Grade 10 Mathematics Presentation Script

Area of Annular Sectors

Pre-Class Preparation

Materials Checklist:

- Two circular paper cutouts per group (one smaller, one larger)
- Scissors (one per group)
- Protractors (one per group)
- Rulers (one per group)
- Colored markers
- 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 circular cutouts and scissors available
- Prepare examples on chart paper for display

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

Opening Hook (2 minutes)

[DO] Display pictures of annular sectors in real life (windshield wipers, wind turbines, clock hands).

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

[WAIT] Expected: They are parts of rings! They sweep through an angle!

[ASK] How would we find the area of these shapes?

[WAIT] Expected: We need a formula!

[SAY] Exactly! These are called annular sectors. Today we will learn how to find their area.

[SAY] We will explore by cutting out sectors from two concentric circles.

Anchor Activity Launch (3 minutes)

[DO] Distribute circular cutouts, scissors, protractors, and rulers to each group.

[SAY] Here is your challenge: You will discover the formula for finding the area of an annular sector.

[SAY] Here is what you will do:

[SAY] Step 1: Take two circular cutouts of different sizes but with the same center.

[SAY] Step 2: Use a protractor to mark the same central angle on both circles.

[SAY] Step 3: Cut out the corresponding sectors from both circles.

[SAY] Step 4: Place the smaller sector on the larger one and observe the remaining shape.

[SAY] Step 5: Measure and calculate the area of each sector using the formula.

[SAY] Step 6: Discuss how to get the area of the figure you have formed.

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

Student Work Time (8 minutes)

[DO] Circulate among groups.

[ASK] To a group struggling with marking: Did you mark the same angle on both circles? Can you use the protractor?

[WAIT] Expected: Students mark and cut the sectors.

[SAY] Good! Now place the smaller sector on the larger one. What shape do you see?

[ASK] To another group: How do we find the area of this shape?

[WAIT] Expected: We subtract the area of the smaller sector from the area of the larger sector!

[SAY] Excellent! Now calculate both areas and subtract.

[WAIT] Expected: Students calculate the area.

[SAY] Perfect! What formula did you discover?

[DO] For struggling groups: Let us find the area of the larger sector first. Then find the area of the smaller sector. What do we do next?

[DO] For early finishers: Can you write a general formula for any annular sector?

Class Discussion (2 minutes)

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

[ASK] What did you discover about finding the area of an annular sector?

[WAIT] Expected: We subtract the area of the smaller sector from the area of the larger sector!

[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 annular sectors, let us formalize what we learned.

[WRITE] On the board: Area of Annular Sectors

[SAY] An annular sector is the region enclosed between two concentric sectors of a circle with different radii but the same central angle.

[DO] Draw an annular sector on the board.

[SAY] It is similar to a sector but with a smaller sector removed from a larger one.

[SAY] The area of an annular sector is found using this formula:

[WRITE] A = (θ / 360) times π (R squared minus r squared)

[SAY] Where θ is the central angle in degrees, R is the outer radius, r is the inner radius, and π approximately equals 3.142 or 22/7.

[ASK] Does everyone understand this formula?

[WAIT] Check for nods or questions.

Addressing Misconceptions:

[SAY] Let me address some common mistakes:

[SAY] Mistake 1: I can use different angles for the two sectors. No, both sectors must have the same central angle.

[SAY] Mistake 2: The two circles can have different centers. No, the circles must be concentric (share the same center).

[SAY] Mistake 3: I subtract the radii first, then square. No, you must square each radius first, then subtract.

[SAY] Mistake 4: An annular sector is the same as an annulus. No, an annular sector is part of an annulus, defined by a central angle.

[ASK] Does everyone understand?

[WAIT] Check for understanding.

Phase 3: Practice and Application (10 minutes)

Worked Example 1: Wind Turbine (5 minutes)

[SAY] Let us work through an example together.

[WRITE] Example 1: A wind turbine blade sweeps through a central angle of 140 degrees. The length of the blade is 50 m, and the inner radius is 10 m. Find the swept area.

[DO] Draw the diagram on the board.

[SAY] Step 1: Identify the values.

[WRITE] R = 50 m, r = 10 m, θ = 140 degrees

[SAY] Step 2: Write the formula and substitute.

[WRITE] A = (140 / 360) times π (50 squared minus 10 squared)

[SAY] Step 3: Calculate.

[WRITE] A = (7 / 18) times (22 / 7) (2500 minus 100)

[WRITE] A = (7 / 18) times (22 / 7) times 2400

[WRITE] A = 2933.3 m squared

[SAY] The turbine sweeps an area of approximately 2933.3 m squared.

[ASK] Does everyone understand?

[WAIT] Check for understanding.

Worked Example 2 (5 minutes)

[SAY] Let us try another example.

[WRITE] Example 2: Find the area of an annular sector where $\theta = 60$ degrees, R = 12 cm, r = 8 cm (Use $\pi = 3.142$).

[DO] Draw the diagram on the board.

[SAY] Step 1: Identify the values.

[WRITE] $\theta = 60$ degrees, R = 12 cm, r = 8 cm

[SAY] Step 2: Write the formula and substitute.

[WRITE] A = (60 / 360) times 3.142 (12 squared minus 8 squared)

[SAY] Step 3: Calculate.

[WRITE] A = (1 / 6) times 3.142 (144 minus 64)

[WRITE] A = (1 / 6) times 3.142 times 80

[WRITE] A = 41.89 cm squared

[SAY] The area of the annular sector is 41.89 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 questions on the board or distribute exit ticket.

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

Exit Ticket Questions:

1. A windshield wiper moves through 110 degrees. The blade is 45 cm long, and the pivot distance is 15 cm. Calculate the cleaned area.

2. A car wiper has: Outer radius = 40 cm, Inner radius = 10 cm, Central angle = 120 degrees. Find the area cleaned by the wiper.

3. A mechanical arm sweeps through 180 degrees. The outer radius is 8 m, and the inner radius is 2 m. Determine the area covered.

Differentiation Notes

For Struggling Learners:

- Provide pre-cut circular cutouts with sectors already outlined.
- Use simpler angles and 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: wind turbines, windshield wipers, clock hands.
- Investigate the relationship between the angle and the area swept.
- Apply the concept to optimization problems and composite shapes.

Post-Lesson Reflection Prompts

- Did students successfully discover the annular sector formula through the anchor activity?
- Were students able to cut and place the sectors accurately?
- What misconceptions emerged, and how were they addressed?
- Did students understand the relationship between annular sectors, sectors, and annuli?
- What adjustments would improve this lesson?