

**Subject:** Mathematics

**Course:** IB Mathematics Analysis and Approaches

**Level:** IB HL

**Topic:** The Remainder Theorem

**Duration:** 80 minutes

## Learning Objective:

Students will understand and apply the Remainder Theorem to evaluate polynomials and solve related problems.

## 1. Lesson Introduction (10 minutes)

### Engagement – Inquiry Prompt:

- Display the polynomial:  $f(x) = 3x^2 + 11x - 8$
- Ask: “What happens when we divide this polynomial by  $x + 5$ ?”
- Encourage students to predict how the remainder relates to the function value at  $x = -5$
- Ask: “Could we evaluate the remainder without performing full division? Why or why not?”

### Objective Setting:

- Introduce the Remainder Theorem: “When a polynomial  $f(x)$  is divided by  $x - p$ , the remainder is  $f(p)$ .”

## 2. Exploration – Guided Discovery (20 minutes)

### Activity: Small Group Investigation

- Divide students into small groups and provide them with three different polynomials.
- Task:
  - Predict the remainder when dividing by a given linear factor.
  - Calculate the remainder using long division.
  - Verify using the Remainder Theorem.
- **Inquiry Questions:**
  - What patterns do you observe?
  - How does evaluating  $f(p)$  compare with division?
  - Can you think of a real-world analogy for this theorem?

**Class Discussion:**

- Each group presents their findings.
  - Address misconceptions and reinforce key concepts.
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**3. Application – Extending Understanding (25 minutes)****Problem-Solving Scenarios:**

- Work through Example 3 from the provided PowerPoint:
  - Given that the polynomial  $P(x) = x^3 + 4x^2 + ax + b$  has known remainders when divided by  $x - 2$  and  $x + 5$ , find  $a$  and  $b$ .
- **Inquiry Approach:**
  - Students attempt independently for 5 minutes.
  - Discuss methods in pairs.
  - Teacher scaffolds reasoning without providing direct solutions.
  - Whole-class walkthrough.

**Challenge Question:**

- What happens if the divisor is quadratic instead of linear?
  - Pose a scenario where students find the remainder when dividing by  $x^2 - 3x + 7$ .
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**4. Reflection and Consolidation (15 minutes)****Student-Generated Questions:**

- Ask students to write one question they still have about the theorem.
- Discuss selected questions to clear misunderstandings.

**Exit Ticket:**

- Solve: Find the remainder when  $P(x) = x^4 - 3x^3 + x - 4$  is divided by  $x + 2$  using the Remainder Theorem.
  - One-minute written reflection: *"How does the Remainder Theorem make polynomial division more efficient?"*
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## Assessment & Homework

- **Formative Assessment:**
    - Class participation in group work and discussion.
    - Accuracy in using the theorem.
  - **Homework:**
    - Apply the Remainder Theorem to different polynomials.
    - Explain the theorem in your own words and create an example.
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## Differentiation

- For advanced students: Introduce the Factor Theorem and explore its connection to the Remainder Theorem.
- For struggling students: Provide additional worked examples and use visual aids for polynomial division.