

DIRECTIONS:

- No papers, phones, calculators, or gadgets are permitted to be out during the quiz.
- Show all work, clearly and in order **You will lose points if any of these instructions are not followed.**

Questions	Points	Score
1	1	
2	2	
3	2	
Total	5	

Problem 1: (1 point) What is the definition of an onto or surjective function?

Let $f : A \rightarrow B$ be a function. Then if for all $b \in B$ there exists an $a \in A$ such that $f(a) = b$, we call f onto or surjective.

Problem 2: (2 points) Let $\{(a, b)\}, \{(c, d)\}$ be equivalence classes in \mathbb{Q} . Recall the definition of the equivalence relation $(p, q) \sim (p', q') \iff pq' = qp'$. Define multiplication in \mathbb{Q} as $\{(a, b)\} \cdot \{(c, d)\} = \{(ac, bd)\}$. Prove that multiplication is a well defined operation.

Proof: We must show that for $(a, b) \sim (a', b')$ and $(c, d) \sim (c', d')$ then $(ac, bd) \sim (a'c', b'd')$.

$$(a, b) \sim (a', b') \iff ab' = a'b, \tag{1}$$

$$(c, d) \sim (c', d') \iff cd' = c'd. \tag{2}$$

Multiplying the first by cd' and substituting in the second gives

$$ab'cd' = a'bcd' = a'bc'd.$$

Q. E. D.

Problem 3: (2 points) Label the following true or false

(a) (0.5 points) T \mathbb{Q} is an ordered field.

(b) (0.5 points) F A field need not be an integral domain.

(c) (0.5 points) F Let X be a nonempty set and $\wp(X)$ be the power set of X . Then $\wp(X)$ with Δ as '+' and \cap as ' \cdot ' is a field.

(d) (0.5 points) F A subset of $A \times B$ such that each element of A occurs exactly once as a first coordinate is called an injective function.