

Tutorial 1

MATH3020: Real Analysis

0 - Introduction to Analysis

1 - Real Number Axioms and Properties

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Question 1 - Field Axioms for \mathbb{Q}

Prove that \mathbb{Q} is a field.

Answer 1 - Field Axioms for \mathbb{Q}

Question 2 - Algebraic Numbers

True or false: $\mathbb{Q} \subset \mathbb{A}$

Question 3 - Find the Error in this Proof

Find the error in the following proof:

Proof.

Let $x, y \in \mathbb{R}$. First, suppose that $x = y$. Then $x^2 = xy$. Subtracting y^2 yields $x^2 - y^2 = xy - y^2$. We can factor the left as a difference of squares, and the right we can factor out y , resulting in $(x + y)(x - y) = y(x - y)$ which simplifies to $x + y = y$ after cancellation. But since $x = y$, we get $2y = y$ and so $2 = 1$. Q.E.D.

Question 4 - Order Relation

Let's define a new order relation \succeq . We shall say, for two countries A and B , that $A \succeq B$ if A has more (or equal) gold medals **and** more (or equal) total metals than B . First, show that \succeq is an order relation. Then, using arrows, indicate the order relations between the given countries from the 2024 Paris Olympics.



Answer 4 - Order Relation