

CBC Grade 10 Mathematics

Step-by-Step Presentation Script

Vector and Scalar Quantities

Pre-Class Preparation

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

- Materials Needed:
 - Paper (one sheet per group)
 - Pencils
 - Compass (optional, for showing directions)
 - Exit tickets (one per student)
- Classroom Setup:
 - Prepare board space for definitions and examples
 - Display key inquiry question: "What is the difference between quantities that need direction and those that do not?"
 - Prepare emergency scenario poster or slide

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 a fundamental concept in mathematics and physics: the difference between vector and scalar quantities. Imagine someone tells you a hospital is 5 km away. Is that enough information to find it?"

[ASK] "If I say the hospital is 5 km away, can you find it?"

[LISTEN] Expected: No, need to know which direction

[SAY] "Exactly! Some quantities need direction, others don't. Today you'll discover which is which through a real-world emergency scenario."

[WRITE] On the board: "Vector and Scalar Quantities"

[WRITE] Key inquiry question: "What is the difference between quantities that need direction and those that do not?"

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

[SAY] "You will work in groups to create an emergency map. This activity will help you discover why some quantities need direction."

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

[DO] Distribute paper and pencils to each group.

[SAY] "Scenario: A student gets injured during football and needs to go to the hospital immediately. A boda boda rider will help, but doesn't know the way. You must create a map to guide him."

[SAY] "Task: Draw a clear map from the school gate to the nearest hospital. Show all turns—left, right, or straight ahead. Include at least three landmarks like a market, police station, or church. Use arrows to show direction."

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

[DO] Circulate among groups asking probing questions.

[ASK] "Is it enough to say 'go 2 km'? What else is needed?"

[LISTEN] Expected: Need direction, need to say which way

[ASK] "What information is absolutely essential for the rider to find the hospital?"

[LISTEN] Expected: Distance and direction, landmarks, turns

[SAY] "Add a compass showing North, South, East, West to make directions clearer."

[DO] Allow 2 minutes for compass addition (Minutes 12-14).

[SAY] "Discuss in your groups: What information is essential? Is distance alone enough?"

[DO] Allow 3 minutes for discussion and class sharing (Minutes 14-17).

[SAY] "Let's share. Group 1, what information did you include?"

[LISTEN] Expected: Distance, direction, landmarks, turns

[SAY] "Perfect! You discovered that distance alone isn't enough—you need direction too. This is the key difference between scalars and vectors!"

Minutes 17-25: Phase 2 - Structured Instruction

[SAY] "You discovered that some quantities need direction. Let me teach you the formal concepts."

[WRITE] "Definitions"

[SAY] "A VECTOR is a quantity that has BOTH magnitude and direction. A SCALAR is a quantity that has ONLY magnitude."

[WRITE] "Vector = Magnitude + Direction"

[WRITE] "Scalar = Magnitude only"

[SAY] "In daily life, we measure many things with just a number—temperature, mass. But for some quantities, knowing 'how much' isn't enough—we need 'which way'. Like your hospital example: 5 km (magnitude) isn't helpful without knowing the direction."

[WRITE] "Examples of Vectors: Force, Velocity, Displacement, Acceleration"

[WRITE] "Examples of Scalars: Distance, Temperature, Mass, Speed, Time"

[SAY] "Notice: Speed is scalar (60 km/h), but velocity is vector (60 km/h eastward). Distance is scalar (10 m), but displacement is vector (10 m north)."

[WRITE] Create comparison table on board:

Feature	Vector	Scalar
Definition	Magnitude + Direction	Magnitude only
Examples	Force, Velocity, Displacement	Distance, Temperature, Mass
Notation	Arrow or direction words	Number + unit

[WRITE] "Vector Notation"

[SAY] "We represent vectors with special notation. A vector from point A to B can be written as: \overrightarrow{AB} with arrow above, \tilde{AB} with tilde, or letter a."

[WRITE] " \overrightarrow{AB} or \tilde{AB} or a"

[SAY] "The magnitude is written with absolute value bars: $|\overrightarrow{AB}|$. A is the initial point, B is the terminal point."

[SAY] "If we reverse direction, from B to A, we write: $\overrightarrow{BA} = -a$. The negative shows opposite direction."

[WRITE] " $\overrightarrow{BA} = -a$ (opposite direction)"

[SAY] "Real-world: GPS uses displacement vectors. Weather reports use wind velocity (vector) and temperature (scalar). Sports use velocity vectors."

[TEACHING TIP] Use hand gestures to show direction while explaining vectors

Minutes 25-37: Phase 3 - Practice and Application

[SAY] "Now let's apply these concepts to classify quantities."

[EXAMPLE] Example 1: Classification

[WRITE] "Classify: (a) Car travels 80 km/h, (b) Car travels 80 km/h northward, (c) Room temperature 22°C, (d) Force 100 N eastward"

[SAY] "(a) is scalar—speed has only magnitude."

