1. (6 points) Adapt the proof we showed in the class that there are infinitely many primes to prove that there are infinitely many primes of the form $3k + 2$, where $k$ is a nonnegative integer. (Hint: Suppose that there are only finitely many such primes $q_1, q_2, ..., q_n$, and consider the number $3q_1q_2\cdots q_n - 1$.)

2. (6 points) Use the Euclidean algorithm to find:
   
   (a) $\gcd(123, 277)$
   
   (b) $\gcd(6731, 2809)$

3. (6 points) Find integers $s$ and $t$ such that $\gcd(252, 356) = s \cdot 252 + t \cdot 356$.

4. (6 points) Prove that if $a, b, m$ are integers and $m | (a - b)$, then $\gcd(a, m) = \gcd(b, m)$. (Hint: show that any common divisor of $a$ and $m$ is also a common divisor of $b$ and $m$, and vice versa.)

5. (6 points) Use a proof by cases to show that if $n$ is an integer then $n^2 \equiv 0 \pmod{4}$ or $n^2 \equiv 1 \pmod{4}$.