CBC Grade 10 Mathematics

Step-by-Step Presentation Script

Distance and Displacement

Pre-Class Preparation

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

- Materials Needed:
- • Chalk or masking tape to mark paths
- • Measuring tape or ruler (one per group)
- • Notebooks and pens for recording
- • Calculators
- • Exit tickets (one per student)
- Classroom Setup:
- • Identify outdoor space or large indoor area (gymnasium, hallway) for anchor activity
- • Prepare board space for diagrams and formulas
- • Display key inquiry question: "What is the difference between distance and displacement?"
- • Have Pythagorean theorem visible for reference

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 two important concepts in motion: distance and displacement. Have you ever noticed that GPS gives you two different numbers - the total distance you've traveled and how far away your destination is? That's the difference between distance and displacement!"

[ASK] "If you walk from your classroom to the library, would the path you take affect how far you've traveled?"

[LISTEN] Expected: Yes, different paths have different lengths

[SAY] "Exactly! Today you'll discover the difference between the total path traveled and the straight-line distance from start to finish."

[WRITE] On the board: "Distance and Displacement"

[WRITE] Key inquiry question: "What is the difference between distance and displacement?"

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

[DO] Take students to outdoor space or gymnasium.

[SAY] "You will work in groups to walk two different paths and measure the results. This will help you discover the difference between distance and displacement."

[DO] Organize students into groups of 3-4.

[DO] Distribute measuring tapes and notebooks to each group.

[SAY] "Each group will mark three points on the ground: Point A as your start, Point B which is 10 meters east of A, and Point C which is 10 meters north of B."

[DO] Help groups mark their points accurately using measuring tape.

[SAY] "Now, one student will walk from A to B, then from B to C. Another student will walk directly from A to C along the diagonal. Measure and record all distances."

[WRITE] Tasks on board:

(a) Record distances for both paths

(b) Compare distance and displacement

(c) Can displacement be greater than distance?

(d) When are they equal?

[DO] Allow 8 minutes for activity (Minutes 2-10).

[DO] Circulate among groups. Observe their work and ask probing questions:

- • "How far did the first student walk in total?"
- • "How far is the diagonal path?"
- • "Is the straight-line distance the same for both students?"
- • "Which path is shorter?"

[TEACHING TIP] Guide students to recognize: First student walks 20 m total, second student walks about 14 m, but both end up at the same place (displacement is the same)

[DO] At minute 10, bring students back to classroom for sharing.

[SAY] "Let's discuss your findings. Group 1, what was the total distance for the student who walked A to B to C?"

[LISTEN] Expected: 10 m + 10 m = 20 m

[SAY] "Good! What about the student who walked directly from A to C?"

[LISTEN] Expected: About 14 meters ($\sqrt{200} \approx 14.14$ m)

[SAY] "Excellent! Now here's the key question: Both students ended up at point C. What is the straight-line distance from A to C for both?"

[LISTEN] Expected: The same - about 14 meters

[SAY] "This straight-line distance from start to finish is called displacement. Notice that displacement is the same for both students, even though they walked different paths! Let's formalize these concepts."

Minutes 17-25: Phase 2 - Structured Instruction

[SAY] "You discovered that the path taken affects total distance, but not the straight-line distance from start to finish. Let me define these terms precisely."

[WRITE] "Distance:"

[SAY] "Distance is the total length of the path traveled by an object, regardless of direction."

[WRITE] "Distance = total path length"

[WRITE] "• Depends on path taken"

[WRITE] "• Always positive"

[WRITE] "• No direction (scalar)"

[SAY] "Displacement is different. It only cares about where you started and where you ended."

[WRITE] "Displacement:"

[SAY] "Displacement is the straight-line distance from the starting point to the ending point, along with the direction."

[WRITE] "Displacement = straight-line from start to finish"

[WRITE] "• Depends only on start and end positions"

[WRITE] "• Has direction (vector)"

[WRITE] "• Can be zero"

[SAY] "Here's the key relationship:"

[WRITE] "Distance ≥ Displacement (always)"

[ASK] "When would distance equal displacement?"

[LISTEN] Expected: When moving in a straight line

[SAY] "Exactly! Only when you move in a straight line without turning around."

[ASK] "When would displacement be zero?"

[LISTEN] Expected: When you return to the starting point

[SAY] "Perfect! If you walk in a circle and return to where you started, your distance might be 100 meters, but your displacement is zero."

[SAY] "Real-world applications: GPS uses displacement to show you how far away your destination is 'as the crow flies.' In long jump, judges measure displacement - the straight-line distance from takeoff to landing."

[TEACHING TIP] Draw diagrams on board showing: 1) straight path (distance = displacement), 2) curved path (distance > displacement), 3) circular path returning to start (displacement = 0)

Minutes 25-37: Phase 3 - Practice and Application
[SAY] "Now let's apply these concepts to solve problems."

