Grade 10 Mathematics Presentation Script

Area of Common Regions Between Circles

Pre-Class Preparation

Materials Checklist:

- Compasses (one per group)
- Rulers (one per group)
- Pencils
- Graph paper
- Calculators (one per group)
- Chart paper for recording key takeaways
- Markers

Room Setup:

- Prepare board space for formula derivation
- Arrange desks for group work
- Have extra compasses and graph paper available
- Prepare examples on chart paper for display

Phase 1: Problem-Solving and Discovery (15 minutes)

Opening Hook (2 minutes)

[DO] Display pictures of overlapping circles (Olympic symbol, Venn diagrams, traffic islands).

[SAY] Look at these shapes. What do you notice about them?

[WAIT] Expected: They are overlapping circles! They share a common area!

[ASK] How would we find the area of the overlapping region?

[WAIT] Expected: We need a formula!

[SAY] Exactly! This is called the common region. Today we will learn how to find its area.

[SAY] We will explore by drawing overlapping circles.

Anchor Activity Launch (3 minutes)

[DO] Distribute compasses, rulers, graph paper, and calculators to each group.

[SAY] Here is your challenge: You will discover the formula for finding the area of the common region between two circles.

[SAY] Here is what you will do:

[SAY] Step 1: Use a compass to draw a circle with radius 5 cm centered at point O.

[SAY] Step 2: From a point 2 cm to the right of O, draw another circle with the same radius.

[SAY] Step 3: Name the intersection points P and Q.

[SAY] Step 4: Lightly shade the overlapping region.

[SAY] Step 5: Find the area of the common region. How does the distance between centers affect the area?

[SAY] Step 6: Discuss your results with other learners.

[SAY] Work with your group. You have 10 minutes.

Student Work Time (8 minutes)

[DO] Circulate among groups.

[ASK] To a group struggling with drawing: Did you draw both circles with the same radius? Are they overlapping?

[WAIT] Expected: Students draw overlapping circles.

[SAY] Good! Now identify the intersection points and shade the common region.

[ASK] To another group: What shapes make up the common region?

[WAIT] Expected: Two segments!

[SAY] Excellent! How do we find the area of the common region?

[WAIT] Expected: We add the areas of the two segments!

[SAY] Perfect! Calculate both segment areas.

[DO] For struggling groups: Let us identify the two segments first. How do we find the area of each segment?

[DO] For early finishers: Can you write a general formula for the common region?

Class Discussion (2 minutes)

[DO] Call on 2-3 groups to share their findings.

[ASK] What did you discover about finding the area of the common region?

[WAIT] Expected: We add the areas of the two segments!

[SAY] Excellent! Did everyone get the same formula?

[WAIT] Check for understanding.

[SAY] Today we will formalize this formula.

Phase 2: Structured Instruction (10 minutes)

Formalizing the Formula (10 minutes)

[SAY] Now that you have explored common regions, let us formalize what we learned.

[WRITE] On the board: Area of Common Regions Between Circles

[SAY] The common region between two intersecting circles refers to the overlapping area shared by both circles.

[DO] Draw two overlapping circles on the board.

[SAY] It is formed when two circles intersect at two distinct points.

[SAY] The area of the common region is found by:

[WRITE] 1. Calculate the area of the two segments formed by the chord joining the intersection points.

[WRITE] 2. Sum the areas of the two segments.

[WRITE] A = A segment 1 + A segment 2

[SAY] Where each segment area = Area of sector minus Area of triangle.

[ASK] Does everyone understand this formula?

[WAIT] Check for nods or questions.

Addressing Misconceptions:

[SAY] Let me address some common mistakes:

[SAY] Mistake 1: The common region is a single segment. No, it is made up of two segments, one from each circle.

[SAY] Mistake 2: I multiply the areas. No, you add the areas of the two segments.

[SAY] Mistake 3: The two segments are always equal. No, they are only equal if the circles have the same radius.

[SAY] Mistake 4: I can find the area without trigonometry. No, for most problems you need trigonometry.

[ASK] Does everyone understand?

[WAIT] Check for understanding.

Phase 3: Practice and Application (10 minutes)

Worked Example (10 minutes)

[SAY] Let us work through an example together.

[WRITE] Example: Two circles of radii 8 cm and 6 cm intersect. The common chord is 9 cm. Calculate the area of the common region.

[DO] Draw the diagram on the board.

[SAY] Step 1: Find the distances from centers to the chord.

[WRITE] O1M = square root of (8 squared minus 4.5 squared) = 6.14 cm

[WRITE] O2M = square root of (6 squared minus 4.5 squared) = 3.969 cm

[SAY] Step 2: Find the area of segment 1.

[WRITE] angle = 97.18 degrees

[WRITE] Area of sector = 30.53 cm squared

[WRITE] Area of triangle = 17.86 cm squared

[WRITE] Area of segment 1 = 12.67 cm squared

[SAY] Step 3: Find the area of segment 2.

[WRITE] angle = 68.46 degrees

[WRITE] Area of sector = 38.24 cm squared

[WRITE] Area of triangle = 29.76 cm squared

[WRITE] Area of segment 2 = 8.48 cm squared

[SAY] Step 4: Add the areas.

[WRITE] Total area = 12.67 + 8.48 = 21.15 cm squared

[SAY] The area of the common region is 21.15 cm squared.

[ASK] Does everyone understand?

[WAIT] Check for understanding.

Phase 4: Assessment (5 minutes)

Exit Ticket

[SAY] Before we finish, I want to check your understanding. Please complete the exit ticket individually.

[DO] Display question on the board or distribute exit ticket.

[SAY] You have 5 minutes to complete the question.

Exit Ticket Question:

1. Two circular traffic islands of radius 10 meters overlap so that the centers are 12 meters apart. The angle at the center is 120 degrees. Find the area of the overlapping region.

Differentiation Notes

For Struggling Learners:

- Provide pre-drawn overlapping circles.
- Use circles with equal radii for initial practice.
- Pair with confident problem solvers.
- Provide step-by-step calculation templates.
- Break down the formula into steps.

For Advanced Learners:

- Challenge with deriving the formula algebraically.
- Explore real-world applications: Olympic symbol, traffic islands, Venn diagrams.
- Investigate problems with circles of different radii.
- Apply the concept to three or more overlapping circles.

Post-Lesson Reflection Prompts

- Did students successfully discover the common region formula through the anchor activity?
- Were students able to draw overlapping circles accurately?
- What misconceptions emerged, and how were they addressed?
- Did students understand that the common region is made up of two segments?
- What adjustments would improve this lesson?