Grade 10 Mathematics Presentation Script

Using Two Sides and an Angle

Pre-Class Preparation

Materials Checklist:

- Measuring tapes or meter sticks (one per group)
- Protractors or phone apps for angle measurement (one per group)
- Scientific calculators (one per group)
- Worksheets with recording tables (one per group)
- Paper and pencils
- Chart paper for recording key takeaways
- Markers

Room Setup:

- Identify suitable tall objects around the school for measurement (trees, buildings, flagpoles)
- Prepare board space for diagrams and derivation steps
- Check weather forecast to ensure a sunny day for shadow measurement
- Have extra materials available in case of breakage

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

Opening Hook (2 minutes)

[DO] Point to a tall building or tree visible from the classroom.

[SAY] "How could we find the area of a triangle if we do not know the height?"

[WAIT] Expected: Various guesses.

[ASK] "What if we only know two sides and the angle between them?"

[WAIT] Expected: "Use trigonometry!" "Use sine!"

[SAY] "Exactly! Today we will learn how to find the area of a triangle using two sides and the included angle. This is very useful in surveying and architecture."

[SAY] "We will go outside and measure a real triangle using shadows."

Anchor Activity Launch (3 minutes)

[DO] Distribute measuring tapes, protractors, calculators, and worksheets to each group.

[SAY] "Here is your challenge: You will measure the shadow of a tall object, measure the angle of elevation, and use trigonometry to find the height and area of the triangle."

[SAY] "Here is what you will do:"

[SAY] "Step 1: Choose a tree, flagpole, or lamp post as the vertical height. The ground acts as the base."

[SAY] "Step 2: Measure the length of the shadow cast by the object on the ground. This is your base."

[SAY] "Step 3: Measure the angle of elevation from the end of the shadow to the top of the object."

[SAY] "Step 4: Discuss your findings with your group members."

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

Student Work Time (8 minutes)

[DO] Take students outside and circulate among groups.

[ASK] To a group struggling with the angle: "Stand at the end of the shadow and measure the angle from the ground to the top of the object."

[WAIT] Expected: "35 degrees!" or similar.

[SAY] "Good! Now measure the shadow length."

[ASK] To another group: "What triangle are you forming? What is the base? What is the height?"

[WAIT] Expected: "The shadow is the base!" "The object is the height!"

[SAY] "Correct! Now can you use sine to find the height?"

[WAIT] Expected: "height = hypotenuse times sin(angle)"

[SAY] "Excellent! Now calculate the area."

[DO] For struggling groups: "Let us draw the triangle together. The shadow is here, the object is here, the angle is here."

[DO] For early finishers: "Can you verify your calculation by measuring the height directly?"

Class Discussion (2 minutes)

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

[ASK] "What object did you measure, and what area did you calculate?"

[WAIT] Expected: "We measured the flagpole. The area is 50 square meters."

[SAY] "Excellent! How did you calculate that?"

[WAIT] Expected: "We used (1/2) times base times height."

[SAY] "Perfect! Did you use sine to find the height?"

[WAIT] Check for understanding.

[SAY] "Today we will formalize this method into a formula."

Phase 2: Structured Instruction (10 minutes)

Deriving the Formula: Area = (1/2) ab sin C (10 minutes)

[SAY] "Now that you have explored this in the real world, let us derive the formula."

[WRITE] On the board: "Deriving the Formula: Area = (1/2) ab sin C"

[SAY] "Step 1: Recall the basic formula for the area of a triangle."

[WRITE] "Area = (1/2) times Base times Height"

[SAY] "Step 2: Consider a triangle ABC with sides a, b and included angle C."

[DO] Draw a triangle on the board with sides labeled a, b and angle C between them.

[SAY] "The height h is perpendicular from the top vertex to the base."

[DO] Draw the height h on the diagram.

[SAY] "Step 3: Express the height in terms of sine."

[SAY] "Using trigonometry, we know that sin(theta) = Opposite / Hypotenuse."

[SAY] "In our case, the height h is the opposite side of angle C, and side b is the hypotenuse."

[WRITE] "h = b sin C"

[SAY] "Step 4: Substitute into the area formula."

[WRITE] "Area = (1/2) times a times (b sin C)"

[WRITE] "Area = (1/2) ab sin C"

[SAY] "This formula is useful when we know two sides and the included angle instead of the height."

[ASK] "Does everyone understand?"

[WAIT] Check for understanding.

Addressing Misconceptions:

[SAY] "Let me address some common mistakes:"

[SAY] "Mistake 1: Using any two sides and any angle. The angle must be the included angle between the two sides."

[SAY] "Mistake 2: Thinking the formula only works for right triangles. It works for all triangles."

[SAY] "Mistake 3: Forgetting to use sine. You must use sin C, not just C."

[SAY] "Mistake 4: Confusing sin C with angle C. sin C is the sine of angle C, which you find using a calculator."

[ASK] "Does everyone understand when to use this formula?"

[WAIT] Check for nods or questions.

Phase 3: Practice and Application (10 minutes)

Worked Example 1 (5 minutes)

[SAY] "Let us work through an example together."

[WRITE] "Example 1: A triangle HFG has sides 10 cm, 7 cm and 9 cm. Find its area and angles."

[DO] Draw a triangle on the board.

[SAY] "First, let us find the area using Heron formula."

[WRITE] "s = (10+7+9)/2 = 13 cm"

[WRITE] "A = square root of (13 times 3 times 6 times 4) = 30.6 cm squared"

[SAY] "Now let us find the angles using the sine area formula."

[WRITE] "30.6 = (1/2) times 10 times 7 times sin A"

[WRITE] "sin A = 0.8743, so A = 60.96 degrees"

[SAY] "We can find the other angles similarly."

[ASK] "Does everyone understand?"

[WAIT] Check for understanding.

Worked Example 2 (5 minutes)

[SAY] "Let us try another example."

[WRITE] "Example 2: The area of triangle ABC is 28.1 cm squared. Side AB = 7.2 cm and angle ABC = 48.6 degrees. Find BC and the perpendicular height."

[DO] Draw a diagram on the board.

[SAY] "Let us use the sine area formula to find BC."

[WRITE] "28.1 = (1/2) times 7.2 times BC times sin 48.6 degrees"

[WRITE] "BC = 10.4 cm"

[SAY] "Now let us find the perpendicular height."

[WRITE] "h = (2 times 28.1) / 10.4 = 5.4 cm"

[SAY] "Notice how we can work backwards from the area to find missing sides and heights."

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. In a triangle QRS, QR = 10 cm, RS = 24 cm and QS = 26 cm. Find its area.

2. In triangle ABC, angle BAC = 40 degrees, angle ABC = 65 degrees, and side BC = 8 cm. Find its area.

3. Triangle PQR is isosceles with PQ = PR = 10 cm. The base angle is 48 degrees. Find its area.

Differentiation Notes

For Struggling Learners:

- Provide pre-drawn triangles with labels.
- Use simpler angles (30, 45, 60 degrees).
- Pair with confident problem solvers.
- Provide step-by-step calculation templates.

For Advanced Learners:

- Challenge with deriving the formula themselves.
- Explore real-world applications: surveying, architecture.
- Investigate the relationship between sine area formula and Heron formula.

Post-Lesson Reflection Prompts

- Did students successfully measure the shadow and angle?
- Were students able to derive the formula?
- What misconceptions emerged, and how were they addressed?
- Did students understand when to use the sine area formula?
- What adjustments would improve this lesson?