CLASS-7

LESSON-6 THE TRIANGLE AND ITS PROPERTIES

(This PDF Based on NCERT book)

TRIANGLE(त्रिभुज)-A triangle is a fundamental shape in geometry. It's a closed, two-dimensional figure with **three straight sides**, **three corners (vertices)**, and **three angles**.

PROPERTIES OF TRIANGLE(त्रिभुज के गुण):

- **Angle Sum Property**: The three interior angles of any triangle always add up to exactly **180 degrees**. This is the most important property.
- **Triangle Inequality**: The sum of the lengths of any two sides of a triangle must be **greater than** the length of the third side. If this isn't true, you can't form a closed triangle.
- **Side-Angle Relationship**: The longest side of a triangle is always opposite the largest angle, and the shortest side is opposite the smallest angle.

TYPES OF TRIANGLES(त्रिभुज के गुण):

Based on sides(भुजा पर आधारित)-

- **Equilateral Triangle(समबाहु त्रिभुज)**: All **three sides are equal**, and all three angles are equal (each is 60°).

- **Isosceles Triangle(समद्विबाहु त्रिभुज)**: At least **two sides are equal**, and the two angles opposite those sides are also equal.

- **Scalene Triangle(विषमबाहु त्रिभुज)**: All **three sides are different lengths**, and all three angles are different.

Based on angles(कोण पर आधारित)-

- **Acute Triangle(न्यूनकोण त्रिभुज)**: All three angles are **less than 90°**.

- **Right Triangle(समकोण त्रिभुज)**: It has exactly **one angle that is 90°** (a right angle).

- **Obtuse Triangle(अधिककोण त्रिभुज)**: It has exactly **one angle that is greater than 90°** (an obtuse angle).

MEDIAN OF A TRIANGLE(त्रिभुज की मध्यिका)-A **median of a triangle** is a line segment that connects a **vertex** (corner) of the triangle to the **midpoint** of the opposite side. Every triangle has three medians, one for each vertex.

ALTITUDES OF A TRIANGLE(त्रिभुज की उच्चाई)-An **altitude** of a triangle, also known as its **height**, is a line segment drawn from a **vertex** (corner) of the triangle perpendicular to the opposite side. The term "perpendicular" means that the line segment forms a **90-degree angle** with the opposite side (or with the line containing the opposite side).

Every triangle has three altitudes, one from each vertex.

EXTERIOR ANGLE OF A TRIANGLE AND ITS PROPERTY(त्रिभुज का बाह्यकोण और उसके गुण)-

An **exterior angle** of a triangle is an angle formed on the outside of the triangle when one of its sides is extended. It forms a straight line with its neighboring interior angle.

Main Property:

The measure of an exterior angle of a triangle is **equal to the sum of the two opposite interior angles** (the ones not next to it).

For example, in the image below, the red exterior angle is equal to the sum of the two blue interior angles.

Other Properties:

- An exterior angle and its adjacent interior angle always add up to **180°**.
- The sum of all three exterior angles of any triangle (taking one at each vertex) is always **360°**.

ANGLE SUM PROPERTY OF A TRIANGLE(त्रिभुज के कोणों का योग):

The **angle sum property** states that the sum of the three interior angles of any triangle is always **180 degrees** (°).

This means that if you have a triangle with angles A, B, and C, the following formula is always true:

$A + B + C = 180°$

For example, if a triangle has two angles that measure 70° and 50°, you can find the third angle by doing the following calculation: 180° - (70° + 50°) = 180° - 120° = 60° The third angle is 60°.

SUM OF THE LENGTHS OF TWO SIDES OF A TRIANGLE(त्रिभुज की दो भुजाओ की लंबाई का योग):

The sum of the lengths of any two sides of a triangle must be **greater than** the length of the third side. This is a fundamental rule in geometry called the **Triangle Inequality Theorem**.

If this rule isn't true, you can't form a closed triangle. For example, if you have sides with lengths of 2, 3, and 10, they cannot form a triangle because 2 + 3 is not greater than 10. The two shorter sides wouldn't be long enough to connect at their ends.

This theorem applies to all combinations of sides within a single triangle:

- $a + b > c$
- $b + c > a$
- $a + c > b$

RIGHT-ANGLED TRIANGLES AND PYTHAGORAS PROPERTY(समकोण त्रिभुज और पायथागोरस प्रमेय):

A **right-angled triangle** is a special type of triangle that has one angle that measures exactly **90 degrees** (a right angle).

The side that is opposite the right angle is called the **hypotenuse**, and it is always the longest side of the triangle. The other two sides are called the **legs**.

The formula:

If the two shorter sides are called **a** and **b**, and the longest side is called **c**, then the rule is written as:

$a^2+b^2=c^2$

This rule is useful because if you know the length of any two sides of a right-angled triangle, you can always find the length of the third side.

For example, if the two legs of a right-angled triangle are 3 inches and 4 inches long, you can find the length of the hypotenuse as follows:

$a=3, b=4, c=?$

$3^2+4^2=c^2$

$9+16=c^2$

$25=c^2$

$\sqrt{25}=c$

$5=c$ or $c=5$ inches

The **Answer** is 5 inches .