CBC Grade 10 Mathematics

Step-by-Step Presentation Script

Area of Octagons

Pre-Class Preparation

Before students arrive, ensure the following materials and setup are ready:

- Materials Needed:
- • Compass, ruler, protractor for each group
- • Graph paper
- • String (optional for measuring circumradius)
- • Calculators
- • Formula reference chart with $A = 2R^2\sqrt{2}$
- • Exit tickets (one per student)
- Classroom Setup:
- • Display key inquiry question: "How do we calculate the area of regular octagons in real-life situations?"
- • Prepare board space for formulas and worked examples
- • Have formula chart visible: $A = 2R^2\sqrt{2}$
- • Display images of octagonal structures (pavilions, stop signs, flower beds)

Lesson Overview (40 Minutes)

Phase	Duration
Phase 1: Problem-Solving and Discovery	0-15 minutes
Phase 2: Structured Instruction	15-25 minutes
Phase 3: Practice and Application	25-37 minutes
Phase 4: Assessment (Exit Ticket)	37-40 minutes

Minute-by-Minute Presentation Guide

Minutes 0-2: Introduction and Engagement

[SAY] "Good morning, class! Today we explore how to calculate the area of regular octagons—8-sided polygons with equal sides and angles."

[ASK] "Where have you seen octagons in everyday life?"

[LISTEN] Expected: Stop signs, pavilions, flower beds, tiles

[SAY] "Exactly! Octagons appear in architecture, landscaping, traffic signs, and sports facilities. Today we'll learn a systematic method to calculate their area by dividing them into triangles."

[WRITE] On the board: "Area of Octagons"

[WRITE] Key inquiry question: "How do we calculate the area of regular octagons in real-life situations?"

Minutes 2-17: Phase 1 - Anchor Activity (Discovery)

[SAY] "We'll construct a regular octagon and discover how to calculate its area by dividing it into triangles."

[DO] Organize students into groups of 2-3.

[DO] Distribute compass, ruler, protractor, graph paper, and calculators.

[SAY] "Task (a): Draw a circle with radius 6 cm. This radius is the circumradius R—the distance from center to any vertex."

[DO] Circulate to check circles are drawn correctly (Minutes 2-4).

[SAY] "Task (b): Mark 8 equally spaced points around the circle. Since 360° ÷ 8 = 45°, mark points at 0°, 45°, 90°, 135°, 180°, 225°, 270°, and 315°."

[DO] Demonstrate using protractor to mark 45° intervals (Minutes 4-7).

[SAY] "Task (c): Connect the 8 points to form a regular octagon."

[DO] Allow 2 minutes for connecting points (Minutes 7-9).

[SAY] "Task (d): Draw lines from the center to each of the 8 vertices. This divides the octagon into 8 triangles."

[DO] Circulate to verify triangles are drawn (Minutes 9-11).

[ASK] "What is the vertex angle at the center of each triangle?"

[LISTEN] Expected: 45°, 360° ÷ 8

[SAY] "Task (e): Focus on one triangle. What is the length of the two equal sides?"

[LISTEN] Expected: 6 cm, the radius, R

[SAY] "Task (f): Calculate the area of one triangle using $A = (1/2) \times R^2 \times \sin(45°)$. Remember $\sin(45°) = \sqrt{2}/2$."

[DO] Allow 3 minutes for calculations (Minutes 11-14).

[SAY] "Task (g): Multiply by 8 to find the total octagon area."

[DO] Allow 2 minutes for final calculation (Minutes 14-16).

[ASK] "Why does dividing into triangles make calculation easier?"

[LISTEN] Expected: All triangles are identical, we know the formula for triangles

[SAY] "Task (h): Share your results."

[DO] Allow 1 minute for sharing (Minutes 16-17).

[TEACHING TIP] Emphasize: 8 congruent triangles, each with vertex angle 45°

Minutes 17-25: Phase 2 - Structured Instruction

[SAY] "Let me formalize what you discovered. Regular octagons appear in architecture, landscaping, traffic signs, and sports."

