

**Math 300 Intro Math Reasoning**  
**Worksheet 03: Mathematical logic**

(1) Prove the following statement: An integer is divisible by 5 if and only if its last digit is divisible by 5.

[Hint: To formally refer to the unit number of an integer  $n$ , decompose  $n = 10k + d$  where  $k$  is some integer and  $0 \leq d \leq 9$ . Then  $d$  is the unit digit of  $n$ .]

(2) Prove that for all integers  $n$  and  $m$ , if  $n$  is multiple of 6 or  $m$  is multiple of 9 then  $n^2m$  is a multiple of 9.

(3) Let  $a, b$  be integers with  $b \neq 0$ . Prove that any integer solution to the quadratic equation  $x^2 + ax + b = 0$  divides  $b$ .