[EXAMPLE] Example 1: Right-Angle Path

[WRITE] "A person walks 3 m east, then 4 m north. Find distance and displacement."

[SAY] "Let's solve this together. First, distance is the total path:"

[WRITE] "Distance = 3 m + 4 m = 7 m"

[SAY] "For displacement, we need the straight-line distance from start to finish. This forms a right triangle, so we use Pythagorean theorem:"

[WRITE] "Displacement = $\sqrt{(3^2 + 4^2)}$ = $\sqrt{(9 + 16)}$ = $\sqrt{25}$ = 5 m"

[SAY] "The displacement is 5 meters in a north-east direction. Notice distance (7 m) is greater than displacement (5 m)."

[EXAMPLE] Example 2: Opposite Directions

[WRITE] "A learner walks 5 m east, then 3 m west. Find distance and displacement."

[SAY] "Distance is total path:"

[WRITE] "Distance = 5 m + 3 m = 8 m"

[SAY] "For displacement, think about final position relative to start:"

[WRITE] "Displacement = 5 m - 3 m = 2 m east"

[SAY] "The learner ends up 2 meters east of where they started."

[EXAMPLE] Example 3: Returning to Start

[WRITE] "A student jogs 100 m east, then 100 m west. Find distance and displacement."

[WRITE] "Distance = 100 m + 100 m = 200 m"

[WRITE] "Displacement = 100 m - 100 m = 0 m"

[SAY] "The student returns to the starting point, so displacement is zero even though 200 meters were traveled!"

[SAY] "Now try these problems individually:"

[WRITE] "Practice Problems:"

1. 1. Car travels 60 km north, then 80 km east. Find distance and displacement.
2. 2. Person walks 6 m north, then 8 m east. Find distance and displacement.

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

[DO] Circulate to check understanding and provide support.

[TEACHING TIP] Remind students: Add for distance, use Pythagorean theorem for displacement with right angles

Minutes 37-40: Phase 4 - Assessment (Exit Ticket)
[SAY] "Excellent work today! To check your understanding, complete this exit ticket individually."

[DO] Distribute exit tickets.

[SAY] "You have 3 minutes. Show all your work."

[WRITE] Display exit ticket questions:

Question 1: Delivery driver travels 12 km north, then 5 km east.

- a) Calculate total distance
- b) Calculate displacement
- c) Explain why displacement < distance

Question 2: Student walks 8 m forward, then 3 m back.

- a) Total distance?
- b) Displacement?
- c) Direction of displacement?

Question 3: Can displacement be greater than distance? Explain with example.

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

[DO] Collect exit tickets.

[SAY] "Great work today! You now understand the difference between distance and displacement. Remember: distance is the total path, displacement is the straight-line from start to finish. This concept is fundamental for understanding motion. Tomorrow we'll explore speed and velocity!"

Teaching Tips and Strategies

Emphasis Points:

- • Distance depends on path taken; displacement depends only on start and end
- • Distance is always $\geq$ displacement
- • Displacement can be zero even when distance is not
- • Use Pythagorean theorem for right-angle displacement
- • Distance is scalar (no direction); displacement is vector (has direction)

Differentiation in Action:

- • For struggling learners: Use grid paper, provide diagrams, start with 1D motion
- • For advanced learners: Introduce 3D problems, vector notation, complex paths
- • Use physical demonstrations (walking paths)
- • Allow calculators for Pythagorean calculations

Common Student Errors:

- • Confusing distance with displacement
- • Thinking displacement can be greater than distance
- • Forgetting to use Pythagorean theorem for right angles
- • Not recognizing when displacement is zero
- • Forgetting to include direction with displacement

Engagement Strategies:

- • Use hands-on anchor activity (walking paths)
- • Connect to GPS and navigation systems
- • Reference sports (long jump, javelin)
- • Use visual diagrams extensively

Assessment Guidance

Exit Ticket Evaluation Criteria:

- • Correct calculation of distance (sum of path segments)
- • Proper use of Pythagorean theorem for displacement
- • Clear explanation of why distance ≥ displacement
- • Inclusion of direction with displacement
- • Clear working shown with units

Mastery Indicators:

- • Student can distinguish distance from displacement
- • Student can calculate both for various paths
- • Student understands when they are equal vs. different
- • Student can explain real-world applications

Follow-Up for Students Who Struggle:

- • Provide additional practice with grid paper visualizations
- • Use physical demonstrations with string showing paths
- • Create step-by-step Pythagorean theorem guides
- • Schedule small group intervention for concept clarification

Post-Lesson Reflection Questions

After teaching this lesson, reflect on:

- • Did students successfully distinguish between distance and displacement?
- • Were students able to apply the Pythagorean theorem for displacement calculations?
- • What misconceptions emerged about scalar vs. vector quantities?
- • How engaged were students with the hands-on anchor activity?
- • Did students understand when distance equals displacement?
- • What percentage demonstrated mastery on the exit ticket?
- • What adjustments would improve this lesson?