CBC Grade 10 Mathematics

Step-by-Step Presentation Script

Linear Motion in Real-Life

Pre-Class Preparation

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

- Materials Needed:
- • Calculators (one per student or pair)
- • Chart paper for group work
- • Markers
- • Exit tickets (one per student)
- • Formula reference sheets
- Classroom Setup:
- • Arrange desks for group work (groups of 3-4 students)
- • Prepare board space for equations and calculations
- • Display key inquiry question: "How do we apply linear motion principles in real-life situations?"
- • Have equations of motion 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 how linear motion principles apply to real-life situations. You've learned about velocity, acceleration, and equations of motion. Now we'll see how engineers, athletes, and safety planners use these concepts every day."

[ASK] "Can someone give me an example of where motion calculations might be important in real life?"

[LISTEN] Expected answers: Cars stopping, sports, elevators, traffic safety

[SAY] "Excellent! Today you'll work as student consultants to solve a real transportation safety problem."

[WRITE] On the board: "Linear Motion in Real-Life"

[WRITE] Key inquiry question: "How do we apply linear motion principles in real-life situations?"

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

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

[SAY] "You are student consultants helping the local government decide if a new school bus stop location is safe. You'll analyze whether a bus can stop in time if learners cross the road."

[DO] Distribute calculators and chart paper to each group.

[WRITE] Display the scenario on the board:

"The local government plans to introduce a new school bus stop along a straight road near your school."

[WRITE] Given data:

- Bus travelling at 20 m/s
- Learners crossing 50 meters ahead
- Driver's reaction time: 2 seconds
- Deceleration after braking: 4 m/s^2

[SAY] "Your task is to calculate if the bus can stop safely. You'll need to find reaction distance, braking distance, and total stopping distance."

[WRITE] Tasks on board:

(a) Calculate reaction distance (distance during 2-second reaction time)

(b) Calculate braking distance (using $v^2 = u^2 + 2as$)

(c) Calculate total stopping distance

(d) Compare with 50 m available

(e) Make a safety recommendation

[DO] Allow 10 minutes for calculations (Minutes 2-12).

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

- • "What happens during the reaction time?"
- • "Is the bus accelerating or decelerating during reaction time?"
- • "Which formula will you use for braking distance?"
- • "What does your answer mean for safety?"

[TEACHING TIP] Guide students to recognize: reaction distance = speed × time (constant velocity), braking distance uses $v^2 = u^2 + 2as$

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

[SAY] "Let's discuss your findings. Group 1, what did you calculate for reaction distance?"

[LISTEN] Expected: 20 m/s × 2 s = 40 m

[SAY] "Good! What about braking distance?"

[LISTEN] Expected: Using $v^2 = u^2 + 2as$, $0^2 = 20^2 + 2(-4)s$, s = 50 m

[SAY] "So total stopping distance is 40 + 50 = 90 meters. But only 50 meters are available. What does this mean?"

[LISTEN] Expected: The bus cannot stop in time; it's not safe

[SAY] "Exactly! This is how engineers make real safety decisions. Let's formalize what you've learned."

Minutes 17-25: Phase 2 - Structured Instruction

[SAY] "You discovered that stopping distance has two parts. Let me formalize these concepts."

[WRITE] "Transportation Safety Concepts:"

[SAY] "Linear motion principles are fundamental in transportation safety."

[WRITE] "Stopping Distance Components:"

- 1. Reaction distance = speed × reaction time
- (vehicle travels at constant velocity)
- 2. Braking distance = distance to stop after brakes applied
- (vehicle decelerates)
- 3. Total stopping distance = reaction + braking

[SAY] "The relationship between speed, reaction time, and braking distance directly impacts pedestrian safety and accident prevention."

[ASK] "Why do higher speeds increase accident risk?"

[LISTEN] Expected: Longer stopping distances

[SAY] "Exactly! Reaction distance increases proportionally with speed, but braking distance increases with the square of speed. Double the speed, and braking distance quadruples!"

[WRITE] "Real-Life Applications:"

[SAY] "Engineers apply motion calculations in many areas:"

[WRITE]

- • Transportation: vehicle braking systems, road design, speed limits
- • Engineering: elevators, railways, automated systems
- • Sports: sprint analysis, performance optimization
- • Industry: conveyor belts, robotic systems, production lines

[TEACHING TIP] Use hand gestures to show reaction phase (constant speed) vs. braking phase (slowing down).

Minutes 25-37: Phase 3 - Practice and Application

[SAY] "Now let's apply these concepts to different real-life scenarios."

[EXAMPLE] Example 1: Car Braking

[WRITE] "A car travels at 20 m/s. Driver applies brakes and stops in 5 seconds."

