

Homework 1 Solutions and Decimals

Collaborators:

Homework 1 problem: Let A, B be sets. Prove that $A \cup B = A$ if and only if $B \subseteq A$.

Proof.

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Homework 1 problem: Prove or disprove: For any sets A, B, C , we have

$$A \cup (B \cap C) = (A \cup B) \cap (A \cup C).$$

Proof.

□

Homework 1 problem: Prove or disprove: For any sets A, B, C , we have

$$(A - B) - C = A - (B - C).$$

Proof.

□

Homework 1 problem: Prove that if $a \in \mathbb{Z}$ is odd then $a^2 + a + 3$ is odd. Does $a^2 + a + 3$ being odd imply a being odd?

Proof.

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Homework 1 problem: Write down a careful proof of the following statement:

$$\sqrt{6} - \sqrt{2} > 1.$$

Proof.

□

Homework 1 problem: Given that the number 8881 is not a prime number, prove by contradiction that it has a prime factor that is at most 89.

Proof.

□

Express the decimal $1.\overline{813}$ as a fraction $\frac{m}{n}$, where $m, n \in \mathbb{Z}$.

Scratch Work

Writeup:

Which of the following numbers are rational and which are irrational?

- a) $0.a_1a_2a_3\dots$, where for $n = 1, 2, 3, \dots$, the value of a_n is the number 0, 1, 2, 3, or 4 which is the remainder when dividing n by 5.
- b) $0.101001000100001000001\dots$
- c) $1.b_1b_2b_3\dots$, where $b_i = 1$ if i is a square, and $b_i = 0$ if i is not a square.

Scratch Work

Writeup: