

## MATH 201 FALL 2023 PRACTICE TEST #1

*Write clearly, on separate paper. All questions carry equal weight.  
You will receive credit for your three best answers.*

**Prove or disprove three of the following statements:**

- (1) For subsets  $A, B, C$  of a universe  $U$ , one has

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

- (2) For integers  $x$  and  $y$ , if  $4x - 5y$  is even, then  $x$  and  $y$  have the same parity.

- (3) If  $p$  and  $r$  are integers, and  $p$  is prime, then

$$p \mid \binom{p}{r}$$

when  $0 < r < p$ .

- (4) If  $x$  and  $y$  are positive real numbers, then

$$xy \leq \frac{1}{4}x^2 + y^2.$$