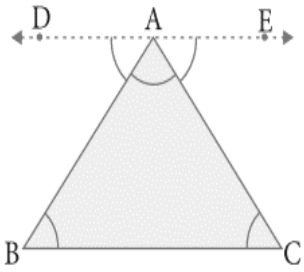
Angle sum property of a triangle

Understanding: Angle Sum Property of a Triangle

- The angle sum property of a triangle states that the sum of all interior angles of a triangle is always 180°.
- This rule is true for all types of triangles.
- It helps in finding the unknown angle when two angles are given.

Let us prove the Angle sum property of triangle that the sum of the measures of the three angles of a triangle is equal to 180°, using the property of parallel lines.

- **Given:** A triangle ABC
- **To prove:** ∠A + ∠B + ∠C = 180°
- **Construction:** draw a line DE parallel to the side BC of the given triangle.
- **Proof:** Since DE is a straight line, it can be concluded that:



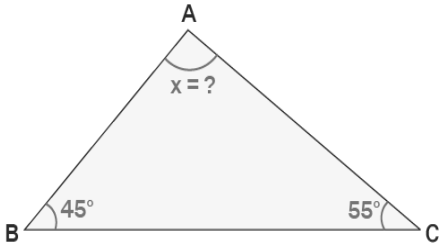
- ∠DAB + ∠BAC + ∠EAC = 180° .....(1)
- Since DE||BC and AB, AC are transversals,
- Therefore, ∠EAC = ∠ACB (a pair of alternate angles)
- Also, ∠DAB = ∠CBA (a pair of alternate angles)
- Substituting the value of ∠EAC and ∠DAB in equation (1),
- ∠ACB + ∠BAC + ∠CBA= 180°
- Thus, the sum of the interior angles of a triangle is 180°.

Examples with Solutions

Example

Find the third Angel: ∠A =?

We know that ∠ABC = 45° and ∠ACB = 55°.



Using the Angle Sum Property of a triangle,

∠A + ∠B + ∠C = 180,

∠A + 45 + 55° = 180°,

∠A + 100° = 180°,

∠A = 180° -100°,

∠A = 80°.

Therefore, the third angle: ∠A = 80°

Example

Can a triangle have angles 90°, 60°, and 40°?

Sum = 90° + 60° + 40° = 190°

No, it is not a triangle because the sum is not 180°

Example

One angle of a triangle is 30°, and the other two angles are equal. Find each of the equal angles

Let each equal angle be x

So, x + x + 30 = 180

2x = 150

x = $\frac{150}{2}$ = 75°

The equal angles are 75° each

Example

In a triangle, one angle is twice the second angle and the third angle is 40°. Find the other two angles

Let second angle = x, first angle = 2x

So, 2x + x + 40 = 180

3x = 140

x = $\frac{140}{3}$ ≈ 46.67°

First angle = 93.33°,

second angle = 46.67°,

third angle = 40°

The three angles are approximately 93.33°, 46.67°, and 40°

Summary Points

- The sum of the three interior angles of a triangle is always 180°.
- If two angles are known, the third can be found using subtraction.
- This rule applies to all triangles regardless of type.
- Use algebra when angles are given in terms of x.