Chapter 3: Geometry

This chapter includes the following subtopics:

- **3.1 Similarity**

- **3.2 Circles**

- **3.3 Constructions**

3.1 Similarity

✦ Explanation:

- Two figures are **similar** if they have the **same shape but not necessarily the same size**.

- In triangles, similarity is established using the following criteria:

  - **AAA** (Angle-Angle-Angle)

  - **SAS** (Side-Angle-Side)

  - **SSS** (Side-Side-Side)

- In similar triangles:

$$\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$$

- Corresponding angles are equal, and corresponding sides are proportional.

✦ Example:

In △ABC and △DEF, ∠A = ∠D, ∠B = ∠E, and AB/DE = AC/DF. Show that triangles are similar.

Solution:
Given two angles are equal, the third will also be equal (angle sum property).
Since two angles are equal and sides around those angles are in proportion → **SAS similarity criterion** is satisfied.
Hence, △ABC ~ △DEF.

3.2 Circles

✦ Explanation:

Key Theorems and Results:

- **Tangent to a circle** is perpendicular to the radius at the point of contact.

- **Two tangents drawn from an external point to a circle are equal in length.**

- **Angle in a semicircle is a right angle.**

- **Cyclic Quadrilateral**: A quadrilateral inscribed in a circle. Opposite angles are supplementary.

✦ Example:

A tangent is drawn from an external point P to a circle with center O. Prove that the radius at the point of contact is perpendicular to the tangent.

Solution:
Join OP and OA, where A is the point of contact.
Triangle OAP is formed.
Since the shortest distance from the center to the tangent is the radius, OA ⊥ tangent at A.
Hence, **radius is perpendicular to the tangent at the point of contact**.

3.3 Constructions

✦ Explanation:

Construction problems involve drawing triangles, tangents, and circles using compass and ruler with precision.

Types include:

- Constructing tangents to a circle from an external point

- Drawing similar triangles

- Dividing a line segment in a given ratio

✦ Example:

Construct a pair of tangents from a point 6 cm away from the center of a circle of radius 3 cm.

Solution:

1. Draw a circle with radius 3 cm and center O.

2. Mark a point P 6 cm from O.

3. Join OP.

4. Find the midpoint M of OP.

5. Draw a semicircle on OP with diameter OP.

6. Draw a perpendicular to OP from point A (where it meets the circle). This intersects the semicircle at points of tangency.

7. Join P to the points of contact — these are the tangents.