Name ——————————, Student Number ————————

QUIZ 1, MATH 235, FALL 2009

Date: October 6, 2009.
Time: 90 minutes.
Instructions: Answer all questions following the instructions. Notes, dictionaries or calculators are not NOT allowed. Write your answer clearly and with full details, where required. Marks will be deducted for ambiguous answers, or messy solutions. Use the back of the exam sheets for answering PART II. Use the additional white pages as scrap paper if needed.

Good luck!

PART I: Multiple choice questions. 64 points Each question has a unique correct answer. Circle the correct answer on the questionnaire; do not include any explanations. Wrong answers get a penalty of -3 points; no penalty for not answering a question. Use the additional pages for calculations.

(1) Let $A = \{1, 2, 3\}$, $B = \{x, y\}$. Let s be the number of surjective functions from A to B and let t be the number of injective functions from A to B. Then $s + t$ is equal to:

(i) 2 (ii) 6 (iii) 8 (iv) 10

(2) Let A, B, C, D be disjoint sets such that $|A| = |B|, |C| = |D|$ then:

(i) $|A \cup C| = |B \cup D|$ (ii) it is possible that $|A \cup C| \neq |B \cup D|$.

(3) Let A, B, C, D be sets such that $|A| = |B|, |C| = |D|$ and $A \supset C, B \supset D$. Then:

(i) $|A - C| = |B - D|$ (ii) it is possible that $|A - C| \neq |B - D|$.

(4) Let A, B, C be sets. Then $(A \cup B) - C$ is equal to

(i) $A \cup (B - C)$ (ii) $(A - C) \cup (B - C)$ (iii) $A - (C - B)$ (iv) $(A - B) \cup (A - C)$

(5) Define a relation on non-zero complex numbers by saying that $x \sim y$ if $x\bar{y} \in \mathbb{R}$. How many of the properties "reflexive", "symmetric", "transitive", does this relation have?

(i) 0 (ii) 1 (iii) 2 (iv) 3

(6) If $a|5c - d$ and $a|d - 3c$ and a is odd, then:
(i) $a|c$ but possibly $a \nmid d$ (ii) $a = \pm 1$
(iii) $a|c$ and $a|d$.

(7) One of the following lists consists entirely of irrational numbers. Which?
(a) $\frac{\sqrt{2}}{\sqrt{18}}, \sqrt{3}, \sqrt{5}$ (b) $\sqrt{2}, \sqrt{\sqrt{2}}$ (c) $\sqrt{2}, (1 + i)^4$.

(8) The gcd of 27807 and 429 is:
(i) 1 (ii) 3 (iii) 11 (iv) 13 (v) 33 (vi) 39 (vii) 143 (viii) 429

PART II: Proof question. Prove the following theorem. You may assume that every positive integer is a product of prime numbers. Write your proof on the other side of this page.

There are infinitely many prime numbers.