

CBC Grade 10 Mathematics

Step-by-Step Presentation Script

Displacement-Time Graphs

Pre-Class Preparation

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

- Materials Needed:
 - Graph paper (one sheet per student)
 - Rulers (one per student or pair)
 - Pencils and erasers
 - Chart paper for displaying graphs
 - Markers
 - Exit tickets (one per student)
- Classroom Setup:
 - Arrange desks for group work (groups of 3-4 students)
 - Prepare board space for graphs and formulas
 - Display key inquiry question: "How do we use displacement-time graphs in real life?"
 - Have sample graphs ready for demonstration

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 displacement-time graphs. Have you ever wondered how GPS tracks your journey? Or how athletes analyze their race performance? Displacement-time graphs help us visualize and understand motion."

[ASK] "Can someone tell me: What is the difference between distance and displacement?"

[LISTEN] Expected answer: Distance is total path traveled; displacement is shortest distance from start to finish.

[SAY] "Excellent! Today you'll learn to draw and interpret graphs that show how displacement changes over time."

[WRITE] On the board: "Displacement-Time Graphs"

[WRITE] Key inquiry question: "How do we use displacement-time graphs in real life?"

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

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

[SAY] "You will work in groups to plot a graph from real data about a motorist's journey. This will help you discover how displacement-time graphs work."

[DO] Distribute graph paper and rulers to each group.

[WRITE] Display the data table on the board:

Time: 9:00 AM - Distance: 0 km

Time: 10:00 AM - Distance: 80 km

Time: 11:00 AM - Distance: 160 km

Time: 11:30 AM - Distance: 160 km

Time: 12:00 PM - Distance: 210 km

[SAY] "A motorist travels from Limuru to Kisumu. Plot this data on your graph paper. Put time on the horizontal axis and distance on the vertical axis."

[DO] Allow 5 minutes for plotting (Minutes 2-7).

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

- "What do you notice about the shape of your graph?"
- "What happened between 11:00 and 11:30?"
- "Which part of the journey was fastest?"
- "How can you tell speed from the graph?"

[TEACHING TIP] Guide students to notice: steep lines = fast motion, flat lines = stationary, slope = speed

[SAY] "Now answer these questions using your graph:"

[WRITE] "a) How far was the motorist from Limuru at 10:30 AM?"

[WRITE] "b) What was the average speed during the first part of the journey?"

[WRITE] "c) What was the overall average speed?"

[DO] Allow 5 minutes for calculations (Minutes 7-12).

[DO] At minute 12, bring the class together for sharing.

[SAY] "Let's discuss your findings. Group 1, what did you find for question (a)?"

[LISTEN] Expected: At 10:30 AM (halfway between 10:00 and 11:00), distance is about 120 km

[SAY] "Good! What about the flat section between 11:00 and 11:30?"

[LISTEN] Expected: The motorist stopped/was stationary

[SAY] "Excellent observation! You've discovered that a flat line means no motion. Let's formalize what you've learned."

Minutes 17-25: Phase 2 - Structured Instruction

[SAY] "You discovered important features of displacement-time graphs. Let me formalize these concepts."

[WRITE] "Key Concepts:"

[SAY] "First, let's clarify distance versus displacement."

[WRITE] "Distance = total path traveled (scalar)"

[WRITE] "Displacement = shortest distance from start to finish (vector)"

[EXAMPLE] "If you walk 3 meters forward then 2 meters back, distance = 5 m, but displacement = 1 m forward."

[SAY] "A displacement-time graph shows how an object's position changes over time."

[WRITE] "Displacement-Time Graph:"

- Vertical axis = displacement (m, km)
- Horizontal axis = time (s, min, h)
- Each point shows position at specific time

[SAY] "The most important feature is the slope. The slope tells us velocity."

[WRITE] "Velocity = Change in displacement / Change in time"

[SAY] "Let me show you what different slopes mean."

[DRAW] Simple graph examples on board:

- Straight line with constant slope → uniform motion (constant velocity)
- Curved line getting steeper → acceleration (speeding up)
- Horizontal line → stationary (zero velocity)

- Steeper slope → higher speed

[TEACHING TIP] Use hand gestures to show steep vs. gentle slopes while explaining speed differences.

