## Solutions for Selected Problems from Aluffi's $Algebra:\ Chapter\ \theta$

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### Chapter 1

# Chapter 1: Fundamentals of Algebra

#### 1.1 Introduction to Sets and Numbers

#### Problem 1.1.1: Basic Set Operations

Consider the sets  $A = \{x \in \mathbb{Z} \mid 0 < x \le 5\}$  and  $B = \{x \in \mathbb{N} \mid x \text{ is even and } x < 10\}$ . Determine  $A \cup B$  and  $A \cap B$ .

**Solution:** First, let's list the elements of each set:  $A = \{1, 2, 3, 4, 5\}$  (integers strictly greater than 0 and less than or equal to 5)  $B = \{2, 4, 6, 8\}$  (natural numbers that are even and less than 10)

Now, we find the union:  $A \cup B = \{1, 2, 3, 4, 5, 6, 8\}$ And the intersection:  $A \cap B = \{2, 4\}$ 

#### Problem 1.1.2: Number Systems - Classification

Classify the following numbers as rational or irrational: some test change a)  $\sqrt{9}$  b)  $\pi$  c) 0.333... d)  $\frac{1}{7}$ 

**Solution:** a)  $\sqrt{9} = 3$ . Since 3 can be written as  $\frac{3}{1}$ , it is a **rational number**. b)  $\pi$  is a non-repeating, non-terminating decimal, so it is an **irrational number**. c)  $0.333 \cdots = \frac{1}{3}$ . Since it can be expressed as a fraction of two integers, it is a **rational number**. d)  $\frac{1}{7}$  is already in the form of a fraction of two integers, so it is a **rational number**.

## Chapter 2

Chapter 2: Functions and Graphs