Proof Portfolio Problem 6

Chose one problem from each numbered group. For example, choose only one of 6A, 6B, and 6C.

The goal here is for you to become competent in proof writing and confident in your ability in your future courses. No collaboration and no outside resources. Please see me when you need support.

Remember to see the directions for what to do with conjectures that are false.

Conjecture 6A. For all integers a, $4 \mid a$ if and only if there exists an integer b such that $a = 1+(-1)^b(2b-1)$.

Conjecture 6B. For all integers k, $3 \nmid k^2 + 2$ if and only if k is not prime or $k = 3$.

Conjecture 6C. For all integers x and y, $xy \equiv 0 \pmod 3$ if and only if $x \equiv 0 \pmod 3$ or $y \equiv 0 \pmod 3$.