Exercises: Vigenère ciphers

1. Encrypt the word 'hippopotamus' using a Vigenère cipher with key word '**MAGIC**'.

2. Decrypt the cipertext 'PZRFHETQRHZ' using a Vigenère cipher with key word '**LONDON**'.

3. The phrase 'mountain goat' was encrypted using a Vigenère cipher and produced the ciphertext 'EIJRKMIAYIPX'. What was the key word?

4. We can make the key of a Vigenère cipher longer by repeating two keywords separately. A combined key is then made by adding the letters of the two keywords together.

   In other words, the letters of two keywords k' and k'' make a combined key $k = k' + k'' \mod 26$.

   Here is an example that uses the keywords **JAMES** and **BOND**.

   Keyword 1: **J A M E S J A M E S J A M E S J**

   Keyword 2: **B O N D B O N D B O N D B O N D**

   Combined Key :

   Plaintext: s h a k e n n o t s t i r r e d

   Ciphertext:

   (a) Complete the combined key, using $k = k' + k'' \mod 26$.

   (b) Encrypt the message using the combined key.

   (c) What is the length of the combined key?

   (d) Show that encrypting a plaintext with k is equivalent to encrypting it twice with k' and k''.