

Subject: Mathematics

Course: IB Mathematics Analysis and Approaches

Level: IB HL

Topic: Polynomials and Operations with Polynomials

Duration: 90 minutes

Learning Objective:

- Perform operations (addition, subtraction, multiplication) with polynomials.
 - Develop conceptual understanding of polynomial structure and operations.
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1. Opening Inquiry Question (10 minutes)

Question:

"How can we model real-world phenomena using polynomials, and how do operations on polynomials affect their behavior?"

Discussion Prompt:

- Can you think of real-life situations where polynomials might be useful?
- How do we define and classify polynomials?
- What happens when we add, subtract, or multiply two polynomials?

Students will brainstorm in small groups (3-4 students) and propose ideas. The teacher will facilitate a short discussion and introduce the lesson objective.

2. Concept Exploration (20 minutes)

Activity: Polynomial Classification & Structure

- Provide students with various expressions and ask them to classify them as polynomials or not.
- Discuss key elements: coefficients, degree, leading coefficient, constant term.
- Explore different types of polynomials (linear, quadratic, cubic, quartic).

Guiding Question:

"What patterns do you notice in polynomial structure as the degree increases?"

Students will investigate and share observations.

IB AAHL 3. Operations with Polynomials (30 minutes)**Activity 1: Addition & Subtraction of Polynomials (Collaborative Investigation)**

- Provide students with two polynomials and ask them to add and subtract them.
- Encourage them to identify patterns (like terms, degree preservation).
- Use polynomial expressions related to motion or growth for context.

Inquiry Prompt:

"How does adding or subtracting polynomials affect their degree and structure?"

Activity 2: Multiplication of Polynomials (Hands-on Approach)

- Introduce multiplication methods (distributive property, grid method, synthetic multiplication).
- Let students work in pairs to derive the product of two given polynomials.
- Ask them to compare different multiplication methods and discuss efficiency.

Guiding Question:

"What do you observe about the degree of a polynomial when multiplying two polynomials?"

Students will predict and test their hypothesis with different examples.

4. Application & Problem-Solving (20 minutes)**Activity: Real-World Connections & Challenge Problems**

- Give students a real-world scenario where polynomials are used (e.g., physics equations, economics, population modeling).
- Let them create a polynomial expression to model the situation.
- Provide challenge problems to extend their thinking (e.g., find the product of two polynomials and interpret the result in context).

Discussion Prompt:

"How do these operations help us understand and solve real-world problems?"

5. Summary & Reflection (10 minutes)

- Students will summarize their learning in pairs.
- Discuss the importance of polynomial operations in higher mathematics.
- Exit Ticket: *"Describe one insight you gained today about polynomials and their operations."*

Assessment & Differentiation

- **Formative Assessment:** Group discussions, hands-on activities, and exit ticket responses.
- **Differentiation:**
 - For advanced students: Introduce division of polynomials or connections to calculus.
 - For struggling students: Provide guided step-by-step examples before independent practice.