Grade 10 Mathematics Presentation Script

Column Vectors

Pre-Class Preparation

Materials Checklist:

- Graph paper (one sheet per student)
- Rulers (one per student)
- Pencils and colored markers
- Large coordinate plane drawn on board or chart paper
- Prepared examples on chart paper

Room Setup:

- Draw a large coordinate plane on the board
- Prepare graph paper and rulers for distribution
- Have colored markers ready for demonstrations
- Prepare example vectors on chart paper

Phase 1: Problem-Solving and Discovery (15 minutes)

Opening Hook (2 minutes)

[DO] Draw an arrow on the board pointing from one location to another.

[SAY] Imagine you are giving directions to a friend. You say: Walk 3 blocks east, then 2 blocks north.

[ASK] How can we represent this movement mathematically?

[WAIT] Expected: Using numbers! Using coordinates!

[SAY] Exactly! Today we will learn about column vectors - a way to represent movement in two directions.

[SAY] Vectors are used in navigation, physics, computer graphics, and many other fields.

Anchor Activity Launch (3 minutes)

[DO] Distribute graph paper, rulers, and pencils to each student.

[SAY] Here is your challenge: You will discover how to represent vectors using column notation.

[SAY] Here is what you will do:

[WRITE] On the board: Step 1: Draw x and y axes on your graph paper.

[WRITE] Step 2: Plot point A(1,1) and point B(5,3).

[WRITE] Step 3: Draw a directed line (arrow) from A to B.

[WRITE] Step 4: Count horizontal and vertical displacement.

[WRITE] Step 5: Write vector AB as (x, y).

[SAY] Work individually first, then discuss with your neighbor.

[SAY] You have 8 minutes.

Student Work Time (8 minutes)

[DO] Circulate among students.

[ASK] To a student: How many units did you move horizontally?

[WAIT] Expected: 4 units!

[SAY] Good! From x equals 1 to x equals 5 is 4 units right.

[ASK] To another student: How many units vertically?

[WAIT] Expected: 2 units!

[SAY] Excellent! From y equals 1 to y equals 3 is 2 units up.

[ASK] So how do we write this vector?

[WAIT] Expected: (4, 2)!

[DO] For struggling students: Let us count together on the graph.

[DO] For early finishers: Can you find vector BA? How is it different from AB?

Class Discussion (2 minutes)

[DO] Call on 2-3 students to share their findings.

[ASK] What did you discover about representing vectors?

[WAIT] Expected: We use two numbers - one for horizontal, one for vertical!

[SAY] Excellent! This is called a column vector.

[SAY] Today we will formalize this notation and learn how to work with vectors.

Phase 2: Structured Instruction (10 minutes)

Formalizing Column Vectors (10 minutes)

[SAY] Now that you have explored vectors, let us formalize what we learned.

[WRITE] On the board: Column Vector

[SAY] A column vector is written as (a, b) where a is horizontal displacement and b is vertical displacement.

[DO] Draw example on board: Vector from O(0,0) to P(4,5).

[SAY] This vector OP equals (4, 5). We moved 4 units right and 5 units up.

[ASK] Does everyone understand?

[WAIT] Check for nods or questions.

[SAY] Now let us learn vector operations.

[WRITE] 1. Vector Addition

[SAY] To add vectors, add corresponding components.

[WRITE] Example: (1, 4) plus (5, 3) equals (6, 7)

[SAY] Add the x components: 1 plus 5 equals 6. Add the y components: 4 plus 3 equals 7.

[WRITE] 2. Scalar Multiplication

[SAY] To multiply a vector by a number, multiply each component.

[WRITE] Example: 2 times (4, 7) equals (8, 14)

[SAY] Multiply both: 2 times 4 equals 8, and 2 times 7 equals 14.

[WRITE] 3. Combined Operations

[SAY] We can combine these operations.

[WRITE] Example: 2a plus 5b where a equals (4, 7) and b equals (3, 5)

[SAY] First: 2a equals (8, 14) and 5b equals (15, 25)

[SAY] Then: Add them: (23, 39)

[ASK] Does everyone understand?

[WAIT] Check for understanding.

Addressing Misconceptions:

[SAY] Let me address some common mistakes:

[SAY] Mistake 1: Vectors are just points. No, vectors represent movement, not location.

[SAY] Mistake 2: Order does not matter in subtraction. No, (5, 3) minus (1, 4) is not the same as (1, 4) minus (5, 3).

[SAY] Mistake 3: I can add x and y together. No, keep them separate.

[SAY] Mistake 4: Multiply only one component. No, multiply both components by the scalar.

[ASK] Does everyone understand?

[WAIT] Check for understanding.

Phase 3: Practice and Application (10 minutes)

Worked Examples (10 minutes)

[SAY] Let us work through examples together.

[WRITE] Example 1: a equals (2, 5), b equals (4, negative 1). Find a plus b.

[SAY] Add corresponding components: (2 plus 4, 5 plus negative 1) equals (6, 4).

[ASK] Does everyone understand?

[WAIT] Check for understanding.

[WRITE] Example 2: a equals (3, negative 2), b equals (negative 1, 4). Find 2a minus 3b.

[SAY] First: 2a equals (6, negative 4)

[SAY] Then: 3b equals (negative 3, 12)

[SAY] Subtract: (6 minus negative 3, negative 4 minus 12) equals (9, negative 16).

[ASK] Does everyone understand?

[WAIT] Check for understanding.

[WRITE] Example 3: a equals (2, 5), c equals (negative 7, 3). Find 5a plus 7c.

[SAY] 5a equals (10, 25), 7c equals (negative 49, 21)

[SAY] Add: (10 plus negative 49, 25 plus 21) equals (negative 39, 46).

[ASK] Any questions?

[WAIT] Address questions.

Phase 4: Assessment (5 minutes)

Exit Ticket

[SAY] Before we finish, I want to check your understanding. Please complete the exit ticket individually.

[DO] Display questions on the board or distribute exit ticket.

[SAY] You have 5 minutes to complete the questions.

Exit Ticket Questions:

1. Given a equals (3, 7) and b equals (2, negative 4), find a plus b.

2. Given c equals (5, 1), find 3c.

3. If p equals (4, 6) and q equals (1, 2), find 2p minus q.

Closing (1 minute)

[SAY] Today we learned about column vectors and how to represent movement in two directions.

[SAY] We learned how to add vectors and multiply them by scalars.

[SAY] Vectors are used in navigation, physics, computer graphics, and many other fields.

[SAY] Next lesson, we will explore position vectors and vector magnitudes.

[SAY] Great work today!

Differentiation Notes

For Struggling Learners:

- Provide pre-drawn coordinate planes with points already plotted.
- Use color coding for horizontal and vertical displacements.
- Start with vectors from the origin.
- Provide step-by-step templates.
- Pair with confident problem solvers.

For Advanced Learners:

- Explore position vectors and their relationship to points.
- Investigate vector subtraction and its geometric meaning.
- Apply vectors to real-world navigation problems.
- Explore three-dimensional vectors.
- Challenge problems with unknown vectors.

Post-Lesson Reflection Prompts

- Did students successfully plot points and draw directed lines?
- Were students able to identify horizontal and vertical displacements?
- What misconceptions emerged, and how were they addressed?
- Did students understand vector operations?
- What adjustments would improve this lesson?