[WRITE] "Real-life applications:"

[WRITE] "• Architecture: Pavilions, gazebos, towers"

[WRITE] "• Landscaping: Flower beds, garden features"

[WRITE] "• Traffic: Stop signs"

[WRITE] "• Sports: Boxing rings, martial arts mats"

[SAY] "The key strategy is to divide the octagon into 8 congruent triangles."

[DRAW] Draw octagon on board with lines from center to vertices.

[SAY] "Each triangle has two sides equal to R (circumradius) and vertex angle 45°."

[WRITE] "Area of one triangle: $A = (1/2) \times R^2 \times \sin(45°)$"

[SAY] "Since $\sin(45°) = \sqrt{2}/2$, we can simplify:"

[WRITE] "$A_{triangle} = (1/2) \times R^2 \times (\sqrt{2}/2) = (R^2\sqrt{2})/4$"

[SAY] "The octagon contains 8 identical triangles, so:"

[WRITE] "$A_{octagon} = 8 \times A_{triangle}$"

[WRITE] "$A_{octagon} = 8 \times (1/2) \times R^2 \times \sin(45°)$"

[WRITE] "$A_{octagon} = 4R^2 \times \sin(45°)$"

[WRITE] "$A_{octagon} = 4R^2 \times (\sqrt{2}/2)$"

[WRITE] "$A_{octagon} = 2R^2\sqrt{2}$"

[SAY] "This is our formula for the area of a regular octagon."

[WRITE] Box the formula: "$A = 2R^2\sqrt{2}$"

[SAY] "R is the circumradius—the distance from center to any vertex."

Minutes 25-37: Phase 3 - Practice and Application

[SAY] "Now let's apply this formula to real-world problems."

[EXAMPLE] Example 1: Octagonal Flower Bed

[WRITE] "A school wants an octagonal flower bed. Circumradius R = 4 m. Find area in simplest surd form."

[SAY] "Step 1: Identify R = 4 m."

[SAY] "Step 2: Apply formula $A = 2R^2\sqrt{2}$."

[WRITE] "$A = 2 \times (4)^2 \times \sqrt{2} = 2 \times 16 \times \sqrt{2} = 32\sqrt{2}\ m^2$"

[SAY] "Step 3: Approximate if needed. $32\sqrt{2} \approx 45.25\ m^2$."

[SAY] "Answer: $32\sqrt{2}\ m^2$ or approximately $45.25\ m^2$."

[EXAMPLE] Example 2: Octagonal Pavilion

[WRITE] "Pavilion with R = 5 m. Find area in simplest surd form."

[SAY] "Step 1: R = 5 m."

[SAY] "Step 2: $A = 2R^2\sqrt{2}$."

[WRITE] "$A = 2 \times (5)^2 \times \sqrt{2} = 2 \times 25 \times \sqrt{2} = 50\sqrt{2}\ m^2$"

[SAY] "Approximate: $50\sqrt{2} \approx 70.7\ m^2$."

[EXAMPLE] Example 3: Stop Sign

[WRITE] "Stop sign with R = 30 cm. Find area in simplest surd form."

[WRITE] "$A = 2 \times (30)^2 \times \sqrt{2} = 2 \times 900 \times \sqrt{2} = 1800\sqrt{2}\ cm^2$"

[SAY] "Approximate: $1800\sqrt{2} \approx 2545.2\ cm^2$."

[EXAMPLE] Example 4: Comparing Octagon and Circle

[WRITE] "Octagon and circle both have R = 3 m. Which has larger area?"

[SAY] "Octagon: $A = 2 \times (3)^2 \times \sqrt{2} = 18\sqrt{2} \approx 25.46\ m^2$."

[SAY] "Circle: $A = \pi R^2 = 9\pi \approx 28.27\ m^2$."

[SAY] "Circle is larger by about $2.81\ m^2$."

