Exercises 1.7.2 and 1.7.3 prompt:

Suppose for example that we wish to add m times the jth row to the$i$th row, transforming $[\mathrm{A}|b]$ to $[\hat{\mathrm{A}}|\hat{b}]$. You can easily verify that

$$[\hat{\mathrm{A}}|\hat{b}] = M[A|b]$$

where:

$$M = \begin{array}{c} \\ \\ i \rightarrow \end{array} \begin{array}{c} \begin{array}{ccccccc} & & & j & & & \\ & & & \downarrow & & & \end{array} \\ \begin{bmatrix} 1 & & & & & & \\ & \ddots & & & & & \\ & & 1 & & & & \\ & & & \ddots & & & \\ & & m & & 1 & & \\ & & & & & \ddots & \\ & & & & & & 1 \end{bmatrix} \end{array}$$

is the matrix that differs from the identity matrix only in that it has an m in the (i, j) position. M is called an *elementary matrix* of type 1.