CBC Grade 10 Mathematics

Step-by-Step Presentation Script

Angles of Depression

Pre-Class Preparation

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

- Materials Needed:
- • Homemade clinometers for each student
- • Rulers or measuring tapes
- • Notebooks and pens
- • Calculators
- • Exit tickets (one per student)
- Classroom Setup:
- • Display key inquiry questions: "What is trigonometry? How do we use trigonometry in real-life situations?"
- • Identify safe elevated positions (steps, balconies, small hills)
- • Prepare board space for diagrams showing angles of depression
- • Have trigonometric ratio reference cards ready
- • Display images of real-world applications (helicopters, lighthouses, planes)

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 angles of depression—angles measured downward from a horizontal line to an object below."

[ASK] "Where have you seen someone looking down from a high place to measure or observe something below?"

[LISTEN] Expected: Lighthouse keepers, pilots landing planes, lifeguards in towers, rangers in observation towers

[SAY] "Exactly! Angles of depression are crucial in aviation, maritime navigation, rescue operations, and surveying. Today we'll use clinometers to measure angles of depression and calculate distances."

[WRITE] On the board: "Angles of Depression"

[WRITE] Key inquiry questions: "What is trigonometry? How do we use trigonometry in real-life situations?"

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

[SAY] "We'll discover angles of depression by measuring them with your clinometers from an elevated position."

[SAY] "This is individual work. You'll need your homemade clinometer, a ruler or measuring tape, and your notebook."

[SAY] "Step 1: Climb up to a higher place like a step, a balcony, or a small hill. Be safe!"

[DO] Guide students to safe elevated positions (Minutes 2-4).

[SAY] "Step 2: Hold the clinometer at eye level, and look through it toward an object on the ground—like a cone, stone, or your friend's shoes."

[SAY] "Step 3: Watch the string and record the angle where it crosses the scale. That's your angle of depression!"

[DO] Circulate to check students are measuring correctly (Minutes 4-8).

[SAY] "Step 4: Measure the height from your eyes to the ground. That's your vertical distance."

[SAY] "Step 5: Calculate how far the object is from the base of your standing point using trigonometry."

[DO] Allow 5 minutes for calculations (Minutes 8-13).

[ASK] "What angle did you measure?"

[LISTEN] Expected: Various angles between 10° and 60°

[ASK] "How is angle of depression different from angle of elevation?"

[LISTEN] Expected: Depression is looking down, elevation is looking up

[SAY] "Step 6: Share and discuss your work with your classmates."

[DO] Allow 4 minutes for sharing (Minutes 13-17).

[TEACHING TIP] Emphasize: Angle of depression is measured downward from horizontal line

Minutes 17-25: Phase 2 - Structured Instruction

[SAY] "Let me formalize what you discovered. The angle of depression is the angle measured downward from a horizontal line to an object below."

[WRITE] "Definition: Angle of depression = angle measured DOWN from horizontal line"

[DRAW] Diagram showing person on elevated platform, horizontal line at eye level, line of sight down to object, angle of depression marked

[SAY] "The horizontal line is your eye level when looking straight ahead, parallel to the ground."

[SAY] "Important relationship: When you look down at an object (angle of depression), from the object looking up at you forms an angle of elevation. These two angles are equal—they are alternate interior angles."

[WRITE] "Angle of depression = Angle of elevation (alternate interior angles)"

[SAY] "To solve problems with angles of depression, follow these steps:"

[WRITE] "Steps:"

[WRITE] "1. Draw diagram with right triangle"

[WRITE] "2. Identify angle of depression from horizontal"

[WRITE] "3. Find corresponding angle inside right triangle"

[WRITE] "4. Identify opposite, adjacent, hypotenuse"

[WRITE] "5. Choose trigonometric ratio (sin, cos, tan)"

[WRITE] "6. Solve for unknown"

[SAY] "Common strategy: Vertical height is given, horizontal distance is unknown. Use tan ratio."

[WRITE] "tan(angle) = opposite/adjacent"

[TEACHING TIP] Use color coding: horizontal line in one color, angle of depression in another

Minutes 25-37: Phase 3 - Practice and Application

[SAY] "Now let's apply these steps to solve a problem."

[EXAMPLE] Hiker on a Hill

[WRITE] "A hiker stands on top of a hill that is 120 m high and looks down at a cabin in a valley. The angle of depression to the cabin is 40°. Calculate the horizontal distance from the hiker to the cabin."

[SAY] "Step 1: Draw a diagram."

