Grade 10 Mathematics Presentation Script

Volume of Frustums

Pre-Class Preparation

Materials Checklist:

- Calculator (one per group)
- Rulers or measuring tapes (one per group)
- Water and a measuring jug
- Real plastic buckets, measuring cups, or flowerpots (frustum-shaped, one per group)
- Worksheets for dimensions and calculations

Room Setup:

- Prepare board space for formula derivation
- Arrange desks for group work
- Have extra materials available
- Prepare frustum diagrams on chart paper for display
- Set up water station for measuring activity

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

Opening Hook (2 minutes)

[DO] Display pictures of frustums (buckets, lampshades, flowerpots).

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

[WAIT] Expected: They are like cones with the tops cut off!

[ASK] What is this shape called?

[WAIT] Expected: A frustum!

[SAY] Exactly! Today we will discover the formula for the volume of a frustum.

[SAY] We will explore by measuring real buckets and calculating their capacity.

Anchor Activity Launch (3 minutes)

[DO] Distribute buckets, rulers, water, measuring jugs, and worksheets to each group.

[SAY] Here is your challenge: You will discover the volume formula for a frustum.

[SAY] Here is what you will do:

[SAY] Step 1: Measure the top radius R, bottom radius r, and height h of your bucket.

[SAY] Step 2: Fill the bucket with water and pour it into a measuring jug.

[SAY] Step 3: Record the actual volume in liters.

[SAY] Step 4: Calculate the volume using the formula.

[SAY] Step 5: Compare your measured volume with the calculated volume.

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

Student Work Time (8 minutes)

[DO] Circulate among groups.

[ASK] To a group struggling: What is the top radius? What is the bottom radius?

[WAIT] Expected: Top radius is 5 cm, bottom radius is 8 cm!

[SAY] Good! Now measure the height.

[ASK] To another group: How much water did your bucket hold?

[WAIT] Expected: 500 milliliters!

[SAY] Excellent! Now calculate using the formula.

[DO] For struggling groups: Let us measure together.

[DO] For early finishers: How would the volume change if the top radius doubled?

Class Discussion (2 minutes)

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

[ASK] What did you discover about the volume of a frustum?

[WAIT] Expected: The measured volume matches the calculated volume!

[SAY] Excellent! What is the formula?

[WAIT] Expected: V = (1 / 3) times π times h times (r squared + R squared + R r)!

[SAY] Today we will formalize this formula.

Phase 2: Structured Instruction (10 minutes)

Formalizing the Formula (10 minutes)

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

[WRITE] On the board: Volume of Frustums

[SAY] A frustum is a cone or pyramid that is cut parallel to its base, removing the top portion.

[DO] Draw a frustum on the board.

[SAY] The volume of a frustum is found using this formula:

[WRITE] V = (1 / 3) times π times h times (r squared + R squared + R r)

[SAY] Where r is the top radius, R is the bottom radius, and h is the height.

[ASK] Does everyone understand this formula?

[WAIT] Check for nods or questions.

Addressing Misconceptions:

[SAY] Let me address some common mistakes:

[SAY] Mistake 1: A frustum is the same as a cone. No, a frustum has two circular bases.

[SAY] Mistake 2: The formula is the same as the cone formula. No, the frustum formula includes both radii.

[SAY] Mistake 3: The height is the slant height. No, the height is perpendicular between the bases.

[SAY] Mistake 4: I can use the diameter. No, use the radius. Divide diameter by 2.

[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: Frustum with top radius 4 cm, bottom radius 8 cm, height 10 cm.

[DO] Draw the diagram on the board.

[SAY] Step 1: Find the slant height using Pythagoras theorem.

[WRITE] ℓ = square root of (8 squared + 10 squared) = 12.80 cm.

[SAY] Step 2: Calculate the volume.

[WRITE] V = (1 / 3) times (22 / 7) times 10 times (16 + 64 + 32) = 1173.33 cm cubed.

[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. Square pyramid frustum: original height 18 cm, truncated top 6 cm, base 12 cm, top 6 cm. Find volume.

2. Frustum volume 900 cm cubed, base radius 10 cm, top radius 6 cm. Find height.

3. Jerrycan frustum: top radius 20 cm, bottom radius 15 cm, height 30 cm. Find capacity in liters.

Differentiation Notes

For Struggling Learners:

- Provide pre-measured frustum models.
- Use simple dimensions.
- 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 using difference of two cones.
- Explore real-world applications: buckets, lampshades, flowerpots.
- Investigate relationship between dimensions and volume.
- Apply to frustums of pyramids.

Post-Lesson Reflection Prompts

- Did students successfully measure frustum-shaped containers?
- Were students able to calculate volume using the formula?
- What misconceptions emerged, and how were they addressed?
- Did students understand the frustum-cone relationship?
- What adjustments would improve this lesson?