, we learned how to calculate the area of a triangle using Heron's Formula without knowing its height. We also studied the concept of semi-perimeter and learned to apply the formula to triangles and quadrilaterals. Heron's Formula is an important mathematical tool with many practical applications.