[DRAW] Diagram showing hill (120 m vertical), horizontal distance d, angle of depression 40° from horizontal

[SAY] "Step 2: The angle of depression from the horizontal is 40°."

[SAY] "Step 3: Inside the right triangle, the angle between the line of sight and the vertical is 90° - 40° = 50°."

[WRITE] "Angle inside triangle = 90° - 40° = 50°"

[SAY] "Step 4: Identify the sides. Horizontal distance d is opposite to the 50° angle. Height 120 m is adjacent to the 50° angle."

[SAY] "Step 5: Use the tangent ratio: tan(50°) = opposite/adjacent = d/120"

[WRITE] "tan(50°) = d/120"

[SAY] "Step 6: Solve for d."

[WRITE] "d = 120 × tan(50°)"

[WRITE] "d = 120 × 1.1918"

[WRITE] "d = 143 m"

[SAY] "Answer: The horizontal distance from the hiker to the cabin is 143 m."

[SAY] "Now try these individually:"

[WRITE] "Practice:"

1. 1. A lifeguard sits in a tower that is 4.5 m above the beach. She spots a swimmer in distress at an angle of depression of 18°. How far is the swimmer from the base of the lifeguard tower?
2. 2. A plane flies to a height of 80 m above the ground. The angle of depression from the plane to a radar on the ground is 30°. Find the horizontal distance between the radar and the plane's projection on the ground.

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

[DO] Circulate to check diagram drawing and trigonometric ratio selection.

[TEACHING TIP] Remind: Draw diagram first, find angle inside triangle, use tan ratio

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: A lifeguard sits in a tower that is 4.5 m above the beach. She spots a swimmer in distress at an angle of depression of 18°. How far is the swimmer from the base of the lifeguard tower?

Q2: A plane flies to a height of 80 m above the ground. The angle of depression from the plane to a radar on the ground is 30°. Find the horizontal distance between the radar and the plane's projection on the ground.

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

[DO] Collect exit tickets.

[SAY] "Great work! You now understand how to use angles of depression to calculate distances. Remember: Angle of depression is measured downward from horizontal line, and we use trigonometry to find unknown distances!"

Teaching Tips and Strategies

Emphasis Points:

- • Angle of depression measured downward from horizontal line
- • Horizontal line is eye level when looking straight ahead
- • Angle of depression = angle of elevation (alternate interior angles)
- • Always draw diagram first
- • Find angle inside right triangle (often 90° - angle of depression)
- • Use tan ratio when vertical height given, horizontal distance unknown

Differentiation in Action:

- • For struggling learners: Pre-drawn diagrams, step-by-step checklist, color coding, reference cards
- • For advanced learners: Reverse problems (finding angles), combined elevation/depression problems
- • Use visual demonstrations with diagrams
- • Connect to real-world applications

Common Student Errors:

- • Confusing angle of depression with angle of elevation
- • Not identifying horizontal reference line correctly

- • Using wrong angle inside the right triangle
- • Confusing opposite and adjacent sides
- • Forgetting to convert angle inside triangle (90° - angle of depression)

Engagement Strategies:

- • Hands-on activity with clinometers from elevated positions
- • Connect to familiar scenarios (lifeguards, pilots, helicopters)
- • Emphasize real-world applications
- • Use visual diagrams with clear horizontal reference lines

Assessment Guidance

Exit Ticket Evaluation Criteria:

- • Correct diagram with horizontal line and angle of depression
- • Proper identification of angle inside right triangle
- • Correct trigonometric ratio selection
- • Accurate calculation of horizontal distance

Mastery Indicators:

- • Student correctly identifies angle of depression as measured downward from horizontal
- • Student draws accurate diagram with right triangle
- • Student finds correct angle inside triangle
- • Student selects and applies appropriate trigonometric ratio
- • Student connects angles of depression to real-world applications

Follow-Up for Students Who Struggle:

- • Provide pre-drawn diagrams with labeled parts
- • Create step-by-step checklist for solving problems
- • Use color coding for horizontal line and angle of depression
- • Provide trigonometric ratio reference cards
- • Allow calculators for all calculations
- • Pair with peer tutors

Post-Lesson Reflection Questions

After teaching this lesson, reflect on:

- • Did students successfully measure angles of depression with clinometers?
- • Were students able to distinguish angle of depression from angle of elevation?
- • Did students understand the horizontal reference line concept?
- • What misconceptions emerged about angles inside right triangles?
- • How engaged were students with hands-on clinometer activity?
- • Did students connect angles of depression to real-world applications?

- • What percentage demonstrated mastery on exit ticket?
- • What adjustments would improve this lesson?