[WRITE] "a) Calculate acceleration"

[WRITE] "b) Calculate stopping distance"

[WRITE] "c) Explain why higher speeds increase accident risk"

[SAY] "Let's solve this together."

[WRITE] "Given: $u = 20$ m/s, $v = 0$ m/s, $t = 5$ s"

[SAY] "For acceleration, we use: $a = (v - u) / t$"

[WRITE] "$a = (0 - 20) / 5 = -4$ m/s^2"

[SAY] "The negative sign means deceleration. For stopping distance:"

[WRITE] "$s = ut + ½at^2 = (20)(5) + ½(-4)(5)^2 = 100 - 50 = 50$ m"

[SAY] "Higher speeds increase accident risk because stopping distance grows rapidly. If this car were going 40 m/s instead of 20 m/s, the stopping distance would be much more than double!"

[EXAMPLE] Example 2: Sprinter Performance

[WRITE] "A sprinter accelerates at 3 m/s^2 for 4 seconds from rest."

[SAY] "This shows how motion analysis helps in sports."

[WRITE] "$v = u + at = 0 + 3 \times 4 = 12$ m/s"

[WRITE] "$s = \frac{1}{2}at^2 = \frac{1}{2}(3)(4)^2 = 24$ m"

[SAY] "Greater acceleration lets athletes reach higher speeds faster, giving competitive advantage."

[EXAMPLE] Example 3: Elevator

[WRITE] "An elevator accelerates from rest to 4 m/s in 2 seconds."

[WRITE] "$a = (4 - 0) / 2 = 2$ m/s^2"

[SAY] "Gradual acceleration ensures passenger comfort. Sudden acceleration would cause people to lose balance."

[SAY] "Now try these problems individually:"

[WRITE] "Practice Problems:"

1. 1. Student walks 10 m in 8 s, another runs same distance in 3 s. Calculate both speeds.
2. 2. Car at 20 m/s, reaction time 1 s. Calculate reaction distance.

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

[DO] Circulate to check understanding and provide support.

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: Cyclist at 5 m/s, reaction time 2 s, child 12 m ahead.

- a) State equation for distance, speed, time
- b) Calculate reaction distance
- c) Will cyclist stop before reaching child?

Question 2: Delivery truck at 15 m/s, reaction time 1.5 s, deceleration 5 m/s^2.

- a) Calculate reaction distance
- b) Calculate braking distance
- c) Calculate total stopping distance

- d) Recommend safe following distance

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

[DO] Collect exit tickets.

[SAY] "Great work today! You now understand how linear motion principles keep us safe on roads, improve sports performance, and guide engineering design. These calculations save lives every day. For homework, identify one place in your community where motion analysis could improve safety."

Teaching Tips and Strategies

Emphasis Points:

- • Reaction distance occurs at constant velocity (no braking yet)
- • Braking distance involves deceleration
- • Total stopping distance = reaction + braking
- • Higher speeds dramatically increase stopping distance
- • Real-world applications save lives and improve performance

Differentiation in Action:

- • For struggling learners: Provide formula sheets, break problems into steps
- • For advanced learners: Introduce complex scenarios, real crash test data
- • Use real-world contexts (transportation, sports, engineering)
- • Allow calculators for all calculations

Common Student Errors:

- • Confusing reaction distance with braking distance
- • Forgetting that reaction occurs at constant velocity
- • Using wrong formula for braking distance
- • Not recognizing deceleration as negative acceleration
- • Forgetting to add reaction and braking distances for total

Engagement Strategies:

- • Use real-world safety context (bus stop scenario)
- • Frame students as consultants making real decisions
- • Connect to multiple application areas (transportation, sports, engineering)
- • Emphasize life-saving importance of calculations

Assessment Guidance

Exit Ticket Evaluation Criteria:

- • Correct application of distance = speed × time for reaction distance
- • Proper use of $v^2 = u^2 + 2as$ for braking distance

- • Accurate calculation of total stopping distance
- • Correct interpretation of results in terms of safety
- • Clear working shown with formulas and units

Mastery Indicators:

- • Student can distinguish reaction distance from braking distance
- • Student can apply appropriate formulas to each phase
- • Student can interpret calculations in real-world context
- • Student can make safety recommendations based on calculations

Follow-Up for Students Who Struggle:

- • Provide additional practice with guided worksheets
- • Use visual aids showing reaction and braking phases separately
- • Create step-by-step formula application guides
- • Schedule small group intervention for equation practice

Post-Lesson Reflection Questions

After teaching this lesson, reflect on:

- • Did students successfully apply motion equations to real-world problems?
- • Were students able to interpret their calculations in terms of safety?
- • What misconceptions emerged about stopping distances?
- • How engaged were students with the real-world context?
- • Did the anchor activity effectively introduce practical applications?
- • What percentage demonstrated mastery on the exit ticket?
- • What adjustments would improve this lesson?