1. Rosen 3.1 #4, pg. 76
   Use the sieve of Erastosthenes to find all primes less than 200.

2. Rosen 3.1 #5, pg. 77
   Find all primes that are the difference of the fourth powers of two integers.

3. Rosen 3.1 #9, pg. 77
   Let \( Q_n = p_1 p_2 \cdots p_n + 1 \), where \( p_1, p_2, \ldots, p_n \) are the \( n \) smallest primes. Determine the smallest prime factor of \( Q_n \) for \( n \leq 6 \). Do you think that \( Q_n \) is prime infinitely often? \( \text{(Note: This is an unresolved question.)} \)

4. Rosen 3.1 #13, pg. 77
   Show that there are no “prime triplets”, that is, primes \( p, p + 2, \) and \( p + 4 \), other than 3,5, and 7.

5. Rosen 3.1 #25, pg. 78 \( \text{(challenging!!)} \)
   A prime power is an integer of the form \( p^n \), where \( p \) is prime and \( n \) is a positive integer greater than one. Find all pairs of prime powers that differ by 1. Prove that your answer is correct.

6. Rosen 3.3 #2(a,b) and #3(a,b), pg. 94
   Use the Euclidean algorithm to find each of the following greatest common divisors:
   (a) \((51,87)\)
   (b) \((105,300)\)
   For each pair, express the greatest common divisor of the integers as a linear combination of these integers.

7. Rosen 3.3 #19, pg. 95
   Let \( m \) and \( n \) be positive integers and let \( a \) be an integer greater than 1. Show that \((a^m - 1, a^n - 1) = a^{(m,n)} - 1\).