[SAY] "Now try these individually:"

[WRITE] "Practice:"

1. 1. Octagonal patio: R = 6 m. Find area in simplest surd form.
2. 2. Boxing ring: R = 4.5 m. Find area.
3. 3. Decorative tile: R = 8 cm. Find area in simplest surd form.

[DO] Give students 7 minutes (minutes 30-37) for individual practice.

[DO] Circulate to check formula application and surd simplification.

[TEACHING TIP] Remind: R is circumradius (center to vertex), formula is $A = 2R^2\sqrt{2}$

Minutes 37-40: Phase 4 - Assessment (Exit Ticket)

[SAY] "Excellent work! Complete this exit ticket to show your understanding."

[DO] Distribute exit tickets.

[SAY] "You have 3 minutes."

[WRITE] Display questions:

Q1: Regular octagon with R = 7 m. Find area in simplest surd form.

Q2: Octagonal gazebo with R = 3.5 m. Find approximate area to one decimal place.

Q3: Explain why we divide octagon into 8 triangles. What is the vertex angle?

[DO] Students work silently (minutes 37-40).

[DO] Collect exit tickets.

[SAY] "Great work! You now understand how to calculate octagon areas using the formula $A = 2R^2\sqrt{2}$. Remember: Divide into 8 congruent triangles, each with vertex angle 45°!"

Teaching Tips and Strategies

Emphasis Points:

- • Circumradius R is from center to vertex, not center to side
- • Divide octagon into 8 congruent triangles
- • Each triangle has vertex angle $360° \div 8 = 45°$
- • Formula: $A = 2R^2\sqrt{2}$ (memorize this)
- • Express answers in simplest surd form
- • Connect to special angles: $\sin(45°) = \sqrt{2}/2$

Differentiation in Action:

- • For struggling learners: Pre-drawn octagons, formula cards, review sin(45°), allow calculators, explicit steps
- • For advanced learners: Derive formula, extend to other polygons, compare to circles, explore side length relationship
- • Use visual diagrams to show 8 triangles clearly
- • Connect to real-world applications

Common Student Errors:

- • Confusing circumradius with side length
- • Forgetting to multiply triangle area by 8
- • Not simplifying surd form (leaving as $4R^2\sin(45°)$)
- • Calculating vertex angle incorrectly
- • Forgetting $\sqrt{2}$ in final answer

Engagement Strategies:

- • Hands-on construction activity with compass and protractor
- • Connect to familiar objects (stop signs, pavilions, flower beds)
- • Emphasize real-world applications
- • Use visual diagrams showing triangle division

Assessment Guidance

Exit Ticket Evaluation Criteria:

- • Correct identification of circumradius
- • Proper formula application ($A = 2R^2\sqrt{2}$)
- • Accurate calculation and simplification
- • Answer in simplest surd form
- • Clear explanation of triangle division strategy

Mastery Indicators:

- • Student correctly identifies circumradius from problem
- • Student applies formula $A = 2R^2\sqrt{2}$ without prompting
- • Student simplifies to simplest surd form
- • Student explains vertex angle is 45° (360° ÷ 8)
- • Student connects to real-world applications

Follow-Up for Students Who Struggle:

- • Provide pre-drawn octagons with triangles marked
- • Use formula reference cards
- • Review $\sin(45°) = \sqrt{2}/2$
- • Break into explicit steps: identify R, apply formula, simplify
- • Allow calculators for approximation

Post-Lesson Reflection Questions

After teaching this lesson, reflect on:

- • Did students successfully divide octagon into 8 congruent triangles?
- • Were students able to identify circumradius correctly?
- • Did students apply formula $A = 2R^2\sqrt{2}$ accurately?
- • What misconceptions emerged about circumradius vs. side length?
- • How engaged were students with construction activity?
- • Did students express answers in simplest surd form?
- • What percentage demonstrated mastery on exit ticket?
- • What adjustments would improve this lesson?