

gives a column  $\begin{pmatrix} x \\ y \end{pmatrix}$ : the first two letters give the integer  $x$  and the next two letters give  $y$ . You also know that the last 12 letters of the above ciphertext correspond to the signature "HEADQUARTERS".

- (a) Find the deciphering transformation and read the message.
  - (b) Find the enciphering transformation and make a coded message that impersonates headquarters and says "CANCEL LAST ORDER!" followed by two blanks and the signature "HEADQUARTERS".
26. How many possible affine enciphering transformations are there in the situation of Exercise 25 (with an 841-letter digraph alphabet)?
  27. How many possible affine enciphering transformations are there for **tri**-graphs (3-component vectors) in a 26-letter alphabet?
  28. You intercept the message

"FBRTLWUGAJQINZTHHXTEPHBNXSW, "

which you know was encoded using a linear enciphering transformation of trigraphs in the 26-letter alphabet A—Z with numerical equivalents 0—25. You also know that the last three trigraphs are the sender's signature "JAMESBOND." Find the deciphering matrix and read the message.

## References for Chapter III

1. L. S. Hill, "Concerning certain linear transformation apparatus of cryptography," *American Math. Monthly*, **38** (1931), 135–154.
2. D. Kahn, *The Codebreakers, the Story of Secret Writing*, Macmillan, 1967.
3. K. H. Rosen, *Elementary Number Theory and Its Applications*, 3rd ed., Addison-Wesley, 1993.