Math 2534 Homework 4 on Proof Methods
Instructions: Prove or give a counterexample. Use your own paper and present a well written argument for each theorem proved. Justify all assertions made.

Problem 1: Direct proof:
Theorem: For all integers, if $a$ is even and $b$ is odd then $a^2 - 3b$ is odd.

Problem 2: Direct Proof:
Theorem: If $a$, $b$ and $c$ are natural numbers and $a \mid b$ and $a \mid c$ then $a \mid (b - 2c)$

Problem 3: Indirect Proof by contrapositive
Theorem: If $n^2$ is odd then $n$ is odd for all natural numbers.

Problem 4: Indirect Proof by contradiction
Theorem: For all real numbers, the product of a rational number and an irrational number is always irrational.

Problem 5: Your choice
Theorem: For all natural numbers, if $n$ is odd then $n$ is prime.

Problem 6: Your choice
Theorem: For all natural numbers, if $a$ and $b$ are each prime numbers, then $a + b$ is even.