[WRITE] "(a) Scalar"

[SAY] "(b) is vector—velocity has magnitude AND direction (northward)."

[WRITE] "(b) Vector"

[SAY] "(c) is scalar—temperature has only magnitude."

[WRITE] "(c) Scalar"

[SAY] "(d) is vector—force has magnitude AND direction (eastward)."

[WRITE] "(d) Vector"

[EXAMPLE] Example 2: Vector Notation

[WRITE] "Student walks from M to N, 30 meters north. Write in: (a) arrow notation, (b) tilde notation"

[SAY] "(a) Arrow notation: $MN \rightarrow$ "

[WRITE] " $MN \rightarrow$ "

[SAY] "(b) If we call this vector b, tilde notation: $b \sim$ "

[WRITE] " $b \sim$ "

[EXAMPLE] Example 3: Reversing Direction

[WRITE] "If $PQ \rightarrow = c$, what is $QP \rightarrow$?"

[SAY] "Going from Q back to P is opposite direction, so: $QP \rightarrow = -c$ "

[WRITE] " $QP \rightarrow = -c$ "

[EXAMPLE] Example 4: Real-World

[WRITE] "Pilot flies Nairobi to Mombasa. Classify: (a) Distance 480 km, (b) Displacement 480 km SE, (c) Time 1 hour, (d) Wind 40 km/h from west"

[SAY] "(a) Scalar—distance has no direction. (b) Vector—displacement has direction (SE). (c) Scalar—time has no direction. (d) Vector—velocity has direction (from west)."

[WRITE] "(a) Scalar, (b) Vector, (c) Scalar, (d) Vector"

[SAY] "Now try these individually:"

[WRITE] "Practice:"

1. 1. Classify: (a) 50 kg, (b) 20 m/s down, (c) 15°C, (d) 5 km east
2. 2. Write AB in arrow and tilde notation
3. 3. If $\vec{AB} = d$, what is \vec{BA} ?
4. 4. Give 3 examples each of vectors and scalars

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

[DO] Circulate to check understanding.

[TEACHING TIP] Remind: Vectors have direction words; scalars don't

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: Explain difference between vector and scalar. Give one example each.

Q2: Classify: (a) Runner completes 400 m, (b) Runner moves 400 m north, (c) Ball mass 2 kg

Q3: Write vector from library (L) to cafeteria (C) in arrow notation.

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

[DO] Collect exit tickets.

[SAY] "Great work! You now understand the difference between vectors (magnitude + direction) and scalars (magnitude only). Remember: if it has a direction word, it's a vector! This concept is fundamental for physics, engineering, and navigation. Tomorrow we'll learn how to represent vectors geometrically!"

Teaching Tips and Strategies

Emphasis Points:

- Direction words (north, east, up, down) indicate vectors
- Scalars are complete with just number and unit
- Speed becomes velocity when direction is added
- Distance becomes displacement when direction is added
- Negative sign shows opposite direction

Differentiation in Action:

- • For struggling learners: Color coding, memory aids, visual charts, physical demonstrations
- • For advanced learners: Vector addition concepts, physics applications, 3D vectors
- • Use hand gestures to show direction
- • Connect to real-world navigation

Common Student Errors:

- • Thinking all measurements are scalars
- • Confusing speed (scalar) with velocity (vector)
- • Confusing distance (scalar) with displacement (vector)
- • Forgetting that direction is essential for vectors
- • Not recognizing direction words as vector indicators

Engagement Strategies:

- • Use emergency scenario for relevance
- • Connect to GPS and navigation
- • Use physical demonstrations (walking in directions)
- • Reference sports and weather examples

Assessment Guidance

Exit Ticket Evaluation Criteria:

- • Clear explanation of vector vs. scalar distinction
- • Correct identification of magnitude and direction
- • Accurate classification of given quantities
- • Proper vector notation usage
- • Appropriate examples provided

Mastery Indicators:

- • Student can distinguish vectors from scalars
- • Student recognizes direction as key difference
- • Student can write vector notation correctly
- • Student understands negative vectors (opposite direction)

Follow-Up for Students Who Struggle:

- • Provide visual reference chart with examples
- • Use color-coded flashcards
- • Create memory aid: "Vectors have direction"
- • Schedule small group practice with physical demonstrations

Post-Lesson Reflection Questions

After teaching this lesson, reflect on:

- • Did students successfully distinguish vectors from scalars?
- • Were students able to identify direction as the key difference?
- • What misconceptions emerged about magnitude and direction?
- • How engaged were students with the map-making activity?
- • Did students understand vector notation?
- • What percentage demonstrated mastery on the exit ticket?
- • What adjustments would improve this lesson?