Minutes 25-37: Phase 3 - Practice and Application

[SAY] "Now let's apply these concepts to solve problems."

[EXAMPLE] Example: Constant Velocity

[WRITE] "A car moves with constant velocity of 5 m/s for 8 seconds. Draw the displacement-time graph and find displacement at $t = 6s$."

[SAY] "Since velocity is constant, displacement increases linearly. We use: $s = vt$ "

[WRITE] " $s = vt$ (displacement = velocity \times time)"

[SAY] "At $t = 6s$:"

[WRITE] " $s = 5 \text{ m/s} \times 6 \text{ s} = 30 \text{ m}$ "

[DRAW] On board: Straight line from origin, slope = 5, mark point at (6, 30)

[SAY] "Notice the graph is a straight line because velocity is constant. The slope is 5, which equals the velocity."

[SAY] "Now let's try individual practice. Work on these problems:"

[WRITE] "Practice Problems:"

1. A train moves at 20 m/s for 10 seconds. Draw graph and find displacement at $t = 7s$.
2. Sketch a graph for motion with three phases: acceleration, constant velocity, deceleration.

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

[DO] Circulate to check understanding and provide support.

[TEACHING TIP] Help struggling students by asking: "What does the slope represent?" "Is the object speeding up or slowing down?"

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: A runner's motion:

- Accelerates uniformly for 5 seconds, covering 25 meters
- Maintains constant speed for 10 seconds, covering 50 meters
- Decelerates for 5 seconds until stopping at 100 meters
- Tasks: Sketch graph, find velocity during constant speed, calculate acceleration, find total time, find average velocity

Question 2: A cyclist's motion:

- 0-4 seconds: moves forward at uniform velocity
- 4-8 seconds: stationary
- 8-12 seconds: moves back at uniform velocity
- Tasks: Sketch graph, find velocities, explain flat section, find total displacement

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

[DO] Collect exit tickets.

[SAY] "Great work today! You now know how to draw and interpret displacement-time graphs. These skills help us understand motion in sports, transportation, and many real-world situations. Tomorrow we'll explore velocity-time graphs."

Teaching Tips and Strategies

Emphasis Points:

- Slope represents velocity, not position
- Horizontal line means stationary, not zero displacement
- Steeper slope = higher speed
- Curved lines indicate changing velocity (acceleration/deceleration)
- Distance is scalar, displacement is vector

Differentiation in Action:

- For struggling learners: Provide graph templates, use physical demonstrations
- For advanced learners: Introduce complex multi-phase motion, explore velocity-time graphs
- Use real-world examples (GPS, sports, delivery routes)
- Allow calculators for slope calculations

Common Student Errors:

- Confusing distance with displacement
- Thinking horizontal line means zero displacement (it means stationary)
- Confusing slope (velocity) with height (displacement)
- Incorrect axis labeling
- Not using rulers for straight lines

Engagement Strategies:

- • Use real-world contexts (commute, sports, GPS)
- • Demonstrate motion physically (walk across room while timing)
- • Connect to prior knowledge of speed and velocity
- • Use technology (graphing apps, simulations)

Assessment Guidance

Exit Ticket Evaluation Criteria:

- • Correct graph shape (curved for acceleration, straight for constant velocity)
- • Proper axis labeling with units
- • Accurate velocity calculations using slope formula
- • Correct interpretation of flat sections (stationary)
- • Clear working shown with formulas

Mastery Indicators:

- • Student can plot displacement-time graphs from data
- • Student can interpret slope as velocity
- • Student can identify motion types from graph shape
- • Student can calculate velocity from graph

Follow-Up for Students Who Struggle:

- • Provide additional practice with simple uniform motion
- • Use physical demonstrations to connect graphs to reality
- • Create step-by-step graphing guides
- • Schedule small group intervention for graph interpretation

Post-Lesson Reflection Questions

After teaching this lesson, reflect on:

- • Did students successfully plot displacement-time graphs from data?
- • Were students able to interpret slope as velocity?
- • What misconceptions emerged about distance vs. displacement?
- • How comfortable were students calculating velocity from graphs?
- • Did the anchor activity effectively introduce the concept?
- • What percentage demonstrated mastery on the exit ticket?
- • What adjustments would